Anniversary Essays

Forty Years of Geography at Maynooth

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FOREWORD

The following collection of essays celebrates the Department of Geography's 40th Anniversary. My hope is that this short foreword will help set the scene for readers unfamiliar with the department.

Geography in Maynooth is unique in being the only university department in Ireland established *de novo* in the past forty years. Its base was St Patrick's College, Maynooth, a national seminary for the education of priests. St. Patrick's had been a Recognised College of the National University of Ireland (NUI) from 1910 and opened to lay students for the HDip in Education in 1966-7 and for BA courses in 1969.

The first significant expansion began in 1971 with the appointment of eleven new junior lecturers, including Patrick Duffy in Geography; nearly half of the appointees were religious. The President of the College was Monsignor Jeremiah Newman, a rural sociologist with a particular fondness for rural social geography. During academic year 1971-72, Duffy took the initial steps in the establishment of Geography, with moral support from Professor Tom Jones Hughes, and lots of practical assistance from Dr Anngret Simms, of University College Dublin (UCD). A number of guest lecturers were invited to supplement the limited scope of the First Year programme, among them Francis Walsh who was completing a Master's degree in Simon Fraser University in Canada and Seamus Smyth who was a graduate student in the University of Toronto. Fran Walsh (aka Proinnsias Breathnach from May 1981) was appointed Junior Lecturer in 1972.

Further growth occurred in 1973 with the appointment of W.J. [Willie] Smyth as Senior Lecturer and Head of Department. Smyth had also come from UCD (he was its first PhD Geography graduate) and brought with him experience of teaching in Syracuse and California. His contribution to the development of the department was seminal. He established strategic links with the political movers and shakers in the academic community of Maynooth. 'Not only did he pioneer innovations in the teaching programme, but he also vigorously expanded the departmental facilities on the campus … probably his greatest achievement in Maynooth was the creation of a team spirit in the working of the department.'[i] He left Maynooth to take up an appointment as Professor of Geography in University College Cork in 1977.

The department's establishment was therefore largely undertaken by Irish geographers, products of the first generation of geographers to emerge from the largely British-originated schools in University College Dublin (UCD) and Trinity College Dublin. Indeed, looking back now, the early 1970s were sort of a 'golden age' for geography in Ireland with a surge of appointments of young Irish geographers to existing departments in UCD, Trinity, University College Cork and University College Galway.

By the early 1980s, the department had grown in size under the guidance of W.J. (Seamus) Smyth, who succeeded Smyth as the first Professor of Geography in 1978. John Sweeney, climatologist from the University of Glasgow, was appointed to take over the running of physical geography courses. In 1986, Shelagh Waddington, with interests in geographical education, began teaching second year practical classes. Then, in 1988, following the closure of Carysfort College of Education in Dublin, Jim Walsh joined the department; he was appointed Professor and Head in 1995. In 1991, the physical geographical dimension of the programme was further expanded with appointment of Paul Gibson, who came from the University of Ulster.

With the steady increase in student numbers into the 1990s, the Department was enabled to expand its teaching staff with a corresponding expansion of its course offerings and research output: Brendan Bartley was appointed in 1994; Ro Charlton in 1996; and Rob Kitchin, in 1998. Thereafter, there was a rapid accumulation of teaching and research expertise in the Department: Ronan Foley joined in 2003; Stewart Fotheringham, Science Foundation Ireland Professor and Director of the National Centre for Geocomputation in 2004, with Martin Charlton and Jan Rigby; Steve McCarron, Adrian Kavanagh, and Sinead Kelly in 2005.

Scotsman Mark Boyle was appointed Professor and Head in 2007, the same year another Scot, Alistair Fraser, joined the department. Boyle subsequently negotiated an expansion in staff resources with the appointments of Rowan Fealy and Conor Murphy. Mary Gilmartin followed in 2008 and Chris van Egeraat in 2010. Gerry Kearns, Karen Till and Brendan Gleeson were appointed in 2011, replacing Duffy, Breathnach, Pringle and Bartley who had retired.

Throughout these years, the Geography department made serious attempts to carve out a distinctive identity driven by a need to construct a presence in the geographical community in Ireland, and increasingly in the media. The importance of reaching out – from external examiners and new appointments from beyond Ireland, to public service outside the university – was paramount. There were efforts to nurture a reputation as a young energetic department inhibited only by the small coterie of staff and comparatively large numbers of undergrads. One early approach was to attract guest lecturers from outside to expose students to a broader university experience, the fruits of which were evident in *Milieu* (students' Geographical Socieety magazine) from the beginning. The annual inaugural lecture and the Friday Seminar (4.00pm followed by refreshments in The Roost for all participants) also helped connect the department to the wider discipline. Visiting lecturers have also been invited to guest on a variety of courses. The department networked to attract academics from around the world: in 1980, for example, a

collaboration took place with Groningen University's planology department; the Africa course, supported by Higher Education For Development Cooperation funds from 1990, regularly involved exchanges of staff with Zimbabwe, South Africa and Uganda; and flowing from Fran Walsh and Seamus Smyth's connections, North American, especially Canadian, linkages were strong down the years. Smyth was also President (1982-85) of the Association for Canadian Studies in Ireland, after its foundation in Maynooth in 1982. Courses on North America were supported by visitors from Toronto and elsewhere – Deryck Holdsworth of Penn State, Larry Bourne, Cecil Houston, Gunter Gad, Bruce Trigger of York University. The Department also nurtured Erasmus networks involving student and staff exchanges with Keele, Roskilde, Durham, Toulouse, Lyons, Goteborg, Tubingen, Salamanca, and Amsterdam. Most recently Visiting Professorships have been established to deepen relationships with graduate students especially, including Pete Coxon (TCD) and James Sidaway (National University of Singapore).

Maynooth has also made significant contributions to the development of the discipline in Ireland, with all of the key officer positions in the Geographical Society of Ireland (GSI) being held by Maynooth staff for most of the last decade. The two academic journals, *Irish Geography* and *Geographical Viewpoint* are edited in Maynooth. Members of the Department served on many occasions on the committee of the GSI: Pringle, Sweeney, Duffy, both Smyths, Walsh, Kavanagh, Boyle, Foley, as secretary and/or president. Others have served on the National Committees in the Royal Irish Academy. And John Sweeney and Shelagh Waddington have had long-term commitments with the Association of Geography Teachers of Ireland. Sweeney, who served as editor of *Irish Geography* for many years, has been actively involved in local community affairs in Maynooth; he is currently President of *An Taisce*, the National Trust for Ireland.

From the outset, Maynooth was also a consistent supporter of the Conference of Irish Geographers (CIG), with its staff and graduate students always strongly represented on the programme: indeed Fran Walsh/Proinnsias Breathnach established an unbroken record for reading an annual paper at the conference for more than thirty years. Maynooth first hosted the CIG in 1979 – in the face of a months-long postal strike which severely hampered the delivery of paper abstracts (in those pre-internet days).[ii] The CIG was again hosted by Maynooth in 1990, 1995, 2004 and 2010.

Reflecting its long-standing interest in research, in 1976-77 the department decided to publish a Maynooth Occasional Paper Series (MOPS) edited by Dennis Pringle to showpiece research work by staff and graduate students. The first in the series was by Peter Connell, one of the first Master's students to graduate from the Department. Subsequent

numbers published the findings of research projects into rural and community development in the west and north-west of Ireland and Scotland, a project in which Proinnsias Breathnach, P. J Duffy and Colm Regan were funded by the National Board for Science and Technology (NBST) – one of only two Social Science research projects funded in the first round in 1980. *Social and Economic Geography* (Folens, Dublin, 1980) was a collective effort by Walsh, Duffy and Pringle, at engaging in a conceptually interesting way with the Leaving Certificate syllabus. Although there were hopes of breaking into the (lucrative) school textbook market, it was largely adopted as a workbook by teachers rather than by classes.

Maynooth geographers were also active in other publication outlets. A special edition of *Antipode* was published in 1979 with significant inputs from the Department. It arose from a special conference 'Radical approaches to the study of Irish geography' which was held in UCD in March 1978. The special edition of *Antipode* was edited by Dennis Pringle, Colm Regan and Francis Walsh, with contributions from Duffy, and Jim McLoughlin and Steve Shaughnessy, recent Maynooth graduates. The *Maynooth Review* (1975-1989) was supported by geographers in the department: Willie Smyth contributed important papers on changing communities in Ireland in the early issues. *Irish Geography* and *GeoNews* were edited for many years by John Sweeney, and Dennis Pringle. *Geographical Viewpoint* was edited for seven years by Jim Walsh and subsequently by Shelagh Waddington. Special publications by the GSI have also either been edited by, or contributed to, by Maynooth staff: Proinnsias Breathnach and Mary Cawley (eds) *Change and development in rural Ireland*, 1986; AA Horner and A J Parker (eds) *Geographical perspectives on the Dublin region*, 1987; John Sweeney (ed) *The Irish Sea: a Resource at Risk,* 1989*;* Proinnsias Breathnach (ed) *Irish tourism development*, 1994; Dennis Pringle, Jim Walsh, Mark Hennessy (eds) *Poor people, poor places: a geography of poverty and deprivation in Ireland*, 1999.

Arising from a research grant from the Bishop of Clogher in 1988, P J Duffy published *Landscapes of south Ulster: a parish atlas of the diocese of Clogher* (Belfast, 1993) on which (now retired) cartographer Jim Keenan worked meticulously in the pre-digital design and drafting of more than forty detailed townland maps of parishes. For the Bicentenary in 1995, Paul Gibson published his unique *Geological guide to St Patrick's College, Maynooth.* Seamus Lafferty, the department's first PhD graduate in 2000, with P. Commins and J. Walsh, produced his *Irish agriculture in transition: a census atlas of agriculture in the Republic of Ireland*, 1999.

Research and publication gathered pace from the mid-1990s with the appointment of additional staff – Rob Kitchin especially adding significantly to the department's output. The generation of research centres at this time which was one of the distinguishing features of the department, resulted in a significant increase in published research

outputs. The Centre for Local and Regional Development (CLRD) was established by Geography, together with the departments of Economics and Adult Education. CLRD was the nucleus of the Programme for Research in Third-Level Institutions (PRTLI) bid that led to the establishment of the National Institute for Regional and Spatial Analysis (NIRSA) in 1999. This development accompanied and complemented a surge in social and economic research around the National Spatial Strategy (2002) and the National Development Plan (2007). Geography was the driving force behind NIRSA, which under Rob Kitchin's directorship has become one of the most successful PRTLI-funded research institutes. The National Centre for Geocomputation (NCG, which is committed to extending understanding and utilisation of the capture, analysis and modelling of spatial data) and the International Centre for Local and Regional Development (ICLRD) followed the NIRSA model. Subsequently, ICARUS (Irish Climate Analysis and Research Units), directed by John Sweeney, has developed an internationally-recognized cluster of researchers in climate science.

In addition to these research centres of excellence, the department has continued to nurture individual scholarly research with several books published recently: Paul Gibson, *Heritage landscapes of the Irish midlands and selected itineraries* (Dublin, 2007); P. J Duffy, *Exploring the history and heritage of Irish landscapes* (Dublin, 2007); Ro Charlton, *Fundamentals of fluvial geomorphology* (Oxon, 2008); John Sweeney, *Climate change: refining the impacts for Ireland* (EPA, 2008); Mary Gilmartin et al. *Key concepts in political geography* (London, 2009); Gerard Kearns, *Geopolitics and empire: the legacy of Halford Mackinder* (Oxford, 2009); Ronan Foley, *Healing waters: therapeutic landscapes in historic and contemporary Ireland* (Ashgate, 2010); Karen Till, *Mapping spectral spaces* (Virginia, 2010); Rob Kitchin, *Code/Space: software and everyday life* (Camb., Mass, 2011); Mark Boyle, *Metropolitan anxieties: on the meaning of the Irish Catholic adventure in Scotland* (Ashgate, 2011).

As the preceding discussion demonstrates, then, Maynooth's Department of Geography has been at the forefront of developing the strength and indeed the reputation of Irish geography. From humble beginnings, it has blossomed into one of Ireland's leading academic departments. With luck, its next 40 years will be just as successful.

P J Duffy,
Maynooth, August 2012.

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[i] *Irish Geographical Newsletter*, Sept 1977, p 11.
[ii] See *Irish Geography*, 1979; *Irish Geographical Newsletter*, October 1979, 6-7

ACKNOWLEDGEMENTS

Given what it turned out to entail, I almost wish I'd never had the idea of celebrating the department's 40th anniversary by collecting together these essays; or, at least, I almost wish I'd just kept it to myself. Alas, I ran it past two colleagues whose judgment I trust and then suggested it to Mark Boyle, our Head of Department. The response was favourable. That was at the end of 2011. Since then, I have been helped enormously and in numerous different but always kind and effective ways by Rebecca Boyle, Paddy Duffy, Adrienne Hobbs, Neasa Hogan, Gerry Kearns, Fionnuala NiMhordha, and many of the contributors to the collections. I would also like to thank Suzanne Redmond Maloco in the library for helping me work out what needed to be done and generously clarifying various issues as the work progressed. Let me also thank everyone in the whole department, first of all for replying to my annoying, last-minute emails about the essays, and secondly for having written the essays gathered here. The quality of your work helped make this an enjoyable task. Finally, let me be very clear in saying that I am to blame for any errors, pagination problems, or copyright concerns.

Alistair Fraser

INTRODUCTION

The following collection of 'Anniversary Essays' is an odd mix. But yet, looking through it, I find its oddness perfectly appropriate, because isn't geography – the discipline and the subject matter – precisely that? Space is, as many of these essays explicitly or implicitly highlight, a crazy mixture of thrown together objects, forces and ideas. And it's this fact of geography that gives me heart when I flick through the following essays and think of them as representing what scholars and researchers and teachers in Maynooth's Department of Geography have done over the last four decades. Sure, we've done more than what this collection captures, and there's no doubt we'll continue to do amazing things, but at this juncture, in our 40th year, I believe this collection is a wonderful transect through the department's development and a unique testimony to its intellectual vibrancy. All along the transect, we are exposed to the wide variety of research questions addressed by geographers in Maynooth; questions about colonialism, health, climate, memory, place, migration, water, religion, identity, inward investment, and technology, and much more besides. An odd mix, yes, but a productive one, too. We also get to see developments and changes in the department as a place. In the first few chapters, for example, we see signs of the department's early life as a centre for the study of Ireland's historical geography, as well as a burgeoning location for the study of climate, medical and economic geography. Then, as the collection progresses, we discern a whole set of new issues tackled, including urban and technological change, adaptation to climate change, identity, planning, embodiment, and the politics and economics of Ireland's changing circumstances.

I think it fair to say that the collection also offers a unique opportunity to examine the breadth and richness of our discipline. The essays reflect many of the various ways of thinking about and doing geography. We see, for instance, that geography is about physical *and* social processes, about climate *and* class, say; and that geography is about using a range of methods, from remote sensing to ethnography. We also see examples of how scholars in the department have engaged theoretically with the discipline by drawing from and seeking to contribute to what we know about physical geography, climate change studies, feminist theory, Marxism, post-structuralism, and the world of policy-makers. From their base in Maynooth, geographers in the Department have helped to develop broader understanding of key issues in the discipline, often by making significant key contributions to geographical knowledge. Long may that continue.

The collection lying before you truly is a unique heritage document, which demonstrates what scholarship in one Irish academic department can achieve over a forty-year span. In this sense it has value. But I believe the collection has wider resonance. For students of the history and philosophy of science in general, and geography in particular, the

collection is a landmark contribution. There is plenty of scope to imagine how it might be used to learn about the Irish geography community and how it has grown and changed in the last forty years. I also hope the collection might be used by under- and post-graduate students as an entry point into learning to understand this odd discipline, but also this fantastic department. For example, it is striking how, just as the last five years or so have seen huge changes in the department, we also see in the latter chapters of the collection a wide range of new patterns take shape, such as the internationalization of the department's research foci and publishing venues; the expression of engaged scholarship regarding contemporary issues in Ireland and beyond; new publishing strategies, including the use of blogs; and new strengths in established areas of the department's research activities such as climate change. There have been important developments in academic geography in the last few years, not just in Ireland; this sort of collection should help piece together explanations for what has happened and why.

In sum, then, the collection effectively captures geography's odd mix and some of Maynooth's role in its creation. It is at once a celebration of Geography in Maynooth and an opportunity to glimpse the department's richness, its diversity, and breadth. I hope you agree.

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Having made these brief positioning remarks about the collection, let me now say a few words about how it has been arranged. I asked for contributions from anyone who has worked in the department or in its associated centres and institutions. The only proviso was that essays to be included in the collection were to have been mostly written or finished *in* Maynooth, even if the essay was based on research or teaching practice that occurred elsewhere. The idea was for these to be 'Maynooth essays'; essays reflecting work that was finished and signed off here.[1]

To capture the wide range of writing practices in the department, I suggested that contributing essays could be academic journal articles (single- or co-authored), book chapters, short reports, or (what we call in the year 2012) 'blog posts' i.e. essays written for a weblog such as *NUIM Geography's Eye on the World* or *Ireland After Nama*, two (of the many) blogs in which Maynooth geographers publish.

The response was positive and by mid-March 2011 I had many more than the required forty essays. Since then, I have cautiously re-formatted fonts and some styles (headings, etc.), scanned images from some of the older

[1] Of course, the idea was that the contributor would hope to be proud of the essay in another 40 years when, if anyone is mad enough to do it, perhaps another collection such as this might be produced. For some contributors, no doubt, that particular essay – one that will still read well in 40 years – has yet to be written, so by no means should readers in the year 2052 hold any of us (if we are still alive) to ransom on this.

essays, and presented the chapters in chronological order, with those just published and unpublished coming last. I have re-drawn one or two tables and some authors have even re-drawn some of their figures, but the vast majority of the collection reads as in the original essays. That said, I have taken the liberty of converting endnotes into footnotes, which will make it easier for us to assign individual chapters to our undergraduates in a module on the development of geographic thought, say.

As you will see, some authors have multiple entries whilst others have just a single essay included. By and-large, anyone who has spent up to about five years in or associated with the department has just one chapter in the collection, which is probably just as well because the number of people coming through Maynooth has increased quite dramatically. But there are exceptions and some inequalities here, so I do apologise if any hearts are broken.

Alistair Fraser,
Maynooth, August 2012

CHAPTER 1

ESTATE RECORDS AND THE MAKING OF THE IRISH LANDSCAPE: AN EXAMPLE FROM COUNTY TIPPERARY

WILLIAM J. SMYTH

First published in *Irish Geography* (1976), 9(1), 29-49.

Introduction

Some of the better estate maps of 18th-century Ireland – especially those produced by the French school of land-surveyors – have recently received welcome attention from a number of Irish geographers.[1] There are extensive areas of 18th and of early 19th-century Ireland, however, which are either not covered, or only poorly served, in relation to such rich cartographic source-materials. As Andrews has noted 'most Irish land-surveyors of the pre-Ordnance period concentrated on simple outline maps of tenement boundaries and were both niggardly and arbitrary in their choice of interior detail.'[2] Since maps do constitute the most important single body of evidence for the historical geographer, his task is further frustrated in the Irish context by the loss of quite a number of estate map collections which seem to have disappeared without trace. The objective of this paper, therefore, is simply to draw geographers' attention to the diverse range of estate documentary material – other than estate maps – which can either provide important clues towards the explanation of territorial patterns illustrated on contemporary estate atlases or which – as in this example – can be used in the absence of such maps to build up at least a general picture of the evolution of the rural landscape.

The most important elements in a good collection of such estate records include account books, rentals, estate correspondence (especially between landlord and agent), valuation surveys, deeds and leases. As yet there is insufficient information available to indicate how widespread such source materials are for the country as a whole; the picture is further complicated by the high mortality rate suffered by these records over this century. A quick survey of the estates sections of *Hayes's Manuscript sources for the study of the history of Irish civilisation,*[3] reports on materials in private collections,[4] and work by a number of economic historians[5], however,

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[1] See especially J. H. Andrews, 'The French school of Dublin land surveyors', *Ir. Geogr.,* 5 (4), 1967, 275-292; A.A. Horner, 'Cartouches and vignettes on the Kildare estate maps of John Rocque' *Quart. Bull. Irish Georgian Soc,* 14 (4), 57-76.

[2] J. H. Andrews, 'Changes in the rural landscape of late eighteenth and early nineteenth century Ireland: an example from County Waterford', a paper presented at the I.B.G. conference, Belfast, 1970. See *Area, I,* 1970, 55-56 for a summary of the text.

[3] R. J. Hayes, *Manuscript sources for the study of the history of Irish civilisation,* 11 volumes, Boston, 1965.

[4] *National Library reports on private collections,* National Library of Ireland, Dublin.

gives some suggestion of the range of materials available. However varied, uneven and fragmentary – and despite the temporal and distributional gaps – there is little doubt but that a sufficient body of estate materials has survived to provide the geographer with valuable insights into the forces which have shaped the cultural landscapes of different regions in the landlord era. As a tentative generalisation, one could suggest that the larger estates (and not necessarily those of resident proprietors only) which maintained a fair degree of continuity over time and space should have preserved a fuller range of estate source-materials. Indeed, for such large landholding entities as the Lismore Devonshire estate,[6] the Coolattin Fitzwilliam lands[7] and the Hillsborough Downshire estates,[8] a great deal of material has survived. On the other hand, Dickson and Donnelly[9] have highlighted the rich yet uneven (and sometimes inaccessible) range of materials that have survived at the county level – in this instance for 18th and 19th-century Cork. The actual survival of a very good collection of estate papers, however, may indicate superior estate administration; such sources may therefore not always provide a representative picture of conditions over a wider region. Even the best estate records are also limited in that they detail the needs, perceptions and activities of a ruling elite. They provide a view of the landscape from the windows of the Big House – yet such a perspective may provide a useful antidote to an over-emphasis on 'the little tradition' of the ordinary countryman.

The sample area

The area under consideration comprises the modern parish of Clogheen-Burncourt – practically coterminous with the old civil parish of Shanrahan – in south-western Tipperary. Located between the Galtee and Knockmealdown ranges to the north and south respectively, the parish can be described as comprising 'lowland' townlands with richer limestone soils and generally poorer 'mountain' townlands located upon or bordering on the Old Red Sandstone areas. As Figure 1 suggests, there appears to have been a striking stability in the distribution and size of estates in this part of Co. Tipperary between the mid-17th and the mid-19th century. The Cahir Butler and Fenton (later Kingston) estates did remain for the most part intact but there was no such direct continuity between the early 17th century-created Everard estate and that of Viscount Lismore (O'Callaghan) of the Shanbally estate. The expansion of the O'Callaghan lands to incorporate the greater part of the original

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[5] See in particular, J. S. Donnelly, 'The land and people of nineteenth century Cork,' *Studies in Irish history,* second series, Vol. 9, London, 1975, ; W. H. Crawford, 'Landlord-tenant relations in Ulster 1609-1820', *Irish Economic and Social History,* 2, 1975, 5-21.

[6] Andrews, *op. cit.,* 1970, 3.

[7] See, for example, MSS. 4946, 6001-6051, 6064-6067 and 8815 in National Library of Ireland, Dublin.

[8] W. A. Maguire, *The Downshire estates in Ireland 1801-45,* Oxford, 1972; W. A. Maguire (ed), *Letters of a great Irish landlord, 1809-45,* Belfast, H.M.S.O., 1974.

[9] D. Dickson, 'County Cork: two research experiences. I. The eighteenth century' and J. S. Donnelly, 'II. The nineteenth century', *Irish Archives Bulletin, 2* (1), 1972, 58-66.

Everard estate was, as Fig. 2 indicates, a protracted affair. Legal astuteness, lucrative marriages, mercantile acumen and parliamentary representation (the latter based on the old Everard borough of Fethard) during the first half of the 18th century, combined with later strategic marital alliances with leading national families such as the Ponsonbys and Ormonde Butlers, led to the O'Callaghans becoming one of the leading landowners in Co. Tipperary by the beginning of the 19th century.[10]

Only a few rentals and deeds of the Kingston estate are at present readily available, and the vast Cahir estate records have not as yet been made accessible to the research student, if indeed they still survive. Consequently the main thrust of this paper will focus on the fragmentary remains of the Shanbally estate papers. When the Land Commission purchased Shanbally demesne in the 1950s some estate records were destroyed *in situ*, while much of the remainder apparently ended up in a waste-paper factory. A local historian salvaged two trunks of manuscript materials[11]. This is all that now appears to have survived of the vast corpus of O'Callaghan estate records, despite the fact that in a description of Shanbally estate office papers in the late 1940s, Ainsworth refers to rentals and accounts stretching back to 1736 and a book of estate maps compiled in 1801-2.[12] Included in the residue today are: i) a number of eighteenth century account books for 1761-74, 1775-81, 1786-98 and an almost complete set of 19th-century account books from 1825; ii) rentals for 1761-66, 1779-84, 1813 and a complete record from 1818 onwards; iii) a small number of 18th-century, and a very comprehensive number of 19th-century, tenant leases; iv) landlord letters to the agent for 1827-28 and 1834-39 and summaries of the agents' correspondence for 1811-39, 1850-61 and 1884-91; and v) other miscellaneous material including a few mid-18th-century townland map surveys, wage books, tithe applotment books and timber, sheep and cattle accounts.

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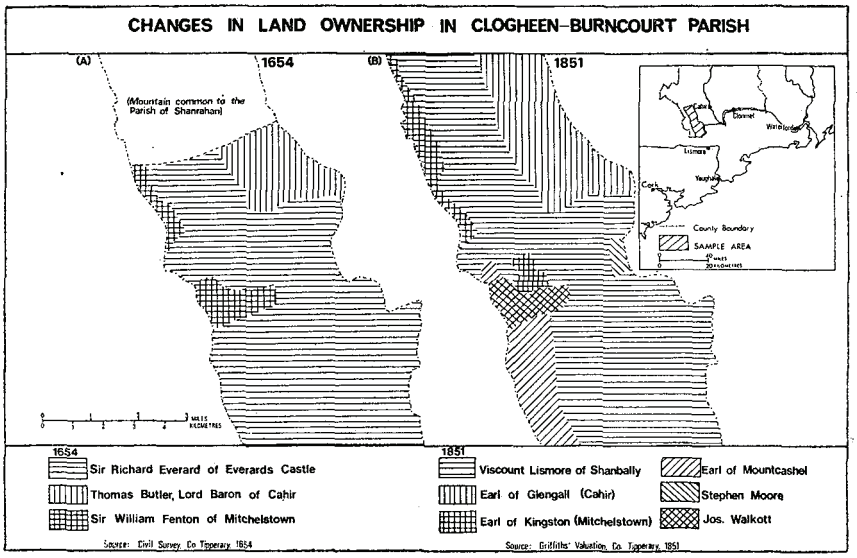
[10] The history of the growth of this estate can be traced by analysis of material in the Registry of Deeds, Dublin. For a general survey of the importance of this institution as a source area for Irish studies see P. B. Phair, 'Guide to the Registry of Deeds', *Analecta Hibernica,* 23, 1966, 257-76.

[11] These materials are now held by Mr Tim Looney, Pearse St, Cahir, Co. Tipperary. Unless otherwise indicated, all references to developments on the Shanbally estate are from this residual collection, recently catalogued by the Irish Manuscripts Commission. My very sincere thanks to Mr Looney for preserving this material, for allowing me to inspect it over a lengthy period and also for his (and his wife's) many helpful comments in interpreting specific passages. My thanks also to Mr John Fleming, Clogheen for his assistance in this sphere.

[12] J. F. Ainsworth, 'Report on the Shanbally estate office papers, Clogheen, Co.Tipperary', N*ational Library report on private collections, No.* 343. One item was acquired for the National Library: *Rent ledger, Shanbally, Co. Tipperary* MS. 5670.

Figure 1.

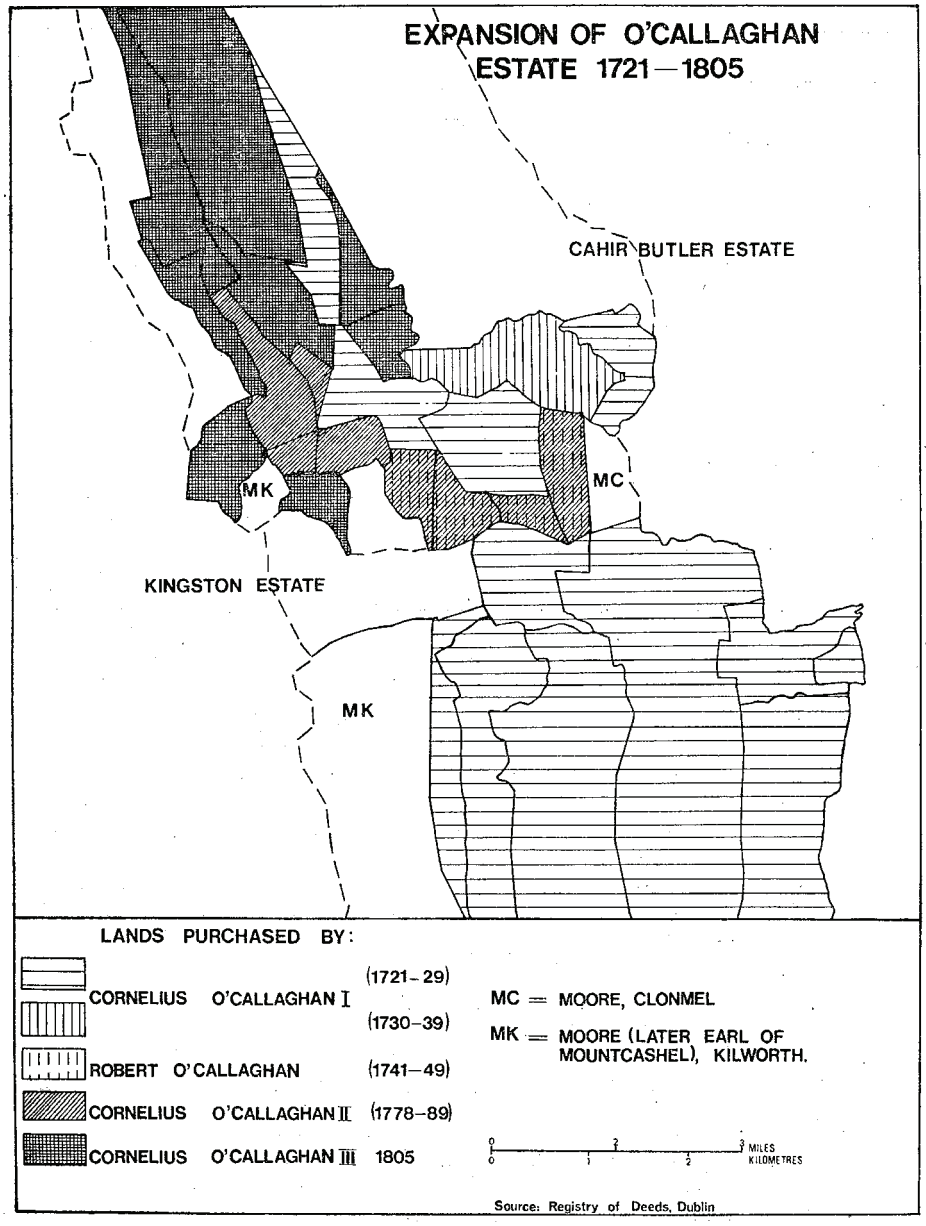


In many ways the account books and the small collection of estate correspondence are by far the most valuable and most interesting documentary sources. The account books generally comprise a day-by-day, or at least a week-by-week, record of estate income and expenditure, ranging from details of the pennies paid to the women weeding the cornfields in the 1780s to the annual rental income of £25,000 in the 1820s. The account books include payments of a series of crown rents and church tithes, monetary exchanges with other landowners in relation to the purchase, mortgaging and renting of lands, wages paid and tasks performed by both regular and temporary workers in addition to the activities of specialist employees such as master-builders and land-surveyors. Details of incoming rents being paid in cash, in kind or work days on or for the demesne (or combinations thereof) are carefully noted. The account books also reveal the surviving feudal duties of tenants, details of the demesne farm economy, costs of materials for new buildings, enclosures, plantations and urban development and contracts with local, regional, national, and cross-channel merchants - in short, as full a description of most aspects of the estate economy and society from the mid-eighteenth century onwards as one might wish for.

The estate agents' letters are especially valuable in high-lighting the character and activities of the estate administration. Changing marketing conditions are regularly noted as is the need for different strategies in the management and development of the demesne, the estate and its tenantry, thus providing a host of anecdotes about the continuous battle-of-wits between the countryman and an agent intimately aware of most goings-on on the estate. The landlord's letters often reinforce the agent's perspectives on local matters, demonstrating in this sample an uncanny awareness of both the estate and demesne economies. The landlord

frequently provides detailed instructions both about marketing timber and cattle, and about problems of estate development and leasing. These letters provide rich insights into the reactions of the ruling elite to changing political and economic conditions at both national and imperial levels as well as many details of family problems and expenses. In addition, rentals, valuations, leases and deeds are rich sources of data for the analysis of changing patterns of landholdings, settlements, terms of tenure and rent movements.

Figure 2.



For the historical geographer with adequate patience (and eyesight) to wade through the details, such records raise a host of questions relating to the evolution of townland and other landholding units, the nature of the estate and demesne economies, the social and spatial structure of the occupying tenantry, and the associated evolution of rural settlement and farmholdings. These sources also provide a greater understanding of changing patterns of trade and communications, processes of urban growth, the geography of the land-market, the mean-information field of the estate bureaucracy, related processes of agricultural innovation and the consequences of changing relationships between the estate and local and central government. And unlike the static cross-sectional view that some other sources provide, here one encounters a moving film of events, providing a dynamic perspective on many landscape changes. Given the wealth of detail, the analysis of such sources – especially of the better account-books – raises important questions of methodology. New techniques such as content analysis may be relevant here, but for the purpose of this study, emphasis is placed on what appeared from a general inspection of the data sources to be most important.

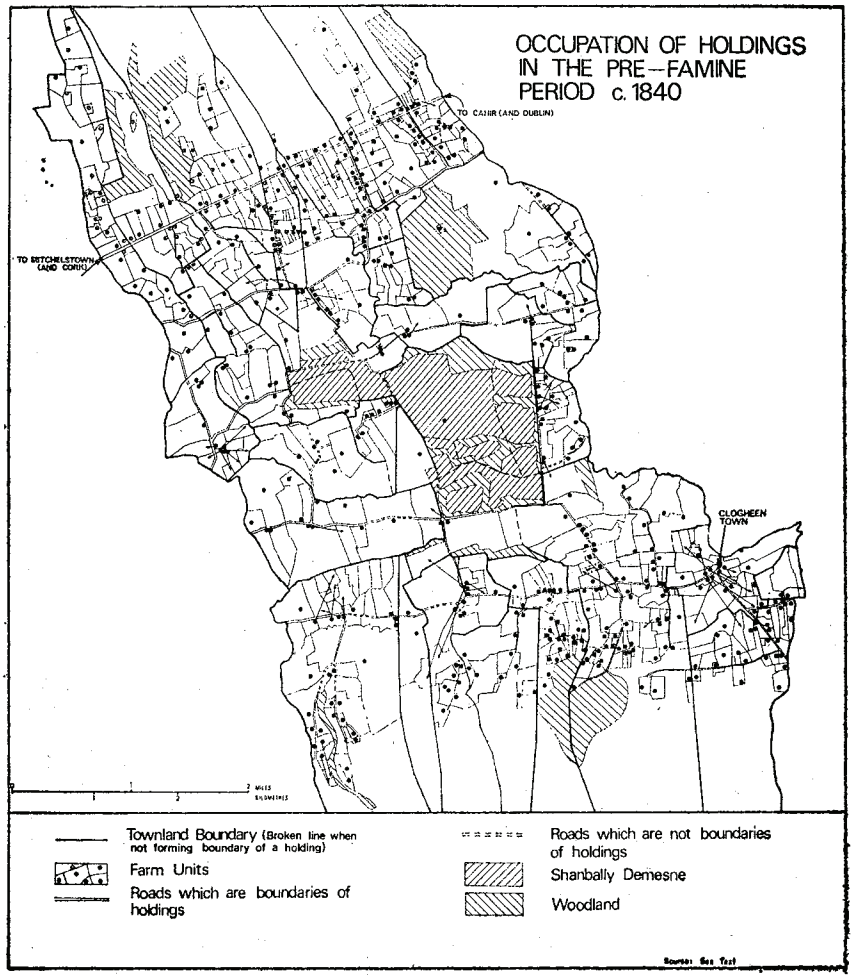
Figure 3 provides us with a useful benchmark from which to explore the estate records for clues to an understanding of some of the major processes which shaped this mid-nineteenth-century landscape. This map represents a composite picture of the pre-Famine landscape, using the 1835 Tithe Applotment books, the 1839-41 Ordnance Survey six-inch map, and the earliest of Griffith's valuation surveys for 1847. It needs to be stressed that the 1841 O.S. map must be seen as portraying the culmination of a phenomenal expansion in the population over the previous half-century. As Andrews has emphasised, one needs to try and clear away some of the debris of this demographic explosion so as to reveal the effects of earlier and perhaps more stable landscapemaking processes.[13] The estate records are obviously a crucial source in such an endeavour. They should also be of assistance in assessing the degree to which the landlord and his administrators were able effectively to control the making of the landscape against the background of other powerful economic and demographic pressures.

Scrutiny of estate records not only points out their value as sources *per se*, but also illustrates the need for the geographer to be sensitive to both short-term and long-term periodicities in the evolution of the landscape. Given the source-material available for this study area, one can distinguish three broad phases between c. 1730 and the Famine era. The first period up to c.1775. can be interpreted as a critical formative phase in the making of the modern landscape in this area. From the perspective of the Big House, we may term this phase as one of *initiation,* while from the perspective of the ordinary peasantry it may be seen as one of reorganisation and displacement. A second, relatively brief phase, but one

[13] Andrews, *op. cit.,* 1970, I.

with enormous demographic and landscape consequence, is represented by the economic boom period between c.1775and 1815. From the landlord's point of view this is a phase of *elaboration* and direct involvement in landscape change, while beyond the walls and hedges of the demesne it is a period of intensification of land use, rapid increases in the number of farm holdings and cottier settlements, and a related demographic explosion. From 1815 onwards, we note a transition phase – one of *reorientation* and farm amalgamation on the part of the landlord, and one of increasing competition between proliferating tenant-farmers for that basic resource, land. This final phase thus set in motion processes of landscape reorganisation which the crisis of the Famine was to accelerate rather than initiate.

Figure 3.



The initiation phase c. 1730-c.1775

One can begin the story of landscape development in the study area about1730 for a number of reasons. As Cullen has demonstrated, the 1730s witnessed the beginning of a very significant expansion in the

pastoral sector of the economy[14]. The demand for wool and beef, bacon and butter provisions increased enormously, thus ushering in a greater emphasis on extensive pastoralist farming. This general date also marked the end of the passing of a series of Acts of Parliament over the period 1716 to 1732 dealing with regulations relating to enclosure and land reclamation[15]. Finally, for the survey area, the 1730s represent the beginning of full-time residence on the part of the O'Callaghan landlord family.

Given their wealth, extensive county and national connections, and the related ability to respond to new ideas and fashions, it is perhaps not surprising that one of the first major impacts of this family on the landscape involved the building of a new mansion and the creation of a small demesne of c.600 st. acres. Today the shadowy foundations of the 820 sq. ft. mansion – comprising a central block linked to twin pavilions and built not later than1735-41 (possibly using Castletown House as a prototype) – only surfaces under dry summer conditions. Early accounts, however, testify to its scale and elegance and there are regular annual entries relating to the cleaning of 26 chimneys. Vallancey's military map for 1782 pinpoints its location, fronting a number of straight tree-lined avenues.[16] The shape and character of the demesne is suggested in Figure 4 with its regular geometric pattern of fields, avenues and roads, ignoring, as had the early Carton demesne, the contours of the landscape.[17] The natural environment was thus subjugated to the art of the designer, so typical of the fashion of this period.

The specific location of the house and demesne is also worth noting. While the O'Callaghans were to purchase the truncated Everard estate (re-granted to the latter family after the Restoration), they failed initially to purchase the old Everard base at modern Burncourt. The new demesne was located in the contiguous townland of Shanbally – on the site of a probable late medieval village which may have focused on a church, mill and forge.[18] The wide approaching avenue to the south led

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[14] L. M. Cullen, *An economic history of Ireland since 1660,* London, 1972, 50-99.

[15] Viscount Mountnorres, *Impartial Reflections on the Present Crisis; Comprised in Four Essays,* London, 1796. See *Irish Statutes* for reign of Anne, George I and II, especially Vol. 4, Ch. 5, 1721, 21-26, in 'an Act to oblige proprietors and tenants of neighbouring lands to make fences between their several lands and holdings', and Ch. 9, 1731, 512-515, 'An Act to encourage the improvement of barren and waste land and bogs and planting of timber trees and orchards'. See also other earlier acts of 1703, 1708, and 1712 'for encouraging and preserving trees' and later acts about treeplanting and fencing for 1735, 1766, 1771-2 and 1783-4.

[16] C. Vallancey, *A military survey of the south part of Ireland, Part* 2, 1782, in British Library, Map Library Division, M.51, 31-2. See also accompanying report, p. 8. For a general survey of Vallancey's mapping activities in Ireland, see J.H. Andrews, 'Charles Vallancey and the map of Ireland', *Geogrl. J.,* 132, 1966, 48-61.

[17] A.A. Horner, 'Carton, Co. Kildare - a case study of the making of an Irish demesne', *Quart. Bull. Irish Georgian Soc,* 18 (2 & 3), 1975, 45-103.

[18] R.C. Simington (ed), *The Civil Survey A. D. 1654-56 for County Tipperary,* Dublin, 1931,1, 373-74.

into an extensive area called 'the Park' -probably the early 17th-century deer-park granted to, and created by, the Fenton family.[19] The latter area was occupied by a branch of the Everard family in the early 18th century, but was let in the 1760s to an extensive grazier farmer. An earlier 1741 lease mentions the building of a park wall around what was probably part of the old deer-park. In this age of improvement it is likewise not surprising to find a 1752 survey of part of the demesne farm itself, confirming that 5200 barrels of roche lime had been spread on an area of 140 st. acres in one year in fields which ranged in size from 33 to 7 st. acres. One workman spent 230 days in 1761-2 clipping and shearing hedges on this demesne, while a mason spent 134 days in the same year repairing the walls of 'the paddock' in an adjoining townland.

Both these workmen belong to an interesting group of small-holders from a townland directly north of the landlord's demesne (and also contiguous to the old Everard mansion at Burncourt). Other members of this group were receiving payments for 500-600 days work on the demesne over a two-year period in the 1760s. The tenants of this townland are always classified in a distinctive fashion in the account books: their rent was computed collectively; accounts of rental arrears on the estate are always exclusive of this group, while other special allowances are made to what were sometimes termed 'the tradesmen and labourers of Toorbeg' or 'Ballybocht' as the townland was sometimes called. We may well have in this example the survival of a serflike group living in a specific townland and rendering heavy labour services to the demesne. It is only in the early 19th century, when two cottier settlements for estate employees were established around the new demesne, that the account books become silent about this specific townland group.

This example, however, of what appears to be a late medieval survival, may have been a relatively rare phenomenon by 1760. There is certainly no evidence to support the view that the three or four small nucleated 'villages,' which are suggested in the mid-17th-century Civil Survey – and which appear to have been centred on castles and/or churches and mills – had survived.[20] The destruction of the older landowning patterns, the dominance of a commercialised pastoral economy, and the related need for farm reorganisation and enclosure, had all made redundant the functions of these old settlement foci. The dominance of sheep and black cattle on the bigger farm entities of the area can possibly be inferred from the demesne farm accounts which show 500-700 fleeces of wool being sold to a Clogheen town woolcomber in the 1750s, while a Quaker woollen manufacturer in the same town received 115 stone of wool from the demesne farm in 1772. The development of the pastoral sector of the economy at this period is above all epitomised by the granting of three

[19] *Index to Calendar Patent Rolls James I,* Pat.14 & 16, 309, 361-63.
[20] Simington, *op. cit.,* 1931, 373-74.

new annual fairs to the landlord in 1745[21] on a site to the east of the demesne. In 1758 two additional annual fairs were granted to the two already existing in Clogheen town since its early 17th-century foundation. Travellers' descriptions in 1748 also note the expansion and development of this small O'Callaghan-owned town. Clogheen is then described as a neat town 'with a very pretty market place not quite finished'.[22] In his intended history of Co. Tipperary for the 1750s, Charles Smith was also impressed with Clogheen, its church, stone bridge and two good inns, and he observed that it was 'of late much improved by its landlord Counsellor Callaghan who has encouraged artificers particularly manufacturers of friezes and rateens to settle there'.[23] Apart from its two wool-combing establishments, the account books showed that Clogheen town also certainly contained at least one tannery in the mid-18th century. It also seems significant that the tenant of the manor grain mill received compensation from the landlord in the early 1760s for introducing new factory wheels from Dublin. The fragmentary evidence available thus points to the direct involvement and encouragement by the landlord of both farm production for a market and of industrial developments fuelled by pastoral concerns.

Leases and deeds of the head-tenants during this period also point to the initiation – or more likely the continuation – of processes aimed at the establishment of large compact grazier farm units. Deeds from the adjoining Kingston estate for the early decades of the 18th century were requiring new head-tenants 'to fence in, as the Acts of Parliament directed and required, all outbounds on the premises',[24] and to build within seven to ten years rather large dwelling houses one-and-a half stories high, complete with stone chimneys. Three English acres of land were to be enclosed contiguous to these houses with a double ditch set with whitethorn; this land was to be planted with good fruit trees. A 1727 deed requires the tenant 'to quicksett all the ditches that shall be made or raised thereon during the said term'.[25] Similarly, on the O'Callaghan estate in the late 1730s, and more especially in the 1740s, a significant number of leases were granted to a number of headtenants (or middlemen, as they came to be known). This group thus came to occupy one or more townlands under tenancies of three lives or three lives renewable. Such leases required the incoming head tenant – in one example on a unit of 640 st. acres – to build a double ditch well-quicked and planted with ash on the outbounds. On the adjoining townland, at the foot of the Knockmealdown Mountains, rent allowances were to be granted in consideration of 'the laying out the same yearly by improving and

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[21] 'Fairs and markets 1338-1773', *Records of the Rolls,* 14, 139, Public Record Office, Dublin.
[22] 'A tour through Ireland by two English Gentlemen', *J .Waterford and South East of Ireland Archaeological Soc,* 7, 1901, 41, (originally published, Dublin 1748).
[23] C. Smith, *A history of counties Limerick, Clare and Tipperary,* MSS 24-G-9, Royal Irish Academy, Dublin, 278.
[24] *Registry of Deeds,* 1724, Book 54, 35. See also 1719, Book 45, 67-71.
[25] *Registry of Deeds,* 1727, Book 54, 384.

bringing in the said lands'[26]. A penal rent of double the rate (then 6/-per Irish or plantation acre) was to be imposed if these conditions – and others forbidding subletting without the landlord's permission – were not fulfilled. Large dwelling houses surrounded by 3 to 5 acre orchards together with malt houses, barns and stables were also required to be built. The legacy of these rules has survived in a number of instances today for some substantial two-storey farm houses of a distinctive architectural style can still be found in a small number of townlands and these were occupied by some local middlemen in the 18th century. Many of these farms also survived to form the cores of the largest farm holdings both in the mid-nineteenth century and at the present day. It is also perhaps worth noting that the landlord in this formative period is often attracting in a new group of Protestant head-tenants to develop certain townlands. This new group, often with mercantile connections in Clonmel and elsewhere, displaced what appear from early 18th-century deeds to be predominantly native Catholic middlemen – the latter possibly descendants of a late medieval system of estate administration. There is also a uniquely high conversion rate by 15 couples, mainly farmers, to the Established Church in Clogheen in 1747 which suggests that specific local economic and institutional factors are operative.[27] On the other hand it should also be noted that quite a number of substantial Catholic tenant farms were to survive right through the 18th century.

A number of surviving townland surveys from the estate also emphasise the importance of the period 1730 to 1760 in the development of the rural landscape. A 1740 map survey illustrates three clearly defined and bounded farm-units – averaging 64 st. acres in size – 'formerly in the possession of Bourk, Doyle and Davoren' (three local family names) – now held by two incoming middlemen/farmers. In this case it is not clear if the compact units were already in existence or actually created c. 1740. This example also suggests that reorganisation might involve the break-up of existing landholding arrangements, and often the displacement of both substantial and smaller farmers. Already in 1717/18 three small-holders are accused of driving the cattle of the descendant of a Cromwellian grantee from a former townland common. That enclosure was already proceeding apace onto formerly unenclosed mountain lands has already been indicated. A fragment of a letter which survives from the early 1750s reinforces this view. 'Due to the violence of the weather' two surveyor brothers, snug in the Globe Inn at Clogheen, direct a letter to the landlord requesting further instructions on how to lay out certain lands. Already certain farms have been sub-divided into $^{3/4}$ Irish or plantation acres, but 227 Irish acres of 'Anglesey's Mountain' were still to be laid out and divided. This latter townland, now known as Mountanglesby, was leased in 1754 to a Protestant middleman whose

[26] *Registry of Deeds,* 1747, Book 100, 541.

[27] Certificates of Conformity, 1701-1782.' *Lodge MSS.,* Public Record Office, Dublin. My thanks to Professor L. M. Cullen for drawing my attention to this source.

corn was to be burnt and fences levelled in the Whiteboy disturbances some years later.[28]

These famous agrarian disturbances, which may have originated from this specific zone, may thus represent the co-ordinated reaction both of displaced substantial native farmers (and native middlemen?) and more especially smaller holders, now deprived of access to a wide range of former communally-held resources either within townlands or on the former common grazing lands on the mountain edges which were now being enclosed. Feuding is also characteristic between adjoining landlords at this period, as the value of the mountain commons are enhanced in this pastoralist phase. Such conflicts call into play the evidence of the Irish-speaking monoglots, consulted in settling disputes about old townland boundaries on the mountains and about the associated rights to turbary, grazing and water resources. Such conflicts were to be resumed in the later 18th and early 19th century as the landlord's timber plantations started creeping up the mountain sides and as the exploding rural population spilled over into the marginal moorland areas.

In summary then by the 1770s the skeletal framework of the modern landscape of compact enclosed individual farms, with still large fields geared to pastoral pursuits, was generally established. Vallancey's stylistic depiction of the field system for the area supports this view.[29] However, it is also clear from the amount of oats coming into the demesne in part-payment for rent, that a tillage tradition was still characteristic, especially amongst the surviving small holding subtenants. There is also evidence for the existence of a number of partnership farms in the lowlands, and more especially in certain peripheral townlands. While we have few clues to the settlement forms associated with such landholding arrangements, two surviving townland maps of partnership farms in the early 19th century demonstrate that such an arrangement need not involve a clustered settlement. It is also clear that the mainly long-established townland boundaries – now and again fragmented by very regular north-south Cromwellian land-divisions – acted as the frames within which the farm and field system was created. In no instance, even at the peak of population in the mid-nineteenth century, did farm boundaries cross these basic divides. It should also be noted that whereas this area to-day contains 40 townlands, a 1639 patent describes over 300 landholding parcels of various kinds of land for this same area.[30] It is possible that many of these sub-townland units of pre-Cromwellian date were also adapted and absorbed into the enclosure pattern associated with the elaboration of the farm and field structures. One might also speculate on other underlying patterns which helped shape the 18th-century landscape, but further analysis is severely hampered by the absence of documentary material relating to the activities of the 8/9 resident middlemen who effectively controlled the majority of townlands for the greater part of

[28] W. P. Burke, *History of Clonmel,* Waterford, 1907, 368-70.
[29] Vallancey, *op. cit.*
[30] *Calendar of Patent Rolls Charles I,* Vol. 6.

the 18th century. The specific contributions of this group, in addition to the role of other substantial tenant farmers, needs to be researched before a more complete picture of this formative phase can be written.

The phase of elaboration c. 1775-c.1815

The Hearth Money Records for Co. Tipperary in 1665-1667 suggest that the population of the parish of Shanrahan was then about 1800.[31] By 1766 the parish is estimated to have contained 23 Protestant and 428 Catholic families, suggesting a population in the region of 2400.[32] The greater commercialisation of agriculture and some in-migration thus resulted in a population increase of about 33% over this hundred years. In comparison with this second phase, however, the stabilising role of a more extensive pastoral economy, more akin to the present day economic regime, made for relative stability in population numbers. The account books for 1761-1774 still retain the flavour of a more leisurely age with the shadows of the later Middle Ages now and again falling across the documents. By 1775, however, a second wave of transformation seems to roll across the landscape. Again the entry of new blood with the next generation of the landlord family taking over (after intermarrying with the prestigious Ponsonby family) coincides with the spread of a more intensive tillage economy in what still remained a mixed farming zone. While the demesne economy (and presumably that of surrounding larger farms) still retained its share of sheep, milch cows and fat cattle, the first large-scale dealing in grain production emerges in 1777, with 1407 stone of wheat being delivered to Moore's mill at Marlfield near Clonmel. Grain production on the demesne had doubled by 1786 when large-scale grain milling came to Clogheen town, and the wool-combers began to fade from the scene. The dairying tradition was also intensified as casks of butter are regularly transported to Clonmel, and pigs become more conspicuous in sales and markets.

Thus began this relatively brief but intensive dairying/tillage boom which had such immense landscape and demographic consequences. The wealth accumulated by the landlord at this time is symbolised in the landscape both by the creation of a new much enlarged demesne and a new mansion. The rentals show that the landlord town of Clogheen was to expand rapidly in the 1780s and 1790s; a new group of millers and

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[31] T. Laffan, *Tipperary's families: being the Hearth Money Records for 1665-6-7,* Dublin 1911. The population was estimated by assuming that Hearth Money records were defective by 50% to 1785 and by using a multiplier of 5.5 on the enumerated 233 households. See K. H. Connell, 'The population of Ireland in the 18th century.' *Economic History Rev.,* 16, 1946, 111-124 for a detailed analysis of household sizes for this period.

[32] W.H. Rennison, *Succession list of the bishops, cathedral and parochial clergy of the dioceses of Waterford and Lismore,* Waterford, 1920. For a number of parishes (but not that of Shanrahan) this survey enumerates both households and total population; on this basis, it was computed that the mean size of the Catholic household was 4.8 and that of the Protestant, 3.3. This would give a total parish population of c. 2130 but it was felt that it would be more realistic to utilise K. H. Connell's nationally based multiplier of 5.5 for this period.

shopkeepers emerges; new houses are built, the streets enlarged and newly paved; a new market house is built; detached Georgian houses and plantations come to surround the town; the bridges are improved and lanes are extended to house the expanding labourer section in the town. The buoyancy of this period is also reflected in the emergence of a really powerful estate bureaucracy – and a much more efficiently managed estate economy. Nurserymen, foresters, a huntsman, masterbuilders, land-surveyors and literally dozens of artisans dominated by masons, stonecutters, quarrymen, brickburners, slaters, carpenters and others loom large in the account books. There is a noticeable expansion in the number of hired labourers (living on 'potato ground' along road edges) who now supplement the much enlarged permanent labour force on the demesne. Such increases reflect both the intensification of the agricultural economy and the labour inputs needed to implement the wide ranging material changes in both the landscapes of town and countryside. A number of small farmers' wives also emerge in the accounts, some of them still spinning wool (a long established tradition in the area) while others assist the men in the tillage fields. These men were also busy at lime-burning, road-making and turf-cutting. On the mountain edges, woodkeepers, shepherds, herdsmen and gamekeepers add to the teeming diversity of the estate culture.

The power and prestige of the O'Callaghan landlord family was now approaching its peak (Cornelius O'Callaghan was created a baron in 1785 and his son was made a Viscount in 1806) and this is epitomised by the creation of a new demesne of 1,200 acres, much of which was to envelop the old deer park area. This development took place in two stages. As Horner also discovered for the Carton demesne,[33] the development and enlarging of the new Shanbally demesne was hampered and delayed by tenurial restrictions. From 1774-79 the northern half of the new demesne was gradually embellished in the naturalistic fashion of the period. It was not until after 1779 that expansion could occur in the area to the south and east – when either leases ended or land was re-purchased from the previous landlord's widow. Former compact farm units in these areas were re-occupied; one large tenant farmer was resettled on a large farm elsewhere on the estate while other small holders were partially compensated and/or resettled in some peripheral townlands. Displacement, however, resulted in some prosecutions relating to the levelling of walls and encroachment on the new demesne plantations. The account books detail this thorough-going reorganisation of the reconstituted core of the estate; cabins are knocked, old ditches levelled, while digging and trenching for new fences, walls, orchards, woodlands, windbreaks, gardens and a nursery became a characteristic feature for at least two decades. Again as in Carton,[34] the move from the old demesne is away from a slightly lower and more flat elevation to a rolling

[33] A.A. Horner, 'Land transactions and the making of Carton demesne', *Kildare Archaeological Soc,* 15 (4), 1974, 387-96.
[34] Horner, *op. cit.,* 1975, 62-64.

landscape with magnificent views of the mountains to the north and the south. New farmyard buildings were completed with the granary occupying the central position in the complex. Finally in the 1790s the neo-classical house, later known as Shanbally Castle, is built. The old demesne is then advertised for letting. The overall design of the new demesne, ignoring the older land-holding divisions along much of its boundaries, thus symbolises the immense significance of the landlord as an agent of landscape change (Fig. 4).

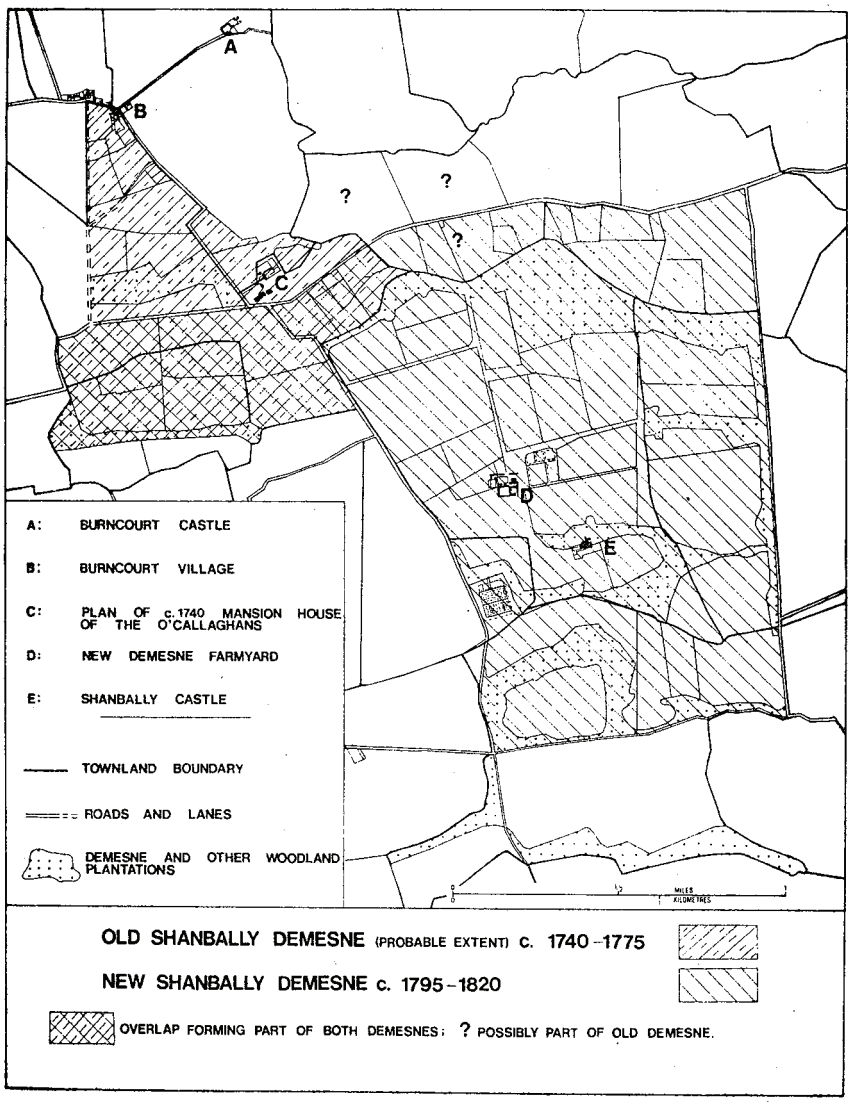
This large-scale reorganisation, apart from welding the O'Callaghan lands into a more compact unit, also made its impact on settlement and communication patterns which reverberated even onto the edges of the settled areas of the estate. The road network around much of the new demesne was created between 1791 and 1795. New roads, lanes and bridges were established to link up with the older east to west roads to the north and south, while an older road, which ran through the southern part of the newly-created demesne, was obliterated. The Clogheen to Lismore road was improved in 1794 while similar contemporary developments in Mitchelstown and Cahir led to the cutting of a magnificent new main road through the extreme northern part of the parish. There are numerous references to tenants' duties in ditching newly established roads. A 1785 deed requires one head-tenant 'to keep the Dublin turnpike road well and sufficiently gravelled and to plant and preserve the road ditches with ash or other timber planted at ten feet distances'[35]. Frequent references to the renting of 'potato-ground' suggest the proliferation of cottier and small-holdings along road edges. It is also clear that quite a number of estate officials - including the land steward, rent-warner, head-mason, gardener and cattleman - came to occupy some of the better farms along the roads encircling the demesne, a feature also characteristic of the older demesne area in the previous era.

The account books of the 1780s and 1790s detail the activities of the land surveyors not only on the new demesne, but also over the now enlarged estate as a whole – a practice which was to continue right up to the 1830s and beyond. Between 1779 and 1811 was a time of rapidly rising prices and rents, and this was especially true between 1791 and 1805 when additional land was again acquired by the estate (Fig. 2), the landlord gradually eliminating the long-established mainly Protestant head-tenants. None of this group show up, even as ordinary tenant farmers, in the 1813 rental, while for the first time the smallest tenant farmers – shadowy and almost completely neglected figures in earlier accounts – emerge as real people. Such widespread changes obviously stimulated the need for up-to-date surveys and it is no coincidence that a book of estate maps was compiled in 1801-02. New leases proliferate, exhibiting a growing tendency towards the granting of shorter tenancies and tenancies-at-will. The latter were by no means dominant, however; in 1796, such leases

[35] *Registry of Deeds,* 1785, Book 387, 339.

only accounted for 28% of the total, but they do hint at acceleration in the process of small-farm proliferation.

Figure 4.

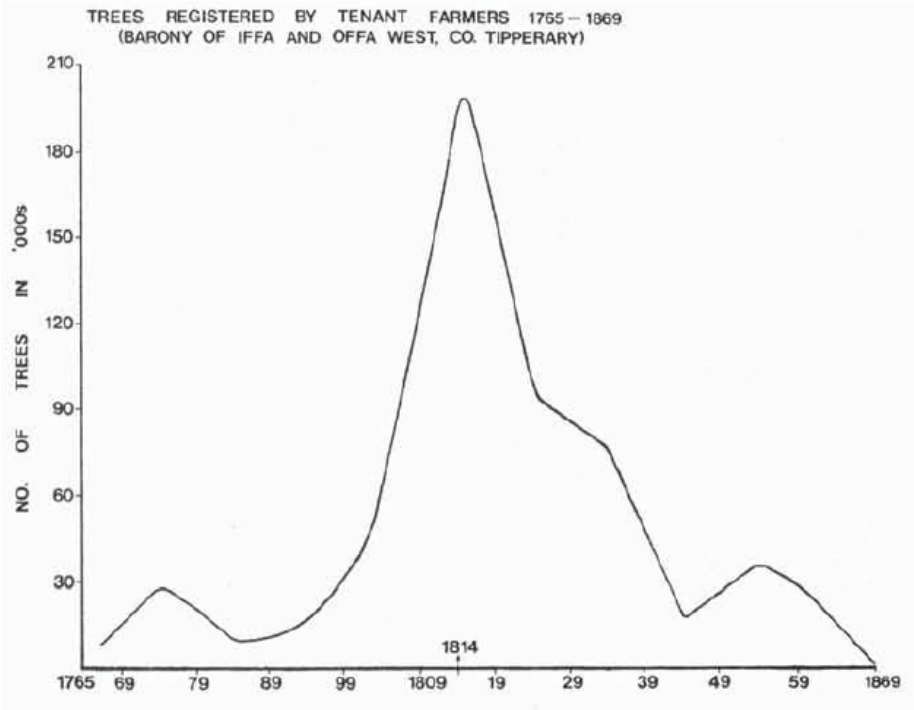


From 1785 onwards, especially on the bigger farms, strict rules in relation to 'no sub-division' emerge; whether such regulations were maintained is another question. These farm leases require that trees and quicks be planted on farms and farmers were to be recompensated for ditching; slated houses and slated outbuildings are to be erected; elm and fir trees to be planted inside road walls and crab and whitethorn quicks to be planted on any new ditches which would be erected on these farms. In the townland of Shanrahan, recently acquired from a middleman, leases for 1806 require the planting of one-acre orchards (also a feature of other townland leases at this time) on farms which appear to have been re-

organised along a new road. The entries for some newly purchased townlands suggest some re-organisation; in one townland old ditches are levelled and a highly regulated group of farms emerge on this townland map survey for 1790. Unlike earlier leases, there is now a specific emphasis on liming with regular quotas prescribed per acre, while the account books also detail the spread of the limekilns throughout the lowland area of the estate.

From the 1770s onwards there are also regular orders to nurserymen in Clonmel, Cork, Dublin, Bristol, and even in Scotland, for hundreds of thousands of Scotch fir, larch, oak, ash, and beech seedlings, while the landlord's brother in the Indian army helps to add greater variety to the early 19th-century plantations begun along the lower slopes of the Galtees and the Knockmealdown Mountains. The intensification of enclosure and quicksetting in this prosperous farming phase is also noticeable. We have no detailed figures for quicksetting ratios per acre. However, central state records help to indicate the scale and timing of tree planting on the part of larger tenant farmers in the barony of Iffa and Offa West from 1763 (Fig. 5). There is a rapid acceleration in tree planting in the late 18th century and especially over the first fifteen years of the nineteenth century. The general embellishment of the rural landscape was to continue, if at a regularly reduced rate, over the remainder of the first half of the 19th century. Presumably, these figures also provide some clues to the timing of the completion of the enclosure patterns in the area as a whole.

Figure 5.



It is also striking that 1814-15 marks a critical peak in landscape investments. This brief phase, 1775-1815, was thus crucial in the elaboration of this rural landscape. The creation of a new demesne; the transformation of the functions and population of Clogheen town; the impressive expansion of the communication network; the emergence of a large number of new woodland plantations; and, above all, the intensification of enclosure on existing farms and the emergence of many new farm units; these all illustrate the importance of this era. Up to 1815, however, the estate records still reveal little of the growing problems of destitution and poverty in the countryside. The foundation of the Clogheen fever hospital and a Clogheen poor fund in 1811 are simply straws in the wind of the approaching storms.

The Phase of Reorientation c. 1815-1850

'Due to the unprecedented depreciation of agricultural produce of every kind and the very great depression in the value of lands, I need not tell you the difficulty of making up rents at this time'. This statement taken from the Shanbally estate agent's letters in 1822 pinpoints the transformation in the estate's fortunes between the unprecedented boom conditions of the 1790-1815 phase especially and the collapse of the market for agricultural products in the years following the ending of the European Wars. Between 1817 and 1830 the landlord – still retaining the life style and family encumbrances of previous decades – was to mortgage portions of his lands for amounts totalling over £100,000. As Maguire noted on the Downshire estates,[36] severe financial pressures often fostered better estate management and the Shanbally estate administration exhibited a similar tendency. In landlord-agent communications in the 1820s there are frequent references to the need to curtail both estate and family expenses. Better management was seen to involve the rationalisation of farm structures, especially on the richer lowland townlands. Between 1817 and 1822, 35 small-holders were evicted on the estate, while in the following two decades a smaller but still significant number of evictions or 'giving up' of farms occurred. Rural conflicts once again erupt; Clogheen town acquired a new police house and a new bridewell in the 1820s, and a new courthouse in 1832 when the estate agent's windows were fronted with iron bars. The period 1815 to 1845 was thus one of transition and reorientation as a battle was waged, and a kind of balance struck, between powerful demographic pressures on the land leading to further fragmentation and sub-division on the one part, and deliberate estate policy, reinforced by the interests of bigger tenant-farmers, aimed at the maintenance of viable farm-holdings on the other.

The population of the parish had almost certainly doubled between 1766 and 1821 when the population was 4,462[37] and it was to increase again by

[36] Maguire, *op. cit.,* 1972, 89-92.
[37] *Census of Ireland*, Dublin 1821, 206

almost two-thirds by 1841.[38] Although the estate records do not reveal the whole picture, it was obviously a landscape of extremes. Approximately one-third of the total number of rural householders were landless cottiers in 1821, when 63% of all farm holdings on the estate were under 15 acres. It should also be noted, however, that the smaller number of larger farms were still dominant in the better lowland townlands, a feature that became more pronounced in the decades both before and after the Famine. The perpetuation of such a pattern was a product of both the vested interests of the landlord and the stronger tenant-farmers. 'I am convinced of the necessity of increasing the size of farms from 25 to 100 Irish acres – the occupiers of such farms would certainly be without want in *all* seasons and having interests would be less likely to combine and at all events we would have less numbers'. Thus wrote the landlord to his agent in 1827, and in 1828 he confides to his trusted ally that he shall keep his mind to himself but that he intends to let the leases of a certain townland run out and then increase the size of farms.

This attempt to consolidate and stabilise farm structures emerges from all estate record items. Any partnership farms which had survived in the lowlands had been reorganised by the early 19th century. By 1820 there is much evidence from the leases to support the view that well-to-do and progressive Catholic tenant-farmers were being attracted into the estate from other parts of southern Tipperary particularly and also from eastern Co. Limerick (where the same landlord owned a number of smaller properties). The new leases now place strict emphasis on the specific allocation of a much smaller proportion of land to tillage; rotations are specified; clover and grass are then to be laid down, thus converting former arable land into good pasture land. Again, many of the bigger farm houses which still survive belong to this phase, while stables, cowhouses and piggeries also become characteristic in this era. Slated buildings, stone-wall fencing, clover seed cultivation all involved direct landlord subsidies. For example five contiguous farm units of 60-80 acres in a part of Shanrahan townland known as Curraghkeal are required in 1830 to build new slated dwelling houses with a chimney at each end, and the alignment of these farms and the associated field patterns in 1841 suggest some re-organisation here in the decade. Even as late as 1838, the landlord and agent are still attentive to rotations and to improving farm units. With reference to the letting of a specific farm, the landlord writes that 'we must make it look nice – a little avenue up to the houses from the road; good offices and good fences – I wish it was as well enclosed as the farms at Curraghkeal'. Given the more powerful demographic pressures on land resources, the relative success of landlord and bigger tenant farmer in maintaining the status quo (or improving upon it) is suggested by the relatively small increase (14%) in the total number of holdings in lowland townlands over the period 1821 to 1835. In sharp

[38] *Census of Ireland*, Dublin 1841.

contrast, there was an increase of 27% in the number of holdings on the mountain townlands over the same period.

It was therefore the poorer peripheral mountain townlands which appear to have borne the brunt of population pressures over the second half of the 18th and the first half of the 19th century. As on the Devonshire Lismore estate,[39] the policy of attempting to maintain or increase farm sizes in the lowlands sometimes resulted in the deflection of former smaller holders or labourers onto the formerly uncolonised moorland edges. Some of the farms along the drift-coated lower slopes of the Knockmealdowns, however, may have been much earlier creations. On the other hand that settlement was relatively recent along the northern flanks of the Galtees is quite clear from: i) large discrepancies between the area of occupied land in the mid-17th century Civil Survey and that of the mid-19th century (partly related to the clearance of two extensive woodland/scrubland areas); ii) the emergence of new townlands with toponymic names; iii) the greater diversity in the origins and names of farm families revealed in the rentals; and iv) the surviving folklore of the residual communities here today. The regular, often geometric arrangement of many of these farms suggests some rationalisation at a later stage – the specific impact of the late 18th-century Cahir-Mitchelstown road in this zone is obviously an important if undocumented one. Subdivision in the mountain townlands was also far more characteristic. One indirect measure of the scale of sub-division may be inferred when contiguous holdings of equal size, and with the same family name, occur in a single townland. Whereas there are no such examples in over half of the lowland townlands by 1835,[40] there are at least four examples in each of nine mountain townlands. That the greatest density of dwarf and subdivided farms is in the townlands owned by the Cahir Butler estate (still leased to middlemen), and the more remote Kilworth-based Mountcashel estate, is obviously instructive here. As always, the varying policies (and locations)of different estate administrations are central in attempting to understand varying landscape patterns.

The final phases in moorland colonisation are documented in the early 19th-century estate records. As we have seen from earlier leases, the enclosure of marginal mountain lands seems to have accelerated by 1750, although the description of boundaries of farms in 1780 leases would suggest that the mountain commonage still covered areas well-settled by 1835. The first direct reference to colonisation on the mountain proper dates from 1811, while the main 'colonial' phase seems to stretch from 1813-1814 into the early 1840s. Much of this activity is concentrated on the more flat moorland areas between 400 and 800 feet, known as 'reas' (Irish ' rèidh': 'level surface'). Small holders, some only occupying 1 to 5

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[39] Andrews, *op. cit.,* 1970, 11.

[40] *Tithe Applotment Books for Co. Tipperary,* (Parishes of Shanrahan and Templetenny, 1835), Public Record Office, Dublin.

acres, but others holding much larger entities, are required to enclose the land, sometimes with stone walls, and to cultivate the lands to the satisfaction of the landlord. Penal rents are prescribed if these and other regulations in relation to liming are not observed, but encouragement is given by the granting of staggered rent reductions over a ten year period. Now one notices the spread of the limekilns onto the mountain edges. The greater elaboration of lanes, bridges and roads (including the new Clogheen-Lismore-Cappoquin road built by 1834) in the mountain areas was especially relevant to this process, as also was the related expansion of the cultivated area. Subsidies were granted for digging up mountain land, for the building of new dwelling houses (even with thatched roofs, a practice frowned on in the lowlands) and for building the limekilns in these harsh colonial situations[41].

Investment on the mountains also took other forms; a hunting lodge, ornamental gardens and an extensive woodland plantation were begun along the middle slopes of the Galtees in 1828 and completed in 1834. The administration also continued to invest in demesne ornamentation, fencing and other woodland plantations; timber sales became an important if still subsidiary element in the demesne economy. Orders for rye grass, red and white clover, Swedish turnips and mangels also became more frequent in the account books. There is an obvious swing away from tillage and from grain production in particular, and there are more cattle sales, although butter remains as important as ever. It is now noticeable that farmers' journals, societies, newspapers and influential clubs act as important sources of new information about a range of agricultural investments and innovations. The signs of modernisation are everywhere. The Clogheen brewery has now supplemented the traditional demesne brewings for the sheep shearers and the harvest workers; new agricultural equipment including Scottish ploughs, turnip-seed sowing machines and a threshing machine appears; while the planning of new drains and watercourses on the demesne begins in 1836.

The estate town of Clogheen continued to expand: it was to enlarge and retain its milling and marketing functions until after the Famine; it acquired a new Catholic church and a new market house, while its service functions (and especially its shopkeeping population) continued to increase. The poverty of many in town and countryside, however, is highlighted both by increases of 32, 48 and 52% in the number of houses in Chapel, Pound and Cockpit Lane in Clogheen town between 1821 and 1847, and by the laying out of its Poorhouse site on 14 October 1839. In the countryside at this time, and more especially throughout the 1840s, the account books record compensations of £1 for persons throwing down their houses and giving up their holdings. A small minority of this group were to receive subsidies to emigrate. The land-surveyor is busy

[41] See K. H. Connell. 'The colonisation of waste land in Ireland 1780-1845', *Economic History Rev.,* 3 (1), 44-71 for a discussion of this process on the national scale.

once again in re-surveying vacated lands, prior to their re-allocation and consolidation. Over eighty farms were to disappear between 1845 and 1850. Many of these deserted holdings were along the mountain edges – one generation farms with weak roots in acidic soils, disappearing without trace to be enveloped by the expanding woodland plantations.

On the demesne the encircling walls are built higher, the mansion is redecorated and a 'Bullock House' is built in the farmyard. The wheel has come full circle in the story as the economy gradually reverts to an extensive pastoralist regime, somewhat similar to the kind of economy prevailing over much of the 18th century. The processes of amalgamation, consolidation, displacement and depopulation accelerate. During the crisis of the Famine, it is striking that the more substantial tenant farmers of the lowlands remained for the most part unaffected by the often catastrophic changes occurring in quite a number of mountain townlands. Stability and durability are the keynotes to the character of these larger farms. They thus emerged unscathed from the crisis of the late 1840s to wax stronger in the agricultural boom of the 1850s and 1860s, frequently enveloping smaller farms as they moved into the growing power vacuum, helping to pave the way for the final phase of an estate system which had ironically fostered this section for its own interests.

Conclusions

The value of estate records as source materials for the historical geographer working in Ireland has been suggested in this sample study. At the very least, these records help to fill in the background details to already well-documented national patterns[42]. At their best, such sources – especially if accompanied by contemporary estate maps – can be of the utmost importance in understanding the timing and nature of the processes (and the motivations of the actors involved) which have shaped the landscapes of colonial Ireland in the 18th and19th centuries. As Maguire[43] and Andrews[44] have both noted, such records also illustrate the only partial success of the landlord and the estate administration in controlling the development of the landscape. Other very powerful and often independent economic and demographic forces were also responsible for processes making for landscape change or stability, thus either reinforcing or cutting across the aspirations of the ruling landed elite. This study also highlights the fact that over much of the 18th century, as both the economy and population growth gathered momentum, middlemen effectively controlled a majority of townlands in the study area. The specific role of this varied group needs urgent attention. Their importance in this study area, however, also raises the problematic questions of how realistic a picture one can expect to gain from such estate records and how representative is the sample area to

[42] T.J. Hughes, 'Society and settlement in 19th century Ireland', *Ir. Geogr.,* 5 (2), 1965, 79-96.
[43] Maguire, *op. cit.,* 1972, ch. 4 & 5.
[44] Andrews, *op. cit.,* 1970, II.

begin with. The estate records tell us little of the heritage of previous eras and of the life of the ordinary country people. Yet in the 1600s this area was already characterised by a highly complex social structure with varied landholding and landscape expressions. The processes shaping the evolution of the modern landscape owe much to early 17th century economic developments. There is also no doubt but that the ghosts of earlier centuries lingered on into the 18th century to provide the skeletal framework into which the estate system poured its rich, yet conflict-laden heritage.

Acknowledgements My thanks to Professor T. Jones Hughes, University College Dublin, and Dr. J.H. Andrews, Trinity College Dublin, for critically evaluating earlier versions of this paper.

CHAPTER 2

DEPENDENCE AND UNDERDEVELOPMENT: THE CASE OF MINERAL RESOURCES AND THE IRISH REPUBLIC

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First published in *Antipode* (1976), 8(3), 46-59.

Dependence and underdevelopment are the results of the penetration of capitalism into societies which were pre-capitalist in the past. The emergence of capitalism in central Europe and its expansion to incorporate all of Europe and later all of the world into its framework marked the beginning of the process of dependence. This situation was first established through direct colonialism and continues today in the form of Neo-colonialism. (Incorporation into the world capitalist system has never been on equal terms.) Such inequality manifests itself primarily between classes but also within space. Recent studies within geography have concentrated upon documenting this process with regard to what has been called the "Third World," (and as a result there has been little, if no, assessment of the impact of Imperialism upon the "Metropole" or "centre").[1] This paper seeks to redress this imbalance, by way of an empirical analysis of dependence and underdevelopment in the context of mineral resources in the Irish Republic.

The failure of orthodox western developmentalist theory to explain the increasing underdevelopment of Latin America, despite the granting of formal constitutional independence, led to the emergence in the late 1960s of Dependency theory.[2] This theory seeks to analyze the various roles Latin America has performed vis-a-vis metropolitan needs at specific historical periods. For example, when the dominant classes in the metropole required specific types of raw materials or cheap labour, the periphery acted as supplier. When new markets for manufactured goods were required, the periphery responded as a market. This situation arose from the specific forms the integration of Latin America into the world capitalist system took. Though individual countries or whole continents may have experienced a change of metropolis through time, the fact of dependency has not changed. Despite the rhetoric of Western sources, dependency has increased through greater foreign corporate, governmental and foundation penetration of manufacturing, retailing, communications, advertising and banking. High prices for imported manufactured goods, coupled with falling prices for primary goods

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[1] A. de Souza and P. Porter, *The Underdevelopment and Modernisation of the Third World,* Commission on College Geography, Resource Paper No. 28 (Washington, D.C.: Association of American Geographers. 1974); H. Brookfield, *Interdependent Development* (London: Methuen. 1975).

[2] For a review of this literature see C. Regan. Geography, Dependence and Development: A Review Essay, unpublished M.A. thesis, Simon Fraser University.

exports is but one reason for this situation. Even where industrialization has occurred within a dependent society, capital is drained through the process of repatriation of profits, interest payments as loans and fees for royalties and shipping costs.

According to Dos Santos, dependency is defined as:

> A situation in which the economy of a certain group of countries is conditioned by the development and expansion of another economy, to which their own is subjected ... an historical condition which shapes a certain structure of the world economy such that it favours some countries to the detriment of others, and limits the development possibilities of the (subordinate) economies.[3]

Upon this basis he identifies three historical periods of dependence. The first is that of colonial dependence associated primarily with exports, in which commercial and financial capital in alliance with the colonialist state dominated the economic relations of the colonies. This process of dependency was maintained through monopolies of trade, land, mines and slave labour. The second period is that of financial-industrial dependency, consolidated at the end of the nineteenth century. A move away from slave labour into wage labour and the emergence of an internal market are hallmarks of this period. The process of dependency is consolidated during the final phase, since the end of the Second World War. Industrial development is dependent on an export sector for the foreign currency to buy the inputs utilized by the industrial sector. Thus, the traditional export economy is preserved and industrial development becomes conditioned upon the balance of payments. The situation is further aggravated by the power structure of technology which is primarily controlled from and developed in the metropolis.

The net result of this type of development is a form of capital accumulation characterized by extreme uneveness between classes, sectors of industry, between agriculture and industry and between town and country.[4] According to Amin:

> as economic growth proceeds, none of these features by which the structure of the periphery is distinguished lessens; on the contrary, each increases. Whereas at the centre, growth is development-that is, it has an integrating effect-in the periphery, growth is not development, for its effect is to disarticulate. Strictly speaking, growth in the

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[3] T. Dos Santos. "The Structure of Dependence," *American Economic Review* 60 (May, 1970).
[4] See R. Chilcote and]. Edelstein, *The Struggle with Dependency and Beyond* (New York: John Wiley, 1974)

> periphery, based on integration into the world market is development of underdevelopment.[5]

Despite the fact that the analysis presented above was developed in the context of Latin America, its application to dependent development in Europe is clearly illustrated in the case of the Irish Republic. In modified form the historical periodisation offered by Dos Santos, the discussion of mechanisms through which dependency is maintained and the results produced are all identical. Hence we can note that Imperialism has produced underdevelopment which is not spatially restricted but manifests itself whenever the world capitalist system penetrates. Dependent underdevelopment is created and maintained by capitalism.

Ireland: Historical Introduction

The history of economic growth in what now constitutes Eire may be seen to fall into three distinct phases. Initially there was the British colonial phase during which the development of industry in certain areas was actively discouraged and indeed prevented, save for some small-scale agriculturally based activities. The net result of this period was commented upon by Engels as follows:

> the more I study the subject, the clearer it is to me that Ireland has been stunted in her development by the English invasion and thrown centuries back.[6]

British colonial policy varied historically, yet it contained one common element in the Celtic realm, the Acts of Union by which Wales, Scotland, and Ireland were politically incorporated into the British Empire. Coupled with a policy of settler colonialism, this union initiated the present political division of Ireland. Preferential treatment was given to Northern Ireland industry (based on textiles and engineering) and integrated that area (and its protestant settler class) into the Clyde and Liverpool industrial complex, a development which integrated this section of the country into that of industrial Britain. The remainder of the country functioned as an agricultural area supplying food stuffs and some other minor products for Britain. Thus Northern Capital came to depend upon union with Britain and preferential treatment in the British market. Consequently it later became possible to combine religious and economic interests in the fight against separatism (a prerequisite for Southern capitalist development). Nowhere is this more clearly illustrated than in the following quotation from a Unionist party pamphlet *Commercial Ulster and the Home Rule Movement in 1902*:

> The cry against separatism ... is not merely the voice of orangemen ... it is the voice of civilised humanity ... it is

[5] S. Amin, *Accumulation on a World Scale* (New York: Monthly Review Press, 1974).
[6] Engels to Marx, May 23.1856 in K. Marx and F. Engels. *Ireland and the Irish Question* (Moscow: Progress Publishers, 1971), p.83.

> the voice of trade, it is the voice of commerce, it is the voice of capital.[7]

Hence the first phase of British domination in Ireland was characterized by institutionalized uneven development between the North-East and the rest of Ireland.

The second phase is that of constitutional independence in the period 1922-32. Civil war and the instability of the Irish political party system combined together to prevent the emergence of an industrial development policy. However, the Great Depression and the rise of protectionism ushered in a new government devoted to fostering small-scale private industry using native materials. The Ideology of this period is graphically illustrated in the slogan: "Burn everything British but their coal."[8]

In economic terms, protectionism was a failure. The net output of manufactured goods increased from 18 percent of total production in 1926 to 28 percent in 1938 but this was offset by a 20 percent decline in agricultural output.[9] The actual number of Irish employers during this period declined despite the offer of grants of up to 60 percent of the costs of fixed assets. This was due in part to the stagnation and depression within the European economy in general, the net result of which was the adoption of a policy geared to the attraction of foreign capital into Europe and also into Ireland.

The decline of Britain in the post World War II period and the restructuring of the European economy encouraged the Irish government to adopt a new policy towards developing an industrial base. Consequently, foreign investment in Ireland (with respect to profits on exports) was to be free of taxation for 15 years. The capital grants scheme was also to be maintained. Government advertisements placed in foreign newspapers and journals emphasized these benefits and others such as the fact that the Irish Labour movement was not strong or communist influenced. This period corresponds to the stage of industrial/technological dependence identified above and marked the full integration of Ireland onto the world capitalist system. Ireland's integration was on terms exceptionally favourable to foreign capital and amounted to a request to come and exploit at will. This situation has led Murray to comment:

> smaller countries, such as Ireland, go even further ... by making general offers of monopolistic advantages to

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[7] Quoted to J. Palmer, "The Gombeen Republic," *International Socialism*, no. 51 (Apr. / June, 1972): 15.
[8] Ibid., p.17.
[9] J. Smyth, "The Changing Nature of Imperialism in Ireland," *Bulletin of the Conference of Socialist Economists* (Spring, 1974): 70.

> foreign investors which exceed those offered to their national capital.[10]

This policy has continued to the present day and its results are briefly discussed in the following sections.

Underdevelopment: Irish Style

This radical change in policy (after 1959) was initially slow in taking effect, but has been accelerated greatly in the last five years as free trade conditions and membership of the European Economic community in particular, have had immense effects on the Irish economy. Native industry has declined rapidly, for example, the share of competing imported manufactured goods in the home market has risen from 14.9 percent in 1965 to 20 percent in 1971.[11] Emigration has slowed down, and this fact coupled with the loss of employment in manufacturing industries (from 197,000 in 1970 to 194,000 in 1972) has created an army of redundant workers.[12] More than half the redundancies for the year 1972 were estimated to have been in textiles, clothing and furniture, industries which had previously been built up through protection.[13] The decline of Irish Capitalism can be attributed directly to the end of protection and the incorporation of the Irish economy into the world system.

The dependent nature of Irish development is evidenced by the fact that in 1971 profits obtained by British investors totalled £21 million (60 percent of total profits for all publicly quoted companies). The Organization for Economic Co-operation and Development has estimated that between a third and a half of all manufacturing is British owned or controlled. In the sphere of trade 55 percent of all imports are supplied by Britain while more than 66 percent of all exports are sold in the British market.[14]

Since the 1960s and early seventies the quantity of British investment has fallen to approximately 4 percent of total foreign investment. Yet this situation has not led to the promotion of Irish industry, rather it has led to the promotion of U.S. and German capital, to name but two examples. The United States in particular has taken advantage of locating in Ireland because of low labour costs, high grants and the easy access to the European market. A point of interest here is that a particular type of international firm is now appearing in Ireland, those who have experienced the restriction of pollution control legislation elsewhere. The South-West coast has now become a dumping ground for oil storage

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[10] R. Murray, "The Internationalisation of Capital and the Nation State," H. Radice, ed., *International Firms and Modern Imperialism* (Harmondsworth: Penguin, 1975). p.122.
[11] J. Smyth, "The Changing Nature of Imperialism in Ireland," pp.70-73.
[12] Ibid.
[13] Ibid.
[14] J. Palmer, "The Gombeen Republic," p.17.

depots, refineries and chemical plants, much to the disadvantage of local residents and the tourist industry upon which so many of them depend. In all 20 countries have participated in the "opening-up" of the Irish economy since 1959, although the bulk of investment is from the U.S., the U.K., West Germany and Canada. Between them they have provided 80 percent of all projects, 75 percent of employment and 70 percent of capital investment since 1970.[15]

The net result of such development policies is not a development program geared to the needs of Irish society. It has created massive uneveness in industrialization, the agricultural sector is falling behind and the future depends more and more upon outside forces over which the people of Ireland have no control. Just how such a situation has emerged is documented in the following section with particular regard to our mineral resources.

Ireland's Mineral Resources: Development

"Ireland's mineral wealth is unsurpassed in Europe." Thus begins a 1974 article in the *Economist*.[16] Somewhat of an exaggeration perhaps, but some indication of a newly discovered resource base. Yet it has been quite a problem convincing the Irish public of this fact. This is a consequence of the inculcation (at all levels of education) of the firm belief that Ireland is devoid of any kind of mineral wealth. Thus Freeman's 560-page standard text on the geography of Ireland dismisses mining in one line: "Mining hardly exists in Ireland."[17] Orme's more recent text, although devoting two pages to the topic of resources, nonetheless refers to "the relative poverty of rich metallic mineral resources."[18] A major government-sponsored report intended particularly to provide a comprehensive survey of the economic resources of each of the Planning Regions, and reporting, among other things to "assess the future needs and potential of... natural resources,"[19] nevertheless devotes only eleven lines to minerals, beginning "the country is not rich in natural mineral resources."[20] As late as 1973, the Prime Minister, Liam Cosgrave, during the course of an election speech, said:

> In this country we have few natural resources except arable land. Compared with other countries we have no great natural resources of raw materials, nor minerals capable of exploitation.[21]

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[15] Statistics derived from *Survey of Grant Aided Industry*. Dublin, 1967, Industrial Development Authority; *Review* 1952/70, Dublin, 1971

[16] "Zinc Irish." *The Economist*. March I, 1974.

[17] T. W. Freeman, *Ireland*, 4th ed. (London: Longman's, 1969), p.223.

[18] A. R. Orme, *Ireland* (London: Longman's, 1970), p.59.

[19] Buchanan, Colin and Parners, *Regional Studies in Ireland* (Dublin: An Foras Forbartha. 1969), p.1.

[20] Ibid.. p.2.

[21] As reported in the *Irish Times*, February 22, 1973.

This statement was made over two years after the first announcement that lead and zinc has been discovered at Navan, County Meath (see Figure 1), a deposit which in 1971 was declared by Rio Tinto Zinc Corporation's chief geologist in Ireland to be "the largest lead/zinc mine in the world."[22]

Table 1 shows Ireland's mineral output in 1971 and 1972, when there was no production from Navan or from offshore hydrocarbon deposits (see below). It can be seen from Table 1 that Ireland's supposed destitution in terms of mineral resources is a myth. What Table 1 does *not* show is that, apart from cement and coal, every ounce of minerals in the table was extracted by foreign companies; apart (additionally) from gypsum, every ounce was exported; and apart (again, additionally) from magnesite, every ounce was exported in unprocessed form, except for primary concentration. Before examining the economic implications of these circumstances, it will be useful to indicate how they have arisen.

Figure 1. Principal Mineral Resource Deposits, Republic of Ireland

Although indigenous small-scale operations have been carried on for centuries, the modern era in Irish mining may be considered to have begun in 1954 when the state mining company, Mianrai Teoranta (literally "Minerals Limited"-now moribund), having unearthed a viable deposit of copper at Avoca (in the Wicklow Mountains south of Dublin-see Figure 1), decided to advertise abroad for a mining company willing to exploit the deposit. As an incentive, the government in 1955 offered a nine-year concessionary period as regards company tax, consisting of four years with 100 percent relief followed by five at 50 percent. In 1956

[22] Quoted in Resources Study Group, *Navan and Irish Mining* (Dublin, 1972). p.4.

a 21-year lease to extract from the Avoca deposit was granted to International Mogul Mines of Canada via its subsidiary, St. Patrick's Copper Mines, Ltd.

Table 1. Mineral Output-Republic of Ireland

	1971	*1972 (000 tons)*
Lead	50.8	55
Zinc	86.1	83
Copper	11.7	13
Pyrites (concentrates)	29.6	40
Gypsum	328	374
Barite	193	233
Coal	88.5	73
Magnesite	--	75
Cement	1,244	1,510
Silver (ozs.)	1.432m	1.950m
Mercury (flasks of 76lbs.)	2,345	1,250

Source: Mining Annual Review, 1973.

These developments marked a fundamental departure from previous official government attitudes towards external participation in the Irish economy, which since the Control of Manufacturers Acts of the early 1930s had been legislatively hostile (although there had been regular exceptions under special ministerial licenses). The opposition party, Fianna Fáil, which was responsible for the earlier Acts, strenuously opposed the new measures in Parliament,[23] although ironically this party, when returned to power, introduced much greater concessions a decade later (see below).

The opening of the Irish economy to outside investment facilitated by the Avoca developments and other government measures in 1956-58 succeeded in bringing in a large number of outside mining companies, mostly from Canada, to undertake exploration work. By 1971, over 25 percent of the total land area of the country had been licensed for prospecting purposes to 27 different companies (see Figure 3).[24] An indication of the success rate enjoyed by these companies is given in Table 2.

Ironically, the Avoca deposit is geologically different from the others, being compared to low-grade ore found as veins within older Lower Paleozoic rocks, whereas the latter are all found in massive, high-grade deposits on the margins between Carboniferous Limestone and other older rocks.[25] Ireland's extensive deposits of Carboniferous Limestone

[23] See Resources Study Group, *Irish Mining-The Need for Action* (Dublin. 1971), pp. 5-8.
[24] Ibid., p.14.
[25] P. Gardiner and R. Horne, "Mining Geology - What's Where in Ireland," *Mining Ireland* (Dublin: Irish Publishing Co., Ltd., 1973).

have therefore strongly influenced the pattern of exploration, as can be seen by comparing Figures 2 and 3. Table 3 represents the principal non-metallic mineral deposits currently being worked in the Republic.

Figure 2. Geology: Ireland

After T.W. Freeman, Ireland, 4TH ed. (London: Longman's, 1969)

Figure 3. Area under Exploration Licence, December 1, 1971

After Resources Study Group, Navan and Irish Mining (Dublin, 1972), p. 42.

Table 2. Commercial Metal Deposits, Republic of Ireland, January 1,1975

Location	*Production*	*Content*	*Operator*	*Parent Co.*	*Domicile*
Avoca	1958	Copper, pyrites	St. Patrick's Copper Mines	International Mogul Mines	Canada
	1966[2]		Avoca Mines (Ireland) Ltd.	Consortium[3]	Canada
Gortdrum	1967	Copper, silver, mercury	Gortdrum Mines (Ireland Ltd.)	Northgate Exploration	Canada
	-------[4]	Zinc, lead, silver	Tara Mines Ltd. Bula Ltd.[6]	Tara Exploration & Development[5] Independent[7]	Canada Ireland
Silvermines	1968	Zinc, lead, silver	Mogul (Ireland) Ltd.	International Mogul Mines (75%) Silvermines Ltd. (25%)	Canada Ireland[8]
Tynagh	1965	Lead, zinc, copper, silver	Irish Base Metals Ltd.	Northgate Exploration	Canada

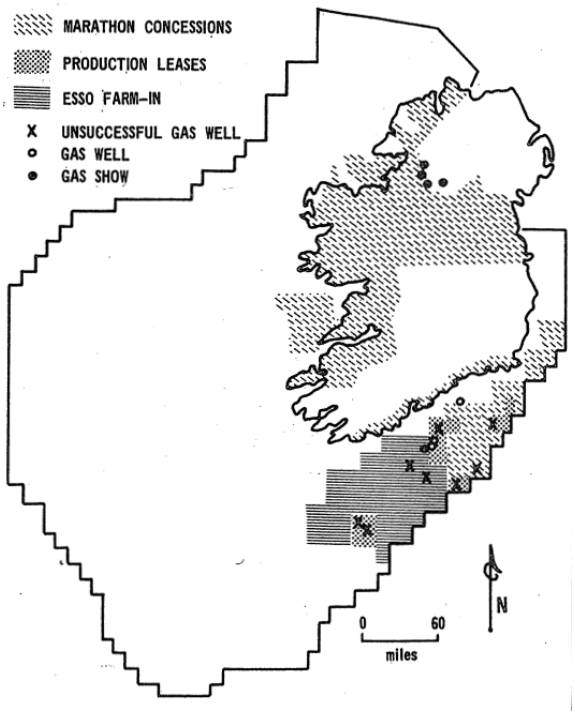
Notes:
[1] See Figure 1
[2] The first Avoca operation closed down in 1962
[3] Principal shareholders: Discovery Mines (47 percent); Patino Corporation (10.67 percent); Superior/Oil Canadian Superior Oil (10 percent); Northgate (10 percent).
[4] Although much preparatory work has been done, work on the deposit is presently (January 1975) at a standstill pending a High Court action concerning the terms of a mining lease.
[5] An "associate" of Northgate Exploration via interlocking directorships and shareholdings.
[6] Ownership of c.12 percent of the Navan deposit via ownership of overlying land confirmed following a prolonged court action in 1973-74.
[7] Nevertheless strong informal relations with Cement/Roadstone Holdings Ltd., Ireland's largest construction minerals operator.
[8] Shareholdings principally held in U.K.

Table 3. Important Non-Metallic Deposits, Republic of Ireland, January 1, 1975

Location	*Production*	*Product*	*Operator*	*Parent Co.*	*Domicile*
Ballynoe	1963	Barite[2]	Magcobar (Ireland) Ltd.	Magent Cove Barium Corp.	U.S.A.
Bennettsbridge	1970	Dolomite[3]	Quigley Magnesite Ltd.	Charles Pfizer Corp.	U.S.A.
Kingscourt	1952[4]	Gypsum	Gypsum Industries Ltd.	B.P.B. Industries Ltd.	U.K.

Notes:
[1] See Figure 1
[2] Important ingredient in drilling "mud" used in hydrocarbon exploration
[3] Processed to magnesite, a refractory material, at Dungarvan (Figure 1)
[4] The original mining lease was for a small-sale operation. Kingscourt gypsum did not become an important export until the 1960s.

Figure 4. Irish Continental Shelf



After map no. 66, Economic Geography Institute, Erasmus University, The Netherlands, 1974.

Possibly of greatest significance of all was the location of commercial deposits of natural gas off the south coast (Figure 4) in 1973 and 1974 by Marathon Petroleum (Ireland) Ltd., subsidiary of Marathon Oil of Ohio. However, unlike the minerals listed in Tables 2 and 3, this gas is destined entirely for domestic consumption in state-run electricity-generating and fertilizer-manufacturing plants and in the home gas supply network. Nevertheless, with Marathon continuing exploration in its 17,515 square mile off-shore concession (60 percent of which has been "farmed out" to the Exxon Corporation – see Figure 4) and with further allocation of exclusive leases expected shortly to some of the seventy international oil companies which have applied for them, one can, in view of the very

promising geological conditions,[26] expect a repeat of the well-established pattern in this case as well.

Implications for Economic Development

The contribution which Ireland's natural resource base can make to the country's trade and economic development will depend in the first place on the actual extent of this resource base; in the second place on the nature of the extracting companies and conditions under which they operate; and in the third place on the manner in which the extracted resources are utilized.

The Extent of Ireland's Resource Base

The significance of the deposits outlined in Tables 2 and 3 and the levels of output of Table 1 can be gauged either in terms of international comparison or by relation to the size of the home economy. Going on the first yardstick, the Tynagh mine has been since 1970 the largest producing lead and silver mine in Europe;[27] the Gortdrum mine is one of the world's principal sources of mercury;[28] while the Silvermines mine is the largest underground zinc mine in Europe.[29] Most of all is the Navan deposit, which, according to the Tara Company, contains an estimated 77 m. tons of ore, grading at an average 10.9 percent zinc and 2.6 percent lead.[30] This is large by comparison with that previously indicated as the world's largest (40.8 m. tons deposit, grading 6.3 percent zinc, 2.4 percent lead at Silver-lake Territory, Canada).[31]

On a lesser scale, the non-metallic mines (Table 3) are also of substantial value, deriving in part from the high degree of purity of each.[32] The Ballynoe barite deposit is thought to be one of the finest in the world [33] and its importance has been greatly enhanced by the rapidly accelerated rate of offshore hydrocarbon exploration since the onset of the so-called "energy crisis," as barite is an integral element in the drilling process. The size of the Kingscourt gypsum deposit may be gauged from the fact that current development plans will double the mine's already high level of output, which at the moment is 30 percent greater than domestic requirements.[34]

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[26] P. Gardiner and R. Horne, "Mining Geology-What's Where in Ireland," p. 38. See also *The Great Irish Oil and Gas Robbery*, by the Research Section, Department of Economic Affairs (Dublin: Sinn Fein. 1974), pp.30-36.

[27] M. V. O'Brien speaking at Irish Geological Association. Seminar in Dublin, January 16, 1971. Quoted in Resources Study Group, *Irish Mining-The Need for Action*. p.8.

[28] Ibid., p.11.

[29] Ibid.

[30] See Resources Study Group. *Navan and Irish Mining*. pp. 13, 14; Annual Report. 1972.

[31] P. Gardiner and R. Horne, "Mining Geology - What's Where in Ireland," p. 29; Resources Study Group, *Navan and Irish Mining*, pp. 22, 24.

[32] M. V. O'Brien in *Irish Mining*. p. II.

[33] See *Irish Times*, May 23, 1973, p. 16 and June 17, 1974. p.14.

[34] See report, the *Irish Times*, January 25, 1975, p.1.

The offshore natural gas deposits found thus far may not seem large by international standards, but the 1973 find is expected to feed 12 percent of the Republic's annual energy demands, while the 1974 discovery is believed to be even larger.[35]

The combined relative importance to the national economy of Irish mining is indicated in Table 4, in which the Republic's mineral exports are standardized to 1974 prices [OECD Consumer Index] for the period 1966-74. The 1966 benchmark represents the first full year of production at the Tynagh mine (1966 exports equal 304.23 percent of the 1965 level, at current prices). "Mineral Exports" are here taken to be the aggregate for the two Standard Classification Codes, Metal Ores and Scrap and Crude Fertilizers and Minerals. The great bulk of each is taken up by the output of deposits listed in Tables 2 and 3 respectively. The total value of minerals and exports in the period in question was 225,102,000, equal to approximately 10 percent of the National Income for 1972, standardized to 1974 prices. Subsequent processing can add up to ten times their value to raw minerals, and this may be a better measure of the relative worth of Ireland's natural resources (see Table 4).

Extracting Companies and Operating Conditions

As can be seen from Tables 2 and 3, Irish resource exploitation is almost entirely externally controlled, especially from North America. The terms under which the companies involved have begun operations have been extremely generous, arising partly from the need originally to get in foreign backers for the Avoca mine, and partly from the general consensus that Ireland had little to offer to the world, resource-wise. From 1956-67 the general mining terms involved a five year tax free period followed by a second five year period at half the normal rate of company taxation, plus a sliding scale (depending on production level) of royalties ranging from 4-9 percent. In 1967 a twenty-year complete tax holiday was introduced with respect to all mining operations commencing before 1986. Royalty rates remained the same.

The 1967 measure was extraordinarily generous, since by that time the Tynagh operation was of major proportions, a fact which was not then and to a great extent still is not-widely recognized within Ireland. In addition, the discovery of Tynagh, Silvermines and Gortdrum had already established Ireland's carboniferous limestone tracts (covering two-thirds of the country's land area-see Figure 2) as an important metallogome province-as borne out subsequently by the high level of exploratory activity (Figure 3) and especially the discovery of the major Navan deposit. Particularly extraordinary about the 1967 measure was that all the operating mines at the time has projected life-spans of less than twenty years. In view of the manner in which the country's mineral

[35] See "Mining Keeps on Making Headlines," leading article, *Mining Ireland*, no. 2 (Dublin: Irish Publishing Co., Ltd., 1974).

output was being disposed of, to be discussed presently, this Government act may be regarded as a classic in the neo-colonial trading tradition.

Table 4. Value and Distribution of Resource Exports, Republic of Ireland

Year	*Value (1974 prices)*	*U.K.*	*Other-EFTA*[1]	*EEC*[2]	*Other OECD*[3] *(Europe)*	*E. Europe*	*U.S./ Canada*	*Other*
1966	12.549	15.13	0.60	62.72	6.75	---	12.64	2.15
1967	13.729	14.11	1.08	69.01	6.32	---	6.35	3.13
1968	21.938	18.24	1.17	64.72	10.83	1.02	3.29	.072
1969	35.348	13.41	1.73	61.17	13.55	6.96	1.78	1.39
1970	35.097	13.71	1.03	63.89	7.07	6.59	6.86	0.88
1971	27.238	15.85	5.89	46.76	16.63	2.92	6.19	5.77
1972	30.291	12.72	3.78	54.50	20.13	2.97	5.01	0.90
1973	30.605	n.a.[4]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1974 (1/2)	18.307	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total 225.102								

Notes:
[1] Australia, Denmark, Finland, Norway, Portugal, Sweden, Switzerland
[2] Before expansion (i.e. West Germany, France, Italy, Netherlands, Belgium, Luxemburg)
[3] Iceland, Greece, Spain, Turkey
[4] Not available

Source: External Trade Statistics.

The concurrence of a change of government and the release of details concerning the extent of the Navan deposit in early 1973 brought about a change in mining conditions. Under a Mining Taxation Act of September 1973, company taxation was introduced with respect to mining operations, although with a series of exceptions which greatly mitigated the impact of the measure.[36] The mining companies launched a concerted campaign against this measure, including the threat of pullout and the organization of "workers" marches, with the full support of the Parliamentary opposition which had also strenuously opposed, when again in opposition, the original tax concessions in 1956. [37]

[36] See J. Palmer, "The Gombeen Republic"; see also "Mining Keeps on Making Headlines," pp. 11, 40.
[37] See report, the *Irish Times*, August. 27, 1974, p.1.

Correspondingly, the coalition government which introduced the original tax concessions had more or less the same composition as that which subsequently removed them. This lack of ideological stability of Irish parliamentary politics may be regarded as a principal agency of the process of neo-colonization in Ireland.

A second innovation has also arisen with regard to the lease for the Navan deposit. Although the terms offered by the Government have not been released, they are thought to involve a 49 percent state share holding (25 percent purchased at the original share price of the company), plus 10 percent royalty and nominal taxation.[38] This represents quite a shift in government policy, and understandably the Tara Company has reacted sharply by bringing the government to court on charges of breach of promise and unreasonableness in its demands. The question is now *subjudice*, although it is now believed that a compromise will be reached out of court.[39]

The terms for offshore exploration and production have been even more interesting. The first lease was granted to Ambassador Oil in 1960 for 500, granting that company exclusive exploration rights in all areas, on-and-offshore, under Irish control. In 1968 the Irish government claimed mineral rights on the continental shelf up to a water depth of 200 meters (previously it had limited itself to the 3-mile limit), and by a 1969 agreement, Marathon Oil of Ohio, which had subsumed the Ambassador Company, was granted exclusive exploration rights in 17,515 square miles of the new territories,[40] with a 21-year production lease guaranteed for all blocks which have been explored by drilling, plus the possibility of extension beyond the 21-year period. In March 1975, 75 percent of unexplored blocks (chosen by Marathon) are to be returned to the government, and the remainder in March 1980. Under the terms of the agreement, all output must be landed in Ireland, but the government "take" in terms of royalties and taxes is limited to a maximum of 40 percent.[41] Some seventy companies have applied for exclusive leases with respect to the remainder of the Irish territories (extended in 1974 to the margins of the continental shelf), and have been granted non-exclusive prospecting licenses pending a forthcoming decision on new leases which is expected to include a "carried-interest" clause on the Norwegian model.[42]

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[38] See report, the *Irish Times*, February 5, 1975, p.1.
[39] Resources Study Group, *Irish Mining*, p.29.
[40] See report, the *Irish Times*. January 11, 1975, p.1
[41] See report, the *Irish Times*. October 10, 1974, p.1.
[42] See M. V. O'Brien, "Review of Mineral Development in Ireland." *Report, Seminar on Metal Industries from Irish Mining* (Dublin: Institution of Engineers in Ireland, 1973), pp.8-9.

Irish Resource Utilization

It is the contention of this paper that, in terms of trade and general economic development, the extraction conditions are insignificant compared with the actual manner in which extracted resources are subsequently utilized and traded. The taxation reforms and minority state shareholdings (in the case of the Navan deposit and probably also forthcoming offshore leases) which do not confer control must be seen in this light. Substantial levels of mineral output could form the basis of a wide range of metallurgical, petrochemical, and other manufacturing industries. Those, if they do not enter the conditions of general capitalist trading, could produce a significant increment to the level of employment, not only directly in the form of manufacturing jobs, but also in spin-off service and primary (agricultural) jobs - particularly when the size of the total labour force is relatively small compared with the level of resource output (as in Ireland). Secondly, the revenues from resource-based industries could reveal further major resource deposits. Thirdly, and most important, the value-added in these industries could provide substantial export revenues which, apart from contributing positively to the balance of payments, could be used for the creation of extra domestic economic activity which may have no relation whatever to the original resources.

This scenario is quite in contrast with the actual pattern of development in Ireland. With the exception of gypsum, all the operations listed in Tables 2 and 3 export their product in unprocessed form, except for primary concentration. Thus all the principal value-adding, employment-generating, and profit-making processing stages take place outside Ireland. The benefits are therefore lost to the Irish economy, except in the negative sense, in that the output of the processing stages has to be reimported in some measure to meet the needs of Irish industry and domestic consumption. One immediate example of the latter may be taken from the 1971 External Trade Statistics, which indicate that Ireland exported unsmelted zinc at an average price of £72/ton (assuming that the entire concentrate value lies in the zinc content) and reimported raw zinc at £157/ton.

This classic, neo-colonial structure is highlighted by Table 4, which represents the distribution of Ireland's resource exports. The degree of dependence on the "Developed World" is almost absolute. The relatively large proportion of exports which goes to the "other-OECD" category comprises mostly copper exports to Spanish smelters which are themselves controlled from the EEC. Even the tiny segment devoted to "other" is largely made up of barite exports to various parts of the world where offshore drilling operations under the auspices of "Developed World" operators are being carried out! Eastern Europe may also be regarded as "developed" in this context, although the variable proportions allocated to this destination are largely attributable to temporary capacity shortages in Western Europe. Thus, in classical neo-

colonial tradition, the developed status of the "Developed World" is to some degree dependent on the continued trading patterns associated with underdevelopment of the Irish economy. That is, if value creatable by resource processing were added within the Irish economy, then value to the same degree would be subtracted from the current level of product in those countries which utilize Irish resources at the moment. Yet, despite the fact that all of Ireland has been categorized as an "undeveloped region" in the context of the EEC Regional Fund, economic analysts in Ireland never attribute this condition to economic and trade relationships with the "developed" areas of the Community.

For many countries, neo-colonialism takes the form of the deliberately depressed prices of their raw materials exports due to the superior bargaining power of the developed world -- a fact which has been more than driven home by the revolutionized terms of trade in the oil sector due to the "turning of tables" as regards bargaining power achieved by producer. However, in the Irish case the situation is rendered even worse by the fact that the country scarcely benefits even from the meagre revenues derivable from depressed commodity prices. This follows from the fact that Irish resource extraction is controlled from the outside, so that the revenues from resource exports also flow out of the country in the form of profits, distributed and undistributed, plus other leakages, such as imports of mining equipment, or shipping hire (less than 10 percent of the Irish import-export trade is carried in Irish-owned ships). It has been estimated with regard to the Tynagh mine that approximately 20 percent of gross output value enters the Irish economy in the form of wages, payments for goods and services, royalties and dividends to Irish shareholders.[43] The loss to the Irish economy is not simply the remaining 80 percent of gross value, since the potential multiplier effects of the lost revenue should also be taken into account. The Irish multiplier has been estimated at 1.43.[44]

This leakage will be reduced somewhat by taxation reforms and the nature of future leases, as outlined above; but in any case, this only constitutes the adding of insult to injury, since the really significant loss to the Irish economy lies in the export of potential value-added annually to the "developed world." The Resources Study Group in 1972 estimated the gross metal value (after smelting) derivable from known Irish mineral deposits throughout their lifespans at £1,770m.[45] This is in itself a great underestimate due to upward revision of reserve estimates and world prices, and does not allow for further discoveries. By multiplying this total by a factor of 8-10 to allow for value added during processing,[46] and

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[43] Resources Study Group, *Navan and Irish Mining*. p.55.
[44] J. Bristow and W. Small, *Bord na Móna Cost-Benefit Study* (Dublin: Institute of Public Administration. 1970). Quoted in Resources Study Group, *Navan and Irish Mining*, p.57.
[45] Resources Study Group, *Navan and Irish Mining*, p. 56,
[46] Ibid. p.57.

then applying the multiplier, one gets an inkling of the extent of the loss of the Irish economy.

The Future

Apart from the tax reforms, it seems as though there will be no future changes as regards the mining operations which are working at the moment. It does seem likely that the construction of a zinc smelter will be a lease condition with regard to the Navan deposit, but there has been no reference to the lead which forms one-fifth of this deposit's metal output. Neither has there been any government proposal of any sort for the development of subsequent metallurgical industries. A privately owned smelter would have no tendency towards the development of forward linkages due to the nature of current tax laws which allow freedom from taxes on profits derived from exports of primary materials; leakage is already guaranteed by the nature of the Marathon agreement, plus the high import content of production equipment. The present gas finds are to be used domestically, but this is more a function of the size of the deposits than deliberate long-term company policy. With Marathon, and its partner, Exxon, continuing exploration in its highly promising concession area and with a further round of concessions in the offing, there is every possibility of Ireland being swamped by hydrocarbon output. One medium-sized oil well producing 100,000 barrels per day would satisfy Ireland's current fuel needs. Any excess over this would have to be petro-chemically processed or exported crude. There have as yet been no government moves to anticipate such developments, except for a proposal to establish a National Gas Board to control the distribution of natural gas as a fuel to homes and industry. Ireland's freedom of action in this sphere could in any case be severely restricted by the obligation of membership in the EEC and more particularly in the International Energy Agency (lEA), obligations which would expressly subordinate Ireland's peculiar developmental needs to the needs of the greater organization.

Conclusion

Since the writing of the original essay the state has come to play a much more important role in mineral resource extraction. Agreement has been reached with the "owners" of the Navan deposit. The terms of agreement include a 25 percent equity stake for the state in Tara Mines free of charge, a 4.5 percent flat rate royalty on Tara's profits and the normal 50 percent company tax rate. Such conditions have obviously created a more equitable situation for the state but they do not fundamentally affect the structure of Irish underdevelopment. Industrialization policy is still foreign oriented, dependent on foreign capital, technology and markets. It has thus made Ireland and its economy an extension of the European market rather than an independent entity.

It is obvious that the characteristics of underdevelopment described by dependency theory are very much in operation in Ireland today. Amin

has indicated three categories which define underdevelopment, these are (a) inequality of production between sectors; (b) the disarticulation of the economy and (c) foreign domination.[47] The first category is evidenced in Ireland by the unevenness of productivity between agriculture and industry, and between the primary, secondary and tertiary sectors. Uneven productivity is also reflected in space as the East Coast and the North East remain industrialized while the remainder of the country lies relatively underdeveloped. The disarticulation of the economy is due to the lack of communications between the various sectors. In the developed world, exchanges which take place between sectors of the economy are often complimentary and the formation which results is integrated. However, in underdeveloped economies only marginal exchanges are directed to the outside world. Hence:

> The disarticulation of the economy prevents the development of any sector from having a mobilizing effect upon the rest. Any such effort is transferred abroad, to the supplying countries: the sectors of the underdeveloped economy appear as extensions of the dominating advanced economy. In turn, this disarticulation and its corollary, the unevenness of productivity are reflected in the distribution of the gross internal product and of investments, which is very different from that which is typical of the advanced countries.[48]

The final category, that of foreign domination needs no further comment. Thus, by these criteria Ireland becomes an "underdeveloped country."

Our discussion as to the uses to which Irish mineral resources are to be put has indicated that they will have no long-term mobilizing effect upon the Irish economy. The industry continues to be externally owned and controlled, its output is externally directed and its benefits will be externally realized. It is not within the plans of international capital to build the "downstream" industries which are so badly needed and upon which real, balanced development could be based. Yet what else should we expect from international capital and its Irish Allies.[49] In this essay we have not touched upon the question of the forces which can change Ireland's dependent development. Perhaps this was neatly summarized by Connolly in 1916.

> We are out for Ireland for the Irish. But who are the Irish? Not the rack-renting, slum-owning landlord; not the sweating, profit-grinding capitalist; not the sleek and oily

[47] S. Amin. *Accumulation on a World Scale*, p. 15.
[48] Ibid. p.17
[49] Referred to locally as "Gombeenmen" or "local lubricants" in the parlance of the mining industry.

lawyer; not the prostitute pressman -- the hired liars of the enemy. Not these are the Irish upon whom the future depends. Not these, but the Irish working class, the only secure foundation upon which a free nation can be reared.[50]

[50] J. Connolly. 1916, "The Irish Flag," reprinted in Berresford Ellis. ed., *James Connolly Selected Writings* (Harmondsworth: Penguin. 1971), pp.143-46.

CHAPTER 3

INVERSION PERSISTENCE AT LONG KESH, NORTHERN IRELAND

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First published in *Weather* (1979), 34(2), 50-60.

Air temperature normally falls with increasing height above ground level. Under certain meteorological conditions, however, the reverse can occur, producing a layer of air in which temperature increases with height. This phenomenon of an inversion of temperature in the boundary layer of the atmosphere can exert a strong control over ground-level concentrations of atmospheric pollutants by restricting the depth of air throughout which they are mixed. Accordingly it is significant in the field of industrial location, in particular chimney design, and merits special investigation as regards height, strength, persistence and frequency of occurrence.

The most common situation giving rise to a temperature inversion is that which occurs due to nocturnal cooling of air in close proximity to a cold ground surface. Where clear skies encourage maximum outgoing radiation the feature is enhanced, particularly in light winds, perhaps sufficiently to survive the turbulent and thermal mixing of the following day. Continuation beyond two or three days is rather unlikely since the conditions favouring outgoing radiation at night also favour maximum incoming solar radiation during the day. In any case, from a pollution viewpoint, the effect of surface-based inversions is small in relation to their numbers since emissions from large sources either occur above or can penetrate these rather shallow features. In these circumstances persistent surface inversions can restrict downward mixing and actually have a beneficial effect on ground-level concentrations.

It is, however, with inversions based in the free air that this investigation is concerned. In general these are of two types, frontal and subsidence, originating in depressions and anticyclones respectively. Variations of these occur, most notably in the case of pre-frontal subsidence that can produce a smaller inversion below the level of the frontal one. It may be this lower one that is the effective trapping level. Sulphur dioxide which is trapped aloft by any inversion may ultimately be returned to ground level. This downward mixing often follows the break-up of an inversion by turbulent mixing and high ground-level concentrations frequently accompany such periods of fumigation. The longer the inversion persists, the greater the build-up of pollution beneath it, and consequently the greater the potential for an air pollution episode of the types widely documented, e.g. Holzworth (1972) and Martin (1964).

Previous investigations

Despite its obvious importance, relatively little work has been done in the field of inversion persistence. More emphasis on forecasting occurrence is apparent, as, for example, in the work of Shellard and Hay (1961). On the basis of one year's radiosonde data from two Atlantic weather ships the relationships between the occurrence of both frontal and subsidence inversions and various synoptic features were used to derive rules for the prediction of inversion occasions. Though 90 per cent successful for non-frontal cases, the technique found only limited application since the information needed most for air pollution studies related to inversion height and duration, rather than prediction of a likely occurrence alone.

Hardy (1973) compiled an exhaustive tabulation of inversions at Cardington based on ten years' data obtained from a tethered balloon. Unfortunately, limitations imposed by the maximum height of ascent (1200 m) and by instrumental problems make these data rather biased. Many ascents were either cancelled or curtailed during periods of high wind speeds or when a risk of lightning or icing was present. Accordingly, complete data up to 1200 m were obtained for only 28.5 per cent of the study period. Despite this, inversions were found to be most frequent and persistent during winter and autumn. More marked seasonal differences were observed at Cardington than at Long Kesh. This undoubtedly reflects the contrast in location between the two sites, as well as the limitations of a tethered balloon sampling only the lower levels of the atmosphere most affected by ground influences.

Table 1. Inversion occurrences at Kiev 1956-60

Duration (hours)	*Altitude (km)*					
	0-0.1	0.1-0.25	0.25-0.50	0.50-1.0	1.0-1.5	1.5-2.0
<12	614	616	524	363	344	426
12-24	259	373	244	174	208	221
24-48	22	27	49	61	70	34
48-72	1	4	12	24	12	3
72-96		3	3	14	7	1
96-120			3	6	2	
120-168			4	4	2	
168-216				3		
>216				1		

Table 2. Persistent inversions at Kiev 1956-60

Duration (days)	*No.*
2-3	56
3-5	39
5-7	10
7-9	3
>9	1

Winter and autumn maxima were also noted by Voloshin (1973) using radiosonde data for Kiev, which also enabled discrimination between lower radiation and higher subsidence inversions. Of course climatic contrasts with the British case are obvious. Table 1 shows that 4738 inversion occurrences were observed during the four years of which 39 per cent were below 250 m and lasted for less than a day. These were obviously surface features and indicate the suitability of the continental Ukrainian climate for radiation type inversions. Surface inversions were not persistent and were generally dissipated by noon on the day following. Even in winter they lasted only three to four hours longer than their summer counterparts. Of the persistent inversions, 109 lasting for over two days occurred (Table 2), enabling some degree of comparability with the Long Kesh data.

Data selection criteria

One feature of Voloshin's results is that only 1 per cent of inversions seem to persist over three days, a seemingly unlikely situation in such a continental climatic regime. This could be a consequence of the selection criteria which may have resulted in a fragmentation of episodes into more numerous occurrences of shorter duration at the various heights. Inversions rise and fall, coalesce and divide, disappear and reappear often without any obvious cause, resulting in great difficulties for anyone seeking to explain their behaviour. The relatively recent development of acoustic radar sensing has, however, proven to be extremely useful in this respect, in monitoring short-term changes in both stability and inversion behaviour in the lower atmosphere.

Acoustic energy propagating upwards through the atmosphere is reflected by turbulent fluctuations of temperature and wind velocity. By analysing the returned echo the monostatic sounder gives an indication of the changes occurring, in both lapse rate and dynamic stability, along the path of the transmitted pulse. This produces a record with a considerable contrast range which can be closely related to the temperature structure of the air through which the pulse passed. The principal advantage of acoustic sounding is its capability of providing a virtually continuous record. In contrast, the radiosonde provides only a twice daily sample and is subject to systematic errors due to a time lag in the response of its pressure and temperature sensors (Wyckoff et al. 1973).

Despite these drawbacks, however, the data source for this study was based on the twice daily (00 h and 12 h) radiosonde ascents at Long Kesh, Northern Ireland. In part, this choice reflected the absence of an acoustic record over a sufficiently long period. However, the practical difficulties involved in using acoustic data were also considered an obstacle to achieving results comparable with research elsewhere. In particular the interpretation of such a record would have involved a

considerable degree of subjectivity, the consistency of which would have been difficult to maintain over a long time-period.

The failure of the radiosonde to provide a continuous spectrum of data necessitates making the assumption that an inversion persists in the intervening period between successive ascents where it is observed. Since this is not necessarily the case over a 12-hour period then this implicit assumption must be seen as a weakness in the present study. However, examination of the intermediate wind observations made at 06 hand 18 h suggested that, for the vast majority of cases, a wind shear with altitude existed, indicative of the probable continuance of inversion conditions. This would seem to suggest that the assumption of persistence between ascents has some validity and does not preclude the derivation of meaningful results from this source.

Methods of analysis

Much of the previous work outlined earlier involved a method of analysis based on the occurrence or otherwise of inversions within fixed altitude bands. Where an inversion oscillated across these boundaries, moving from one band into another, fragmentation of the episode resulted. A method avoiding this was sought which would enable an inversion to be followed in its path through the various atmospheric levels and a truer picture of inversion persistence to be obtained. It was found that this objective was best achieved when the following simplifications were applied to the data.

(i) Only the lowest 4000 m of the atmosphere were considered.

(ii) Surface inversions were ignored except where they formed part of another inversion period with a mean level in the free air.

(iii) When more than one inversion existed only the lowest one was considered.

(iv) Inversions were allowed to vary in height (mid-height) by up to 1000m during successive observations and still remain part of the same episode.

(v) Allocation into height categories was on the basis of the mean altitude during the whole of the episode.

A method of analysis incorporating these restrictions produced a series of inversion episodes over the six-year period. Each episode was characterised by its duration and its mean altitude. Aggregation of the episodes yielded a contingency Table from which other information could be deduced.

Results and analysis

Table 3 summarises the results obtained. At all altitudes the number of inversions decreases with increasing duration, almost half the episodes lasting for only one observation. Short durations like this are probably largely accounted for by frontal inversions, which, even if they can be identified for a day or two, rapidly change elevation and seldom persist except in the case of almost stationary fronts. Single observation inversions occur in each layer with the following frequencies: 51 per cent (0.25-0.5 km), 27 per cent (0.5-1 km), 37 per cent (1-2 km), 63 per cent (2-3 km), and 88 per cent (3-4 km). This suggests that inversion persistence decreases above and below the layer 500-2000 m. In particular, the level between 500 and 1000 m shows a pronounced tendency for persistent inversions; 13 per cent of those lasting more than two days lasted a week.

Table 3. Inversion occurrences at Long Kesh 1971-77

Duration (hours)	*Altitude (km)*				
	0.25-0.5	0.5-1.0	1.0-2.0	2.0-3.0	3.0-4.0
<12	51	41	175	164	91
12-24	23	32	96	58	9
24-48	20	26	86	25	3
48-72	7	21	52	7	
72-96		12	24	3	
96-120		6	17	1	
120-168		7	20	1	
168-216		5	3		
>216		2	1		

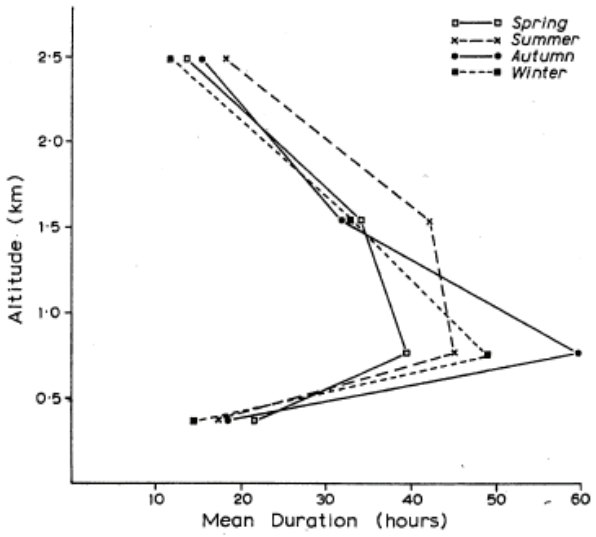
A breakdown of Table 3 into its seasonal components can be seen in Table 4. In terms of the number of inversions there is no significant difference between the seasons, with roughly the same number occurring at all times of the year. This contrasts markedly with the Ukraine and reflects the all year round influence of the sea on the climate of the British Isles. In addition to the effect of the sea other influences can be identified.

If inversions persisting over two days are considered then summer stands out from the other three seasons as having up to 25 per cent more in this category. On closer examination these fall mainly in the 1000-2000 m range. Good summers in the British Isles are characterised by high pressure systems which either extend or break off from the summer Azores anticyclone. This would produce the fairly persistent inversion described.

For each height category a spread of inversion durations ranging from less than 12 hours to over nine days is obtained. From this the mean duration of episodes whose mean inversion height lay at that altitude can be calculated. These values can be seen at the foot of Table 4. They are

however, more informative if plotted adjacent to each other and this has been done in Fig. 1 in order to illustrate seasonal variation. The increased frequency in summer again stands out. Apart from this the only obvious seasonal differences relate to spring and autumn frequencies from 500-1000 m. During the spring the sea around Ireland is at its warmest in relation to the land. This introduces elements of instability into the lower atmosphere, causing an increased incidence of unsettled weather, hindering the development of long inversion periods. By contrast, in autumn, the sea temperature is close to air temperature, no marked instability exists, and blocking anticyclones are common in the stable conditions which characterise the season. This would explain the contrast between spring and autumn durations which is observed.

Figure 1. Variation of mean inversion duration with height and season



Where an inversion lasts three or more days it is almost certainly in association with subsidence from a slow moving anticyclone. This can quickly be confirmed by a glance at surface pressure data for these periods. The behaviour of the inversion during these periods closely mirrors the movement of the high pressure system, falling to a minimum height as subsidence reaches its peak, then rising as the anticyclone moves away. A sample study revealed the height difference between entry and mean minimum level to be of the order of 1400 m. The lowest level reached, on average about 1000 m, occurred between two and three days after entry. The rate of descent thus agrees well with that found by Holzworth (1972) for the principal subsidence inversion during the Thanksgiving Week episode in New York, between 0.6 and 0.8 cm s^{-1}.

Table 4. Seasonal occurrences of inversions at Long Kesh 1971-77

Duration (hours)	*Altitude (km)*																							
	0.25-0.5				0.5-1.0				1.0-2.0				2.0-3.0				3.0-4.0							
	Sp	S	A	W	Sp	S	A	W	Sp	S	A	W	Sp	S	A	W	Sp	S	A	W				
<12	16	10	13	12	14	7	13	7	52	40	45	38	55	43	32	34	22	13	33	23				
12-24	4	6	8	5	5	7	7	13	21	22	27	26	15	13	17	13	1	1	4	3				
24-48	8	6	4	2	8	10	4	4	20	22	22	22	7	5	8	5			2	1				
48-72	4		2	1	6	3	7	5	12	15	12	13	4	3										
72-96					1	4	2	5	7	8	3	6		2	1									
96-120					2		2	2	3	4	6	4		1										
120-168					1	2	3	1	7	8	2	3												
168-216					1	1	2	2		2	1													
>216							1																	
Total	32	22	27	20	38	34	41	39	122	121	118	112	81	67	58	52	23	14	39	27				
Mean	21.8	17.5	18.0	14.7	38.4	44.8	53.9	48.3	33.2	41.1	30.9	32.5	13.5	16.8	15.0	11.9	6.5	6.9	8.8	8.4				

Persistent inversions whose mean level is below about 700 m might represent cases where, for at least part of the time, the inversion falls close to ground level. This is significant from a pollution viewpoint since it greatly restricts the mixing layer over a wide area. For one four-day occurrence in 1974, when the Long Kesh subsidence inversion fell close to ground level, sulphur dioxide concentrations at Linwood, a semi-rural site in western Scotland, were 315, 225, 222, and 228 μg m^{-3}. This compares to a long-term average of 52 p.g m-s. On the basis of Table 3

about one in four persistent inversions might be expected to fall to near ground level.
The trapping of pollutants below this falling inversion lid can be visualised. If, however, intermittent surface inversions exist at the same time then, as these latter inversions are dissipated each morning, successive periods of fumigation occur. This was pointed out by Halstead (1976) and is clearly visible in Holzworth's (1972) data for the Thanksgiving Week episode. Similar conditions have been observed in west central Scotland on several occasions in the last six years, frequently exacerbated by the effect of cold air katabatic flows from the surrounding uplands and moorlands.

Conclusions
Problems of classification make for difficult comparisons between areas in terms of their inversion characteristics. Nevertheless, it is likely that Long Kesh is fairly representative of much of the north-western quadrant of the British Isles. As far as frequency is concerned inversions seem to occur about three days out of five, mostly between one and two kilometres in height, but occur with the greatest persistencies lower down, between 500 and 1000 m. Variations in seasonal frequency are slight and may relate to fluctuations in the importance of thermal and dynamical factors both in the air and adjacent sea, though this requires further study. Certainly, an investigation of anticyclonic occurrences would help towards understanding this and also the behaviour of inversions during such episodes. The importance of the latter has been demonstrated by Halstead (1973) for managing air pollution concentrations in enclosed basins. In general, greater knowledge will facilitate a better use of the dispersive capabilities of the atmosphere, something increasingly important in the future.

Acknowledgment The author wishes to thank Mr C. A. Halstead, Department of Geography, University of Glasgow, for his assistance and advice in this project.

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CHAPTER 4

THE TERRITORIAL ORGANISATION OF GAELIC LANDOWNERSHIP AND ITS TRANSFORMATION IN COUNTY MONAGHAN, 1591-1640

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First published in *Irish Geography,* (1981) 14, 1-26.

Introduction

An increasing amount of information is available about the organisation and functioning of Gaelic society, especially in the crucial area of landholding, its legal basis and the way in which inheritance and tenurial systems operated.[1]

In spite of these growing insights, there is still very fragmentary knowledge about the spatial organisation of Gaelic society. It is generally accepted that the landscape legacy of small territorial divisions (townlands), and the documentary legacy of numerous extinct denominations, are indicative of an apparently systematic and comparatively uniform territorial organisation. Its exact function and nature are still unclear, however, and there are seeming inconsistencies in some views of a highly developed territorial system on the one hand[2] and a socially mobile and fluid population on the other.[3]

The purpose of the following paper is to focus on the territorial organisation of Gaelic landownership in an Ulster county in the Elizabethan period and to examine the processes, endogenous and exogenous to the county, which led to the break-down in this system in the first half of the seventeenth century. It is suggested that commercial forces quite apart from the direct political and economic intervention of the English crown were bringing about an insidious transformation in social and landholding structures in parts of Ireland. Co. Monaghan provides a valuable case study because of the persistence of Gaelic social forms in the county throughout the Elizabethan period and because, as a result of political coincidence, it was excluded from the direct upheavals of the Ulster Plantation. In view of the persistence of the townland unit

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[1] See, for example, D. O Corráin, *Ireland before the Normans*, Dublin, 1972; K. Nicholls, *Gaelic and Gaelicised Ireland in the middle ages*, Dublin, 1972. Also J. M. Graham, 'Rural society in Connacht, 1600-1640', in N. Stephens and R.E. Glasscock (eds), *Irish geographical studies*, Belfast, 1970, 201..

[2] P. W.Joyce, *The origin and history of Irish names of places*, (Dublin, 1887), 241-246. T.Jones Hughes, 'Administrative divisions and the development of settlement in nineteenth century Ireland', *University Review*, 3, 1964, 8-15.

[3] K. Nicholls, Land, law and society in sixteenth century Ireland, O'Donnell lecture, National University of Ireland, 1976, 9-11, 18-19. D. B. Quinn and K. W. Nicholls, 'Ireland in 1.534', in T. W. Moody, F. X. Martin and F.J. Byrne (eds), A new history ofIreland, iii, Oxford, 1976, 34-6.

today, reconstruction of the evidence on landholding in the Gaelic period necessitates an examination of the significance of this small territorial unit.

The county of Monaghan

The territory of Airghialla, which contracted through the medieval period to the county of Monaghan in 1585, was the domain of the McMahons. 'The McMahon' as the chief lord became known in the late fifteenth century, was traditionally an ally of O'Neill of Ulster.[4] Airghialla, by virtue of its location in the south Ulster borderland, followed a politically vacillating course throughout the medieval period, wavering in allegiance between the English influence to the south and the O'Neills to the north.[5] It was a comparatively poor borderland area, comprising a drumlin-littered, poorly-drained landscape which prevented easy access by colonising forces to the interior of much of Ulster. The absence of any significant architectural remains is an indication of the relative poverty of this region in the medieval and early modern period. No great abbeys were endowed in Monaghan, for example, and there are no remains of castles or tower houses. The ubiquitous and often imposing raths, and the small crannogs, comprise the only significant settlement residues from the medieval and earlier periods. In spite of initial Anglo-Norman influence little colonisation took place in Farney and so Airghialla was essentially a Gaelic territory. Its placenames heritage is totally Gaelic, for example. Its geographical location, however, did not isolate it from social and economic contact with the Pale. Throughout the medieval period there were marriage alliances between Monaghan families and families in Louth and Meath.[6] By the sixteenth century, proximity to Dundalk and Drogheda ports undoubtedly exerted some influence on the economy of the region, with the penetration of traders, for example, and the migration of some Monaghan families to the Pale.[7]

In Gaelic Monaghan, the political and landholding systems were interlinked. The principal territories of the McMahons, which were defined as baronies in 1585, represented the estates and wealth of the chief families and their subordinates, each of which families had rights of election to the overlordship of all the territories in Airghialla.[8] In 1591, the government abolished the McMahonship and re-defined and

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[4] Quinn and Nicholls, *op. cit.*, 16. P.O Mordha, 'The MacMahons of Monaghan (1500¬1593)', *Clogher Record*, 1, 1955, 22-38

[5] K. Simms, Gaelic lordships in Ulster in the later middle ages, unpublished Ph.D. dissertation, University of Dublin, 1976, 346, 368, 369; T. 0 Fiach, 'The O'Neills of the Fews', *Seanchas Ardmhacha*, 7, 1973, 1-64.

[6] S. 0 Dufaigh, 'Notes on the McKennas of Truagh', *Clogher Record*, 8, 1974, 221-227.

[7] N. P. Canny, *The Elizabethan conquest of Ireland: a pattern established, 1565-76*, Harvester, 1976, 4-8. S. 0 Dufaigh, 'Further notes on medieval Clones', *Clogher Record*, 4, 195-7.

[8] A list of McMahon and his vassals by territory in 1297 (Simms, op. cit., 326-7) reveals a structure which remained essentially unaltered until the late sixteenth century, except that by the fifteenth century, three branches of the McMahons had expanded to monopolise the right to overlordship.

established the landholding structure in accordance with English law. As a consequence, Monaghan was excluded from the Ulster plantation and was therefore unique in being the only county in Ulster not systematically or extensively planted in the early seventeenth century. It experienced instead a gradual colonial infiltration with small-scale private enterprise plantations taking place in the pre-Cromwellian decades.

The townland legacy

The legacy of townlands in the modern landscape provides a key to the period under discussion. Continuity of farm family names and coincidence of farm and townland boundaries today attest the operation of a territorial order over many generations.[9] The landholding implications of townlands must provide a vestigial link with an earlier pre-plantation territorial order. Reconstruction of this evidence for a Gaelic territorial system in the period of transition from a Gaelic to a colonial economic order may help to throw some light on the operation of landholding in Gaelic society.

There is still no dear understanding of the nature of Gaelic territorial divisions. There is a general awareness of the presence of a structured territorial organisation ranging from larger barony units to tiny local land divisions. The immensity of the task of undertaking a regionally comprehensive examination has prevented a broad view of such a system emerging. Although there have been very few systematic analyses of the evolution of Gaelic territorial units, researchers in various fields, timescales and regions have sometimes made incidental suggestions on their origin and development.[10] It is almost certainly true, however, that while there were regional differences in territorial organisation as a result, among other things, of differential colonial experiences, there is the basis for what was a comparatively uniform system. Hogan's paper of fifty years ago makes a case for the existence of a harmony in Gaelic spatial order, but is confined to the larger territorial units.[11] Reeves's paper of over a century ago is still the most comprehensive examination of the townland and its significance.[12] Not surprisingly, his conclusions are limited in value.

In Co. Monaghan there are over 1800 townland units, as officially defined by the Ordnance Survey in the 1830s. With the absence of any extensive mountainous areas in the county, the Ordnance Survey created few new townland units and altered few boundaries. Boundaries had been exactly defined by the estate proprietors of the eighteenth century. The

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[9] P. J. Duffy, *Population and landholding in Co. Monaghan: A study in change and continuity*, unpublished Ph.D. dissertation, National University of Ireland, 1976, ch. 8.

[10] See E. E. Evans, *Irish heritage*, Dundalk, 1942, 11-13; *Mourne country*, 2nd ed., Dundalk, 1967,99-103. Jones Hughes, *art. cit.* M. McCurtain, *Tudor and Stuart Ireland*, Dublin, 1972, 95-7.

[11] J. Hogan, 'The Tricha Cét and related land measures', *Proc. R.I.A.*, 39, 1928-29,155-179.

[12] W. Reeves, 'On the townland distribution of Ireland', *Proc. R.I.A.*, 1857-61, 475-482.

Down Survey of Monaghan, in the parts which were mapped, indicates that most of the townland units were established features of the seventeenth century landscape.[13] The 1591 Survey of Co. Monaghan indicates that the tate (townland) system was a well-established feature of Gaelic Monaghan.[14] Some of the boundaries may have been less well defined in a hedgeless, relatively road-less landscape which contained quite a lot of boggy bottom land. But most of the tates of the late sixteenth century have their corresponding townlands today. Although nationally Co. Monaghan has the smallest average townland size, there is considerable variation within the county, with units averaging over 250 acres in the Barony of Cremourne compared with 100 acres in some parishes in Monaghan Barony. It would seem that there is a connection in Monaghan between the size of townland and its agricultural potential, as is evident also in Co. Tyrone.[15] Reeves pointed to the lack of a direct relationship between townland size and land productivity, but he was probably analysing the structure on too broad a scale. As he suggests, the variation in size nationally must have its origin 'in the civil peculiarities of the districts while in the possession of the original inhabitants '.[16] Thus, it might be suggested that a uniform system of land organisation prevailed in Gaelic Ireland, with variations in scale from one region to another.

The townlands of Monaghan undoubtedly represent the vestiges of a system of land organisation inherited from the Gaelic period. Here is a minute subdivision of the landscape into places with distinctive names, referring in general to the quality of the environment, in size sensitively reflecting agricultural potential and possessing even today a local significance for population and landholding. The record shows that this legacy was part of a more extensive and logical organisation which prevailed throughout Gaelic Ireland.[17] Most of this system was swept away following the political and economic subjugation of Gaelic society, leaving only the finer mesh of townlands. The following section examines the operation of this defunct territorial system.

The territorial organisation of landholding in 1591 and 1606

The 1585 composition of Connacht, the 1591 Survey of Co. Monaghan and the Ulster Plantation documents provide a record of the Gaelic

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[13] Down Survey Barony Maps, Facsimiles, Ordnance Survey of Ireland, Phoenix Park, Dublin.

[14] The 1591 survey of County Monaghan: *Inquisitions of Ulster*, Introduction, xxi-xxxi.

[15] P. Robinson, 'Irish settlement in Tyrone before the Ulster Plantation', *Ulster Folklife*, 22, 1976, 59; See also J. Graham, 'South-west Donegal in the seventeenth century', *Ir. Geogr.*, 6, 1970, 136-52.

[16] Reeves, *op. cit.*, 476.

[17] The apparent contradiction in Monaghan having comparatively poor land and the smallest average townland reflecting agricultural potential is due to the operation of *local* variations (e.g., 1/16 ballybetaghs in south Ulster compared with 1/12 elsewhere) in a universal system of landholding. See Reeves, *op. cit.*

landholding system in which the territorial significance of barony, ballybetagh and smaller units emerges.

Detailed analysis of the operation of the landholding system, insofar as this is reflected in the 1591 and 1606 surveys, shows that the ownership structure rested on a well-developed territorial framework. The ballybetaghs emerge as fundamental property units with a very strong element of stability. The structure of these units, with their systematic subdivisions of tates, is evidence of a deeply rooted spatial organisation. The problem is that while these surveys came early enough to catch a glimpse of the Gaelic system before it had gone, they were too late to see it at the height of its development. Gaelic Ireland in the late sixteenth century was increasingly experiencing fundamental economic changes,[18] so that by the time of the colonial surveys the landholding system was already in the process of changing, in some places more than in others. In sixteenth-century Connacht, for example, there are unclear remnants of a macro-system of territorial order above the level of ploughlands.[19] In areas like north Tipperary, there is even more disorder in the system in the first half of the seventeenth century.[20] In Ulster, however, areas like Tyrone, Fermanagh, Cavan, Donegal and Monaghan still contained strong reflections of a systematic landscape geometry in the late sixteenth and early seventeenth centuries.[21]

The 1591 division of Monaghan was the end result of the government's policy of abolishing landholding by Gaelic law or hybrids of English and Irish law.[22] Short of confiscation and plantation, such a policy involved the elimination of the concept of Gaelic overlordship, the implementation of the crown's sovereignty over the land and the establishment of inheritance by primogeniture under English law. In Monaghan confiscation was minimal in 1591, except in the case of termon lands which being outside secular Gaelic control, were generally granted to government nominees. Mensal lands also became technically available to the government on the abolition of the McMahonship. The 1591 division in general simply re-established the existing pattern of

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[18] Canny, *op. cit.*, ch. 1; Canny, 'Hugh O'Neill, Earl of Tyrone, and the changing face of Gaelic Ulster', *Studia Hibernica*, 10, 1970.

[19] Graham, *op. cit.*, 193-194. K. W. Nicholls informs me that the Connacht system of Bailes of four quarters was still quite intact in the Headford version of the BSD.

[20] W. J. Smyth, 'Land values, landownership and population patterns in Co. Tipperary for 1641-60 and 1841-50', in *Etudes rurale*, forthcoming. See I. Leister, *Peasant openfield farming and its territorial organisation in Co. Tipperary*, Marburg/Lahn, 1976, for a detailed analysis of the evidence for the pre-Norman origins of many of the territorial structures.

[21] See 'Ulster Plantation documents', *Analecta Hibernica*, 3 (1931), 150-218; G. Hill, *An historical account of the plantation in Ulster at the commencement of the seventeenth century* (Belfast, 1877); The 1591 survey of Co. Monaghan, *op. cit.*, and also *Fiants Ire., Eliz. 1*, 5621-5680, P.R.I. rep. D.K. 16; 1606 Division of Monaghan, *Cal. S.P. Ireland*, 1606-1608, 164-87; J. Graham, *art. cit., Ir. Geogr.*

[22] McCurtain, op. cit., 92-4; W. F. Butler, The policy ofsurrender and regrant, Dublin, 1913; E. P. Shirley, Some account of the territory or dominion of Farney, London, 1845, 95.

landownership in a different legal context.[23] Apart from some relatively minor alterations aimed at the establishment of lords' estates of roughly equal size it may be assumed fairly confidently that the 1591 survey is an adequate reconstruction of the shape and structure of the Gaelic landholding system in Monaghan. Because of the war in Ulster and the involvement of some of the Monaghan families, it was necessary to reactivate the settlement in 1606. Apart from the disposition of some additional property to servitors, the 1606 settlement is essentially the same as in 1591.[24]

The 1591 and 1606 divisions of Monaghan consisted of surveys by inquisition of the distribution of property in the county. The baronial territories of the principal families were divided into ballybetaghs and tates. It is thus possible to map the proprietorial geography of late sixteenth-century Monaghan, and its manifestation in a hierarchy of territorial divisions. Figure 1 shows the location of ballybetaghs and church lands in the county for this period.

Secular property Units

The tates and ballybetaghs named in the 1591 and 1606 surveys, and where insufficient detail is provided, in the *Book of Survey and Distribution* (BSD)[25] and the Down Survey, have been mapped onto the modern townland framework. Unidentified tates, or townlands which had no corresponding unit in the records, are omitted. Broken lines in the map indicate uncertain boundaries. Ninety-nine ballybetaghs can be fairly confidently identified. In some cases, the names of the ballybetaghs relate to the name of one of the tates. For example, Ballilecke (No. 35) obviously refers to the tate and townland of Leek. Balleglaslagh (12) refers to the 'two tates of Glaslaghes'. Ballilurgan (5) is derived from a tate, the name of which has since been changed.[26] In other instances, the name obviously refers to some past association of the ballybetagh, as in Ballevickenally (24 and 42: *Baile Mhic AnFhailghe*, incorporating the family name McAnally). In most cases, it would seem that the ballybetagh name incorporates placenames which even in the sixteenth century had fallen into disuse.

The later seventeenth-century BSD, which was used in some cases, shows obvious signs of irregularity resulting from a deterioration in Gaelic territorial organisation from the early seventeenth century. It may be accepted, however, that in normal circumstances in the sixteenth century, the ballybetagh was divided into sixteenths. In some cases, half

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[23] P. J. Duffy, 'Patterns of landownership in Gaelic Monaghan in the late sixteenth century', *Clogher Record*, forthcoming

[24] 24 'Servitors' were soldiers who were paid for service by grants of land. See Aidan Clarke in *New history of Ireland*, iii, 197.

[25] Book of survey and distribution, Co. Monaghan, Public Record Office, Dublin; also printed in appendix to E. P. Shirley, *History of the County Monaghan*, London, 1879.

[26] P. MacDuinnshleibhe, 'Baile na Lorgan', *Clogher Record*, 2, 1957, 131-4.

ballybetaghs of eight tates or quarter ballybetaghs of four tates occurred. Ballelisnespynan (65) in 1591 is a half ballybetagh, the other part of which appears to have been subsumed in Ballidirrekinard (64a) in 1606. Cargagh (46) is also a half ballybetagh. Ballecurren (76) was a full ballybetagh, but only half of it was detailed in 1606. In some cases, tates were also divided into units equivalent to half tates.

Ecclesiastical property divisions

Figure 1 shows the location of church properties. As church land was not specified by tate in either 1591 or 1606, the BSD was used to assist identification. Most of the lands were listed as termons in 1591, with large properties being held by the bishopric of Armagh and Clogher. The church lands ranged in size from one to ten tates, with Tedavnet and Muckno termons containing one and three ballybetaghs respectively.

Civil parish boundaries have been inserted in Figure 1 for the light they throw on the links between secular and ecclesiastical territorial organisation. Parishes were not mentioned in 1591 or 1606, but were first listed comprehensively in the BSD. Nearly all the Monaghan parishes are named in various papal records of the fourteenth and fifteenth centuries, and some can be traced back to the period after the Synod of Rathbreasail, reflecting presumably monastic spheres of influence in the twelfth century.[27] None of them, however, are identified in detail. When the parish boundaries are related to the ballybetaghs, as in Figure 1, they correspond almost exactly with the ballybetagh boundaries. In a few instances, where there is a lack of correspondence, it is clear that the ballybetagh boundary coincides with the barony boundary. Undoubtedly, therefore, the parish units which were adopted by the established church were identical with pre-existing Gaelic units and reflected a strong connection with the secular landholding system. The parishes represented the spatial administration of titheable property, and the correspondence of secular and ecclesiastical boundaries, both with fundamental property rights, is thus a significant feature of Gaelic territorial organisation.

As Reeves suggested, the sixteen-tate aggregate was clearly the most important territorial expression of the ballybetagh unit in south Ulster.[28]

Property divisions and the landholding system

The functioning of the Gaelic landholding system helps to explain the territorial management of property. In general, there were two andowning classes in Gaelic Monaghan: firstly, the chief families, from whom the overlord or McMahon was traditionally chosen, and secondly, the subordinate septs who rendered economic and military services to the principal lords. The church could be included as constituting a further

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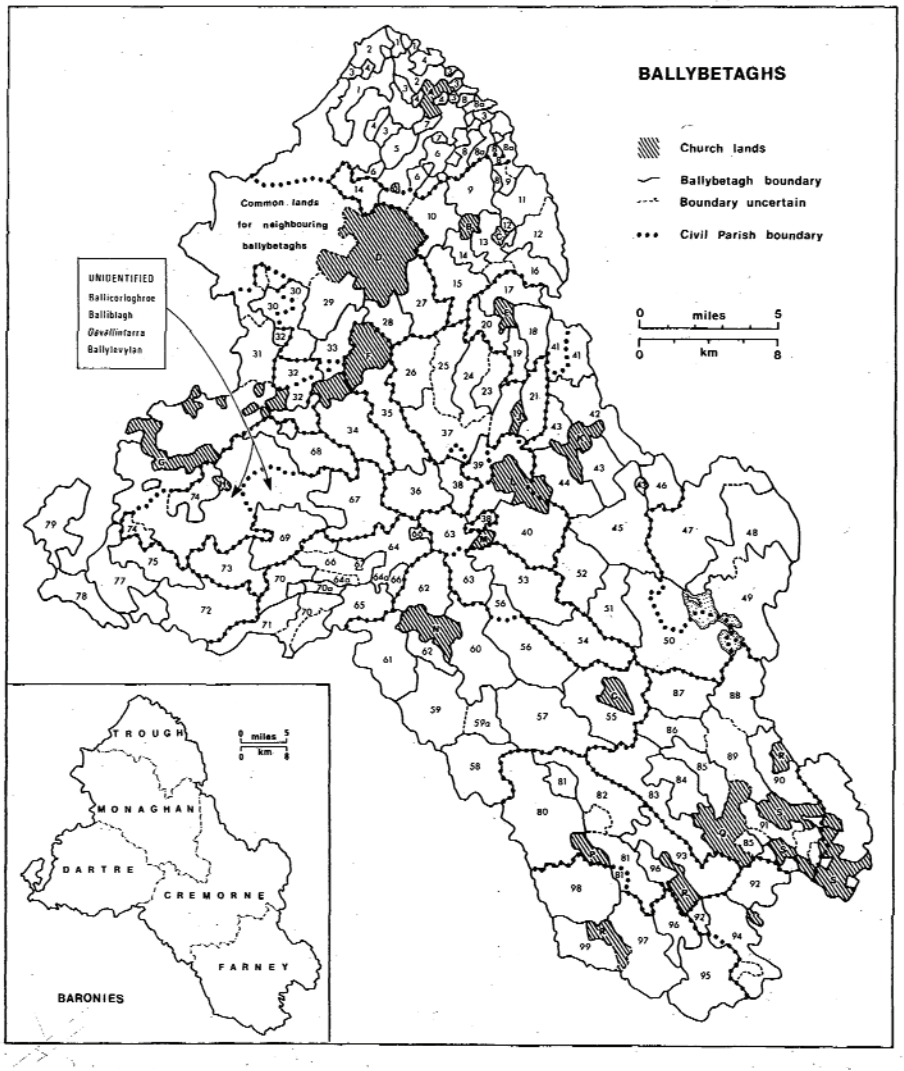
[27] See M. A. Costello (ed.), *De Annatis Hiberniae*, Vol. 1, (Dublin, 1912), 27-57. H. J. Lawlor, 'The genesis of the diocese of Clogher', *Journal ofthe Co. Louth Archaeological Society*, 4, 1917, 129-159.

[28] See also Robinson, *art. cit.*

landowning class, but it is technically exceptional in being outside the control of the lords, although in practice by the sixteenth century much of the church land had been incorporated into the secular system. The non-landowning classes comprised the mass of the population who as tenants and labourers worked the land for the landowners.

Figure 1. Ballybetaghs and church lands in late sixteenth century Monaghan.



Although the 1591 survey ascribed the land to named individuals, one must assume that these properties had fallen to them under the Gaelic landholding system. Under this system, the land was the collective property of the sept or lineage group, to be divided and periodically redistributed among the separate families of the group. Inheritance was partible, The operation of this system shaped the territorial organisation of the land. The ballybetagh was the fundamental property unit of the lineage group. It was the estate of Gaelic society, and the tate was the territoria! mechanism by which the property was allocated among the

families of the sept. Although a comparatively detailed picture of the territorial structure of landholding in 1591 is available, information on the functioning of the system is inadequate. From the early seventeenth century an increasing amount of information becomes available on the processes of change in landholding in Monaghan, which unfortunately only reflects the decline of the system.[29] With the help of recent work by Nicholls especially it is possible to try to explain the operation of Gaelic landholding.[30]

	NUMBER OF BALLYBETAGHS		
	1591	1606	BSD
No. of tates per ballybetagh			
4	1	1	–
8	4	10	1
9	–	–	1
10	–	1	1
11	–	–	3
12	1	1	3
13	–	–	1
14	–	1	5
15	–	2	6
16	36	31	16
17	–	4	2
18	1	–	2
19	–	–	2
32	–	1	1

Four main categories of property with different functions and tenurial conditions can be seen in sixteenth-century Monaghan, all resting on a territorial superstructure of ballybetagh estates.

1. The lands of the freeholding septs. Subordinate to the overlord in their territory or barony, the ballybetaghs of the freeholders belonged to them by right under Gaelic law. They owed service and dues to their overlord, as their overlord, not as their landlord. The chief families also, of course, held their own sept lands, the only difference between them and the other freeholders being that they were politically ascendant and thus in a more powerful position to influence the status of the subordinate freeholders. Many of the freehold properties were, as a result of expansion by the dominant group, held by kinsmen of the principal ruling families. In Monaghan in 1591, approximately forty-eight ballybetaghs were occupied by freeholders, approximately thirty of them by McMahons. The title of 'freeholder' in 1591 represented an attempt by the government to fit the Gaelic system into a legally comprehensible English landholding structure. In Monaghan, the individual freeholders held their portions of the sept lands in 'fee simple, free and common soccage'. They paid 20 shillings per tate to the sheriff, who reserved 7s 6d for the Crown and paid the remainder to the freeholder's superior lord.

[29] As in the *Calendars of State Papers relating to Ireland* from 1608 onwards and the *Inquisitions of Ulster*.
[30] Nicholls, *Gaelic and Gaelicised Ireland,* and *Land, law and society in sixteenth century Ireland.*

The subsequent fragmentation and sale of their lands by the freeholders in the early seventeenth century are evidence that they were outright owners of their land, and the charges payable to the lords represented traditional dues and not rent.

2. The demesne lands. The demesne lands represented varying groups of ballybetaghs which attached to the office of chief lord in the territory. Thus Ross Bán McMahon and Patrick McKenna were the lords of the territories of Monaghan and Cremourne respectively in 1591, and a number of ballybetaghs in both baronies went with their office. The demesne lands were occupied by tenants of equivalent status with the freeholders, except for their differing tenurial conditions.[31] Their names do not appear in the 1591 survey.

3. Mensal lands. Also attached to the office of McMahon were the household or mensal lands (*lucht tighe*) whose owners traditionally provided food for the lord's household in return for being free of other exactions. Ballybetaghs 25, 26, 37 (Figure 1) comprised the *lucht tighe* ofMcMahon, occupied by an un-named sept of similar socio-economic status to the freeholders.

4. Church lands. Church lands were outside the secular landholding system. They were held by the church, under an agreement of 1297, free of exactions by the overlords in Monaghan.[32] The erenaghs of the church lands were the social equivalents of the freeholding septs. By the sixteenth century, however, the secular overlords had in many parts of Gaelic Ulster intruded onto church lands [33] to the extent that the Protestant bishop of Clogher embarked on a lengthy campaign in the early seventeenth century to establish the legal immunity of church lands from secular taxation. [34] Monastic and erenagh lands, which had contrasting landholding experiences in the seventeenth century, are difficult to identify separately.

Figure 2 shows the distribution of freeholder and demesne lands in Monaghan in 1591. The McMahonship having been removed, seven principal families were identified and allotted twenty-eight ballybetaghs in demesne. Each in turn was allocated a number of freeholders from which a fixed charge was received. The church lands were granted to servitors and the mensal lands were ultimately given to Edward Blaney, the seneschal, in 1606.

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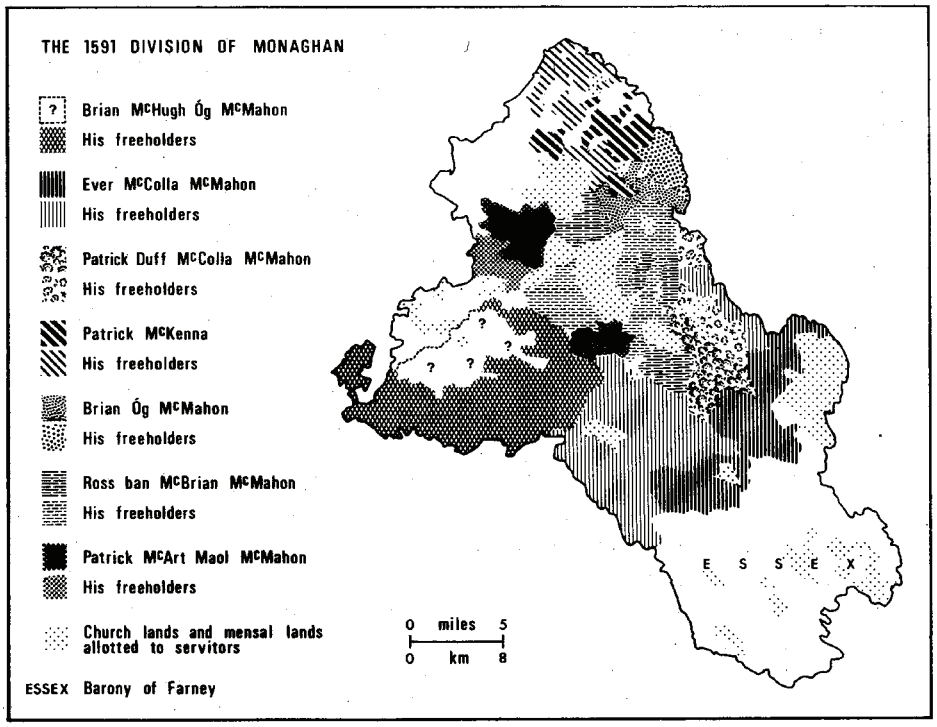
[31] Nicholls, *Gaelicised Ireland*, 70

[32] Simms, *op. cit.*, 326-7. See J. Graham, *art. cit.*, *Ir. Geogr.*, 6, 1970, 143, on the position of freeholders in Donegal.

[33] N. P. Canny, *The Elizabethan conquest of Ireland*, 26; Quinn and Nicholls, *op. cit.*, 30.

[34] Hill, *op. cit.*, 170-1, 208-210. Shirley, *Farney*, 156-7.

Figure 2. The 1591 division of Monaghan.



The 1591 and 1606 divisions of Co. Monaghan therefore represented the stage to which the Gaelic landownership system had evolved by the late sixteenth century. It may be illustrated as a territorial hierarchy:

'McMahon' (sept, mensal and demesne lands)	: Airghialla (Co. Monaghan)
Chief families (McMahons, McKenna) (sept and demesne lands)	: Territories (baronies)
Freeholders (sept lands)	: Ballybetaghs
Individual families (farm holdings)	: Tates (townlands)

The above idealised system differed considerably from reality, where the freeholders were displaced by the chief families, and where quarrelling between the branches of the McMahons meant that each territory tried to establish its independence from the overlordship.

The smaller landowning septs generally provide most information on the system. Unfortunately not a lot of evidence is available on the freeholding septs in the sixteenth century. The 1591 and 1606 surveys

act as a benchmark at one end of the time-scale and the BSD (in lieu of the Civil Survey) provides a record of the situation in 1640. The changes in freehold property in the intervening period help to illuminate the process of change in the early sixteenth century. In the Gaelic system, the freehold sept lands were under constant pressure from the chief families at the top. The ruling families tended to expand their territory at the expense of the freeholders. [35] Large families of sons, which were characteristic of Gaelic families, help to explain this process.[36] By means of exactions, the ruling families were in a strong position to make the freeholders indebted to them. The traditional pledge (or mortgage) was the mechanism by which freeholder property was taken over by the ruling lords. In addition in parts of Gaelic Ireland, the lords appear to have had rights of occupation of unoccupied freeholder land which did not negate the freeholder's title, but often made it extremely difficult for him to repossess his property.[37] The MacCathmhaoils of Clogher were completely dispossessed in the sixteenth century as a result of expansion of the chief family.[38] In this way also, the McMahons held land in many parts of Monaghan by 1591.

At the bottom of the property system, inherent structural tendencies also exposed the freeholders to dispossession. Partible inheritance constantly weakened the freeholders, so that after a number of generations had passed and the ballybetagh had been considerably fragmented, dispossession and reconsolidation by the superior, economically stronger sept took place.

Figure 3 shows the nature of landownership within three freehold ballybetaghs. Even with the abundance of McMahons among the freeholders, each ballybetagh estate was clearly held by a distinctive lineage group. As the 1591 survey shows, each ballybetagh was held by from one single freeholder to a multiplicity of kin-linked freeholders. Where the land was divided among more than one individual family, invariably one member of the sept, the sept leader or the most senior member of the clan, held the largest share. Thus in Balleclonaugre (36) Breine McCabe Fitz-Alexander held five tates and in Balleviddigan (72) Con McColla McMahon held eight tates (Fig. 4). The remainder of the ballybetaghs were divided into one and two tates, presumably reflecting the seniority of the owners. When the ballybetagh was very much divided among a multiplicity of freeholders, as in Balledromgowla (7), where twelve individuals, with one exception, held one tate each, the process

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[35] Nicholls, *op. cit.*, 11, 57.
[36] *Ibid.*, 11; P. 0 M6rdha, 'The MacMahons of Monaghan (1603-1640)" *Clogher Record*, 2, 1957, 148.
[37] Nicholls*, op. cit.*, 65; also K. Nicholls, 'Some documents on Irish law and custom in the sixteenth century', *Analecta Hibernica*, 26, 106-7. Nicholls, *Land, law and society in sixteenth century Ireland*; M. McCurtain, 'Rural society in post-Cromwellian Ireland', in *Studies in Irish History* edited by A. Cosgrove and D. McCartney, Dublin, 1979, 128-9.
[38] S. 0 Dufaigh, 'The MacCathmhaoils of Clogher', *Clogher Record*, 2, 1957, 42-4.

had reached its ultimate state of subdivision through inheritance. Presumably such a situation left it most prone to acquisition by a stronger sept.

The 1591 and 1606 surveys indicate that the individual tates or groups of tates functioned as farm holdings within the ballybetagh estate. The one-sixteenth divisions of ballybetaghs provided scope for the landholding system to operate: properties expanded or contracted by tate. The tate was, therefore, the micro-unit of property, the building block which singly or in groups provided a flexible structure of farms for the branches of the septs.

Figure 3. Distribution of properties in three ballybetaghs, 1591.

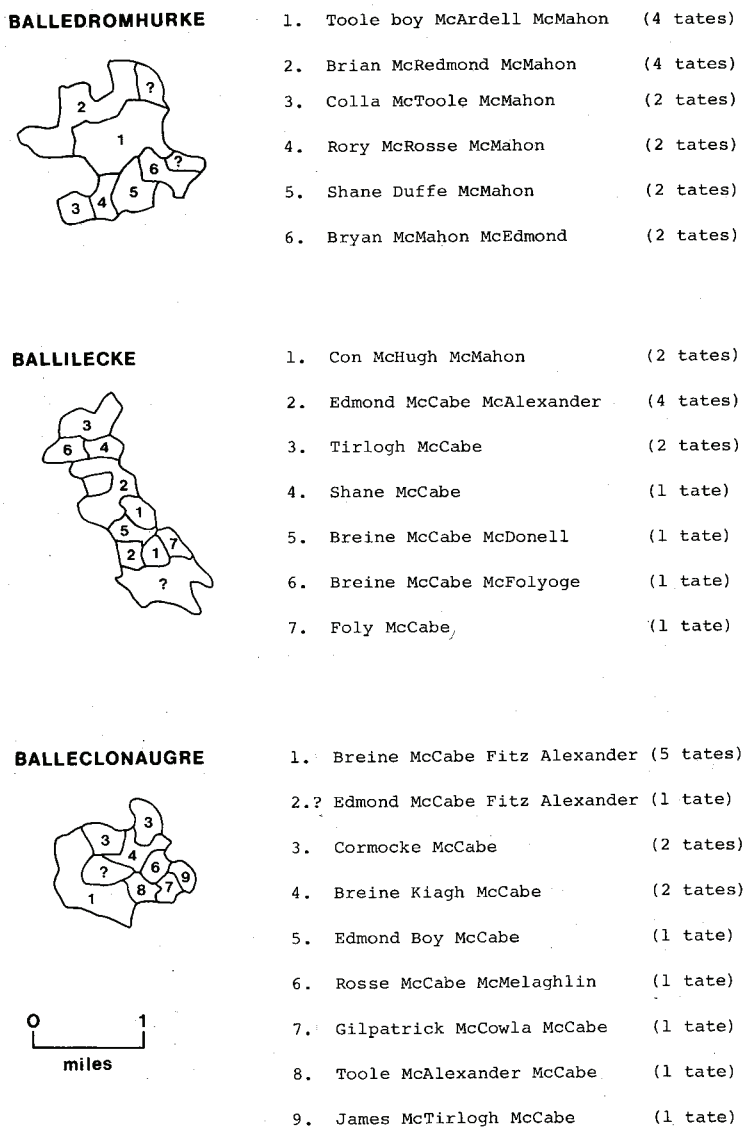


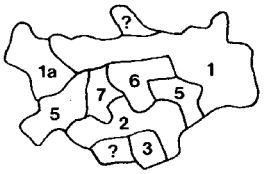
Figure 4. Changes in landholdings in two ballybetaghs between 1591 and 1606.

BALLEVIDDIGAN

1591

1.	Con McColla McMahon (Slain)	(8 t)
2.	Henry McPhillip	(1 t)
3.	Nele McPhillip	(1 t)
4.	Owen McPhillip McHenry	(1 t)
5.	Edmond McCochonaght (Slain)	(2 t)
6.	Donell McDonogh more	(2 t)
7.	Breine McMorogh McPhillip (Slain)	(1 t)

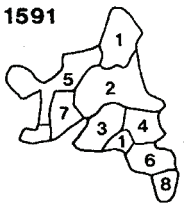
1606



1.	Redmond McAghie McMahon	(6 t)
1a.	Rosse McOwen McMahon	(2 t)
2.	Henry McPhillip	(2 t)
3.	Ditto.	
5.	Patrick McMahon McOwen	
6.	Ditto.	
7.	Hugh McPhillip	

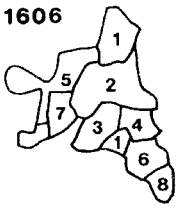
BALLEGLASLAGH

1591



1.	Patrick McCabe	(2 t)
2.	Arte Boy McQuaide	(2 t)
3.	Tege McQuaid	(2 t)
4.	Nele oge McQuaid	(2 t)
5.	Melaghlin McMahon	(2 t)
6.	Patrick McGillegrome McQuaid	(2 t)
7.	Patrick McQuaid McPhelym	(1 t)
8.	Art McQuaid	(1 t)

1606



1.	Ditto.	
2.	Ditto.	
3.	Neale McTeig McQuaid	
4.	Shane McNeale oge McEdmond	
5.	Melaghlin McMelaghlin	
6.	Ditto.	
7.	Ditto.	
8.	Art brother to Art McQuaid	

Most of the evidence suggests that redistribution of farms took place, either periodically or on the death of the owner. The land was reincorporated into the stock of land of the sept (the ballybetagh) and a redistribution occurred.[39] Unfortunately, the 1591 and 1606 surveys, which enable a fifteen year time-span to be examined, do not confirm this trend, possibly because the Gaelic system had changed substantially.

[39] Nicholls, *Gaelicised Ireland.*

Such a change was, of course, the government's objective in the 1591 division. Examination of changes in the distribution of land in ballybetaghs in both surveys shows that primogeniture was obviously operating in inheritance (in that where the 1591 holder was deceased, one son evidently succeeded him), and property boundaries within the ballybetaghs remained virtually unchanged. By 1606, families were clearly identified by inheritance with specific tates. No redistribution had taken place. In the case of Ballividdigan (Fig. 4), the two bigger farm units had changed hands, and while it is difficult to see the relationship of the new owners to the 1591 owners who died in the Ulster war, the properties were the same in all cases. In Balleglaslagh, three sons and a brother in 1606 inherited the unaltered tate-farms of 1591 (Fig. 4).

The territorial structures of Gaelic Monaghan, therefore, probably remained comparatively unaltered throughout the later medieval period, witnessing only a cyclical turnover in owners. The logic and continuity of the ballybetaghs are strongly supported by their interlinkage with the ecclesiastical parish structure. The landholding system functioned within the crucible of the ballybetagh through the tate. The tates themselves with their distinctive placename labels were also stable territorial units over a long period, and these sixteen sub-units provided scope for the expansion and contraction of farm holdings, reflecting the waxing and waning of population and septs.

Breakdown in the Gaelic landholding system, 1600-1640

New attitudes to landownership were gradually being adopted in the late sixteenth century, especially among the principal Gaelic families.[40] Apart from careers in continental armies, which became a common outlet for sons of Gaelic nobility from the early seventeenth century, as well as service in the church, the sons of chief families were traditionally established on the home estates, often, as has been seen, on the land of subordinate freeholders. By the late sixteenth century, the economic advantages of personal and family aggrandisement of property were growing. English law and traditional Gaelic practice in relation to landholdings combined to enhance the possibilities of personal acquisition of property by the dominant family groups. In Monaghan, the 1591 and 1606 settlements provided the opportunity for the chief families to establish personal title to extensive demesne lands.

The freeholding septs were interested in English law as a means of freeing them from the exactions of their overlords, but the 1591 settlement to a great extent simply reasserted their subordinate status, and authorised the chief families to continue to exert their dominant economic role in relation to their freeholders.[41] Thus, the inherent

[40] See Canny, *op. cit.*

[41] . 'Monaghan is likely to be the worst settled county in the north, if the freeholders be not freed from the distresses and dependency of the McMahons', Blaney reported in a letter in 1610, Shirley, *op. cit.*, 121.

tendencies in the traditional functioning of the landholding system became accentuated rapidly following the 1591 settlement and the new developments in economic attitudes to the land.[42] Apart from the accelerating changes within Gaelic landownership structures in the early seventeenth century, new external forces were brought to bear on the system. This final section examines the transformation in the landholding system up to the mid seventeenth century.

In the planted counties of Ulster after 1609, extensive confiscation occurred and new estates were created, in which colonisation and the establishment of a completely new settlement and economic infrastructure were encouraged. Monaghan, however, was excluded from the plantation. To some extent, Co. Monaghan represented an island in a sea of active colonial enterprise, where residual Gaelic land-holding structures were comparatively unaltered. Some minor intrusions had occurred, however, from 1591 and these acquired growing significance in the seventeenth century. In addition, the gradual deterioration in the Gaelic land-holding system allowed more colonial infiltration to occur in the seventeenth century.

The initial planter influence in Co. Monaghan can be traced back to the grant of all church and mensal lands to servitors in 1591. In addition, two ballybetaghs of freehold land were allotted to Captain Humphrey Willis and Christopher Fleming, a Newry merchant. The death in the Ulster war of a number of Monaghan freeholders allowed the government in 1606 to establish approximately seventeen servitors on properties ranging from one to four tates in the baronies of Monaghan and Trough. In 1606, also, Sir Edward Blaney received, in addition to the former McMahon mensal lands, ballybetaghs 47 and 50 (Fig. 1). Between 1591 and 1606, Christopher Fleming, who also held property in Armagh,[43] had expanded his possessions in Monaghan. The 1606 survey, in addition to his earlier grant, confirmed him in possession of Ballenefaragh (39) and four other tates enjoining him to 'plant the same with honest civil people'.

Figure 5 shows the extent of the colonial infiltration in Co. Monaghan in 1640.[44] Church lands are listed *en bloc*, except where details of church land leases are given in the BSD. The large property of Essex in Farney represented on paper one of the earliest confiscations in the county. Essex, however, never effectively settled his estate, which in the 1620s was divided into large leaseholds.[45]

The expansion of Blaney's property from the early grants can be seen in Figure 5. Fleming's estate also reflected vigorous expansion in the first

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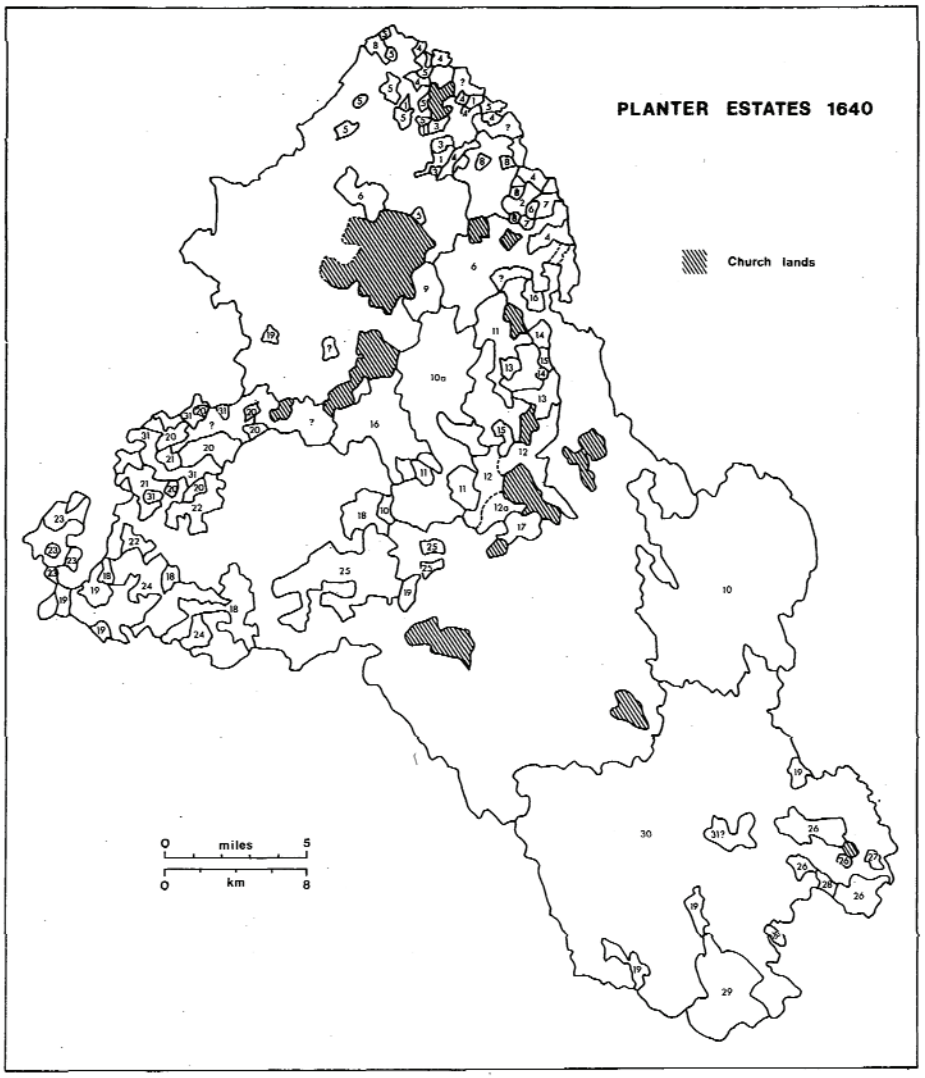
[42] See Clarke, *op. cit.,* 169-70.
[43] Hill, *op. cit.*, 156.
[44] Figure 5 is based mainly on the BSD and partly on information in the *Cal. S.P. Ireland*, and in Shirley's *History of the County Monaghan*.
[45] Shirley, *Farney*, 125, 126.

half of the seventeenth century. The Countess of Carlile's estate resulted from the only direct forfeiture of Gaelic property in the county. Brian Og McMahon (Fig. 2) lost his estates following rebellion in 1609, and Sir Thomas Ridgeway acquired them. Carlile held them by lease or mortgage in 1640.

Figure 5. Planter estates, 1640.



The remaining planter estates are the result of a gradual percolation into the county by growing numbers of land speculators from surrounding plantation counties. Many of the people who bought land in Monaghan from 1610 to the 1640s were also involved in the Ulster Plantation. Ridgeway held lands in Tyrone, Claude Hamilton had a proportion in Co.

Armagh, Arthur Culme's brother owned land in Co. Cavan.[46] The geographical location of the new planter acquisitions reflects a diffusion of information and tenants from the planted counties: the barony of Dartrey, for example, was close to Fermanagh and Cavan. The barony of Trough was very close to the plantations in Tyrone and north Armagh. Planters such as Sir Robert Forth of Co. Cavan had lands in Dartrey; a Mr Manning of Fermanagh leased part of Brian Og McMahon's lands; Ross Bán in 1614 leased some of his lands to Robert Cowell, who held property in Tynan.[47] Even the presbyterianism of the settlers in the northeast of the county in contrast with the predominance of Anglicans in the west reflected patterns established in adjoining plantation counties.

Figure 5 also implies that the better endowed parts of the county, such as the Monaghan and Glaslough areas, were more attractive to opportunistic planter elements than the poorer districts in Cremourne for example. Penetrating the more attractive areas, the newcomers exploited weaknesses in Gaelic landownership. As the Ulster Inquisitions indicate, there was a very active land market in Co. Monaghan in the early seventeenth century. By 1622, for example, John Burnett had made up to thirty-six land purchases from Irish and English alike. The McKennas of Trough were the earliest to succumb to the economy of the land market. The mortgage (or land purchase with delayed payments) became a common method of land transfer from Gaelic landowners in need of cash to planters with limited capital and lots of enterprise.

It is only when Gaelic landownership in 1640 is examined that the complete picture of breakdown in the landholding system is clarified and the nature of colonial penetration is understood (Fig. 6). Two principal features characterise Figure 6: (a) the emergence of substantial Irish-owned estates in 1640 and (b) the virtual disappearance of the smaller freeholder element. There is evidence of some consolidation of property by the descendants of the chief families of the late sixteenth century. Coll McBryan McMahon provides what is clearly an exceptional case where the early demesne grant of Ever McColla (Fig. 2) was expanded at the expense of his freeholders. Elsewhere, some of the principal grantees of 1591 and 1606 slightly extended their demesne grants, while others sold off their estates piecemeal.[48]

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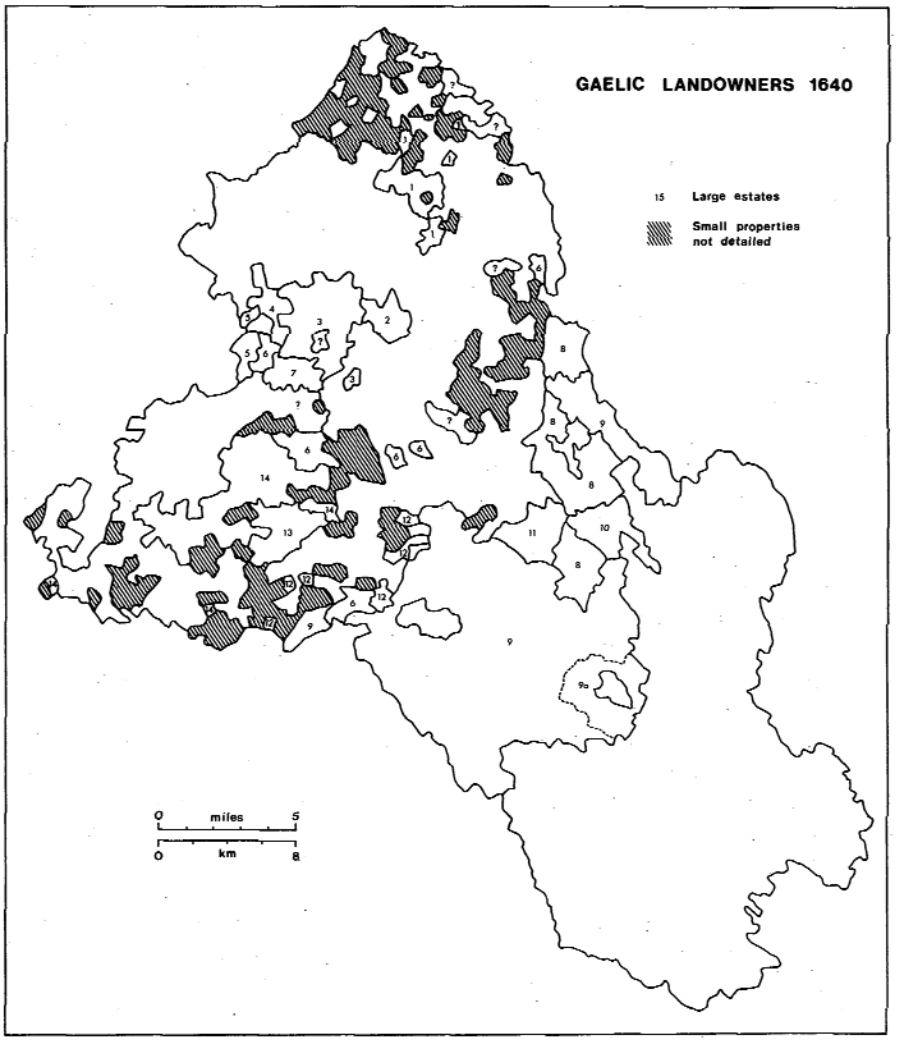
[46] See Hill, *op. cit.*, 278, 279, 455, 487. Many of these purchasers were clearly speculating in the land market. Ridgeway, the Irish treasurer, was in an advantageous position in the government to pick up property, Waterhouse Crimble, another Monaghan purchaser, was appointed comptroller of the customs in Co. Down in 1625 (*Cal. Pat. Rolls, Chas. I*, 7).

[47] Shirley, *Monaghan*, 135, 192, 217.

[48] For comparative information on broader trends, see Clarke, *op. cit.,* 169-70; Graham, *art. cit.*, 200-5.

Figure 6. Gaelic landowners, 1640.



The most notable pattern in Figure 6 is the manner in which the freeholder estates of the late sixteenth century were acquired either by existing major Gaelic landowners or by rising elements among the freeholders or by planters from outside the county. Hugh McMahon expanded his ancestral demesne grant by incorporating his freeholders' properties. Patrick Barnewall (No. 6, alias Patrick Don McCabe) acquired estates piecemeal throughout the county by buying up the lands of freeholders. In the main, however, it was to incoming planter capital that most of the freeholder properties succumbed. Burnett, Fleming, Aldridge, Forth, Barckly, Culme, Hamilton, Barrett, all acquired freeholders' lands in Dartrey, Trough and Monaghan baronies. Only the apparently equal acquisitiveness of the bigger Irish landowners in the barony of Cremourne or, more probably, colonists' lack of interest in this comparatively poor region prevented extensive planter estates developing there. In Figure 6, the shaded areas represent remaining small Irish

landowners in 1640. Owning individual tates for the most part, they represent the vestiges of the much more extensive freehold estates of the sixteenth century. By 1640 approximately 40 per cent of Monaghan remained in Gaelic hands; the remainder had been gradually acquired by planters.

The evidence of Figure 6 indicates that some of the Gaelic landowners in Monaghan had accumulated considerable properties and were participating like the British investors in the land market. They appear to have adopted the new mercenary perception of land as a commodity of value. But there are constant references to their apparent inability to match the investment and managerial astuteness of the new colonial entrepreneurs. Many of them got into debt; many were forced to sell off or mortgage parts of their estates to the British. Although Art Og McMahon's estates in Dartrey were still quite extensive in 1640, he had sold off parts of them to planters in the 1620s.[49] By the late 1620s Patrick McKenna of Trough had sold most of his estate to Walterhouse Crimble, Edward Dowdall, Edward Shergold, Bartholomew Brett, George Hadsor and others. Patrick MacArt Maol McMahon sold property to Edward Blaney and Francis Wootan. Ross Bán McMahon sold extensive lands to Christopher Fleming, John Burnett and others.[50] The principal difference, therefore, between the Gaelic consolidation of estates and the new colonial estates was the apparent inability of the former to manage their properties successfully, in contrast to the British investors, who had the capacity and motivation to make the land work for them. Some of the latter, of course, were speculators with land scattered throughout the county (see Willoughby, No. 19, for example), but many were small purchasers, interested in planting their acquisitions with Protestant tenants. In Trough and Dartrey, purchase of land was followed quickly by the establishment of colonists and farmers, preferably Scottish, to work the land,[51] a pattern of in-depth plantation in the first half of the seventeenth century which strongly influenced the spatial distribution of Protestants in Co. Monaghan up to the twentieth century.

Following the Cromwellian settlement, the property remaining in Gaelic ownership was totally confiscated and all the land of the county was thus transferred to new planter elements. Out of this combination of Cromwellian grants and pre-Cromwellian properties, developed the estates of the nineteenth century. Many of the dispossessed Gaelic families in the mid seventeenth century probably continued for a time as middlemen on the new British estates: undoubtedly some of them would

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[49] O M6rdha, *art. cit.*, 161-6.
[50] *Ulster inquisitions*.
[51] Shirley, *Monaghan*, 242; M. Percival-Maxwell, *The Scottish migration to Ulster in the reign of James 1*, London, 1973, 278

have had the capital to purchase some of the bigger leases.[52] Few, however, survived as substantial landholders in the eighteenth century.

The gradual fragmentation of Gaelic landholding structures in the period up to 1640 resulted in the inevitable breakdown of the system of territorial organisation upon which it rested. The irregular character of the ballybetagh structures as recorded in the BSD reflects this process. Analysis of the BSD, however, and the process of change in landownership in the first half of the seventeenth century indicates that where the Gaelic landholding structures persisted or where there was direct continuity between the Gaelic and the new colonial properties, the ballybetaghs remained relatively unimpaired. The system of ballybetaghs, for example, continued virtually unchanged in the barony of Cremourne. Many of the ballybetagh boundaries continued in the Gaelic estates of 1640. By virtue of their origin, many of the planter properties were also aggregates of ballybetaghs. Blaney's estates, for example, were simply groups of Gaelic ballybetaghs, and were so recorded in the BSD. Carlile's property in Donagh parish also comprised distinct ballybetaghs in the BSD. Elsewhere, although the ballybetaghs were not specifically mentioned, the larger planter estates of 1640 clearly reflected the earlier geography of the ballybetaghs. As the integral property unit of Gaelic Monaghan, the ballybetagh's integrity was preserved when it was purchased in toto.

The transfer of the freeholders' properties, however, resulted in the elimination of the ballybetagh. Fragmentation was the inherent characteristic of freeholder estates. Traditionally, the Gaelic landholding system, whereby the sept owned the ballybetagh, prevented the break-up of the unit. However, the gradual adoption of individualistic attitudes to their land by the members of the sept, in conjunction with a new mercenary assessment of landownership, resulted in the break-up of ballybetaghs through sales of individual tate shares. By 1640, the lands of Trough and Dartrey were mainly identified by tate only, so fragmented had the ownership of the land become.

Conclusion

The evidence of Monaghan in the late sixteenth century shows the prevalence of a stable territorial organisation which reflected, and was maintained by, the functioning of the Gaelic landholding system. It appears that the indigenous landholding system in Ireland, by the end of the Elizabethan period, was being transformed quite rapidly through a combination of political tactics (e.g. the Composition of Connacht and

[52] See, for example, P. 0 Mórdha, 'Colla Dubh McMahon, his ancestors and descendants', *Clogher Record*, 8, 1974, 194-206. For an examination of the fate of Gaelic landowning classes in the later seventeenth and eighteenth centuries, see McCurtain, *op. cit.*

the 1591 division of Monaghan) and the influence of new mercenary attitudes to landholding. It might be suggested that the breakdown in Gaelic landholding systems in the early seventeenth century, upon which rested the whole superstructure of the Gaelic social system, signalled the general transformation of Gaelic society in the face of economic forces emanating from the expanding mercantilist English state. Apart from direct imposition of the new order in many places through the medium of confiscation and plantation, in many unplanted territories such as Monaghan the indigenous system seems to have collapsed in the first two decades of the seventeenth century.

In Elizabethan Monaghan, the combination of ballybetaghs and their sub-units represented a systematic organisation of the land resources of the county, based on a method of assessment of land value, which functioned within the peculiar tenurial and inheritance conditions of Gaelic society. Its boundaries may not have been mapped and measured, but they were inscribed in the minds of generations of the petty landowning classes in Gaelic Monaghan. The ballybetagh emerges as a well-ordered territorial system, in contrast with other Gaelic areas, such as in Munster, where greater instability seems to have prevailed. The stability of the ballybetagh geography is especially well reflected in the close relationship between these secular estates and the parochial divisions of the sixteenth-century church.

With the breakdown of overlordship in the late sixteenth century, the general adoption of individualistic mercenary attitudes to landownership and the gradual infiltration of opportunistic colonial investors in land, the *raison d'etre* of the Gaelic territorial organisation was fast disappearing. The traditional tendency towards fragmentation of property within the ballybetaghs was exacerbated in the new economic milieu of the early seventeenth century, so that by 1640 the ballybetagh had gone into disuse in many parts of the county or contained very irregular numbers of subdivisions. The ultimate removal of all Gaelic landowners in the mid seventeenth century effectively eliminated the ballybetagh as an element in the proprietorial geography of Monaghan. The boundaries of the parishes, and of many of the nineteenth-century estates, were relict reflections in the landscape of an extensive social and territorial order in the pre-plantation era. As units of popular significance, however, the ballybetaghs, and indeed the baronies on a larger scale, ceased to exist after the Cromwellian settlement.

At the bottom of the territorial hierarchy, townland units continued. The divergence of experiences of ballybetaghs and townlands illustrates the resilience of property boundaries in the cultural landscape but more importantly the relationship between territorial and social structure. The ballybetagh, as an integral part of Gaelic socio-spatial order, disappeared with the dissolution of Gaelic landholding and social structures. The townland, however, persisted partly because it was more adaptable to the

plantation administration of the mid seventeenth century, but mainly because it continued as a landholding unit of popular significance for the mass of the population. The tenantry of the post-plantation period, many of them belonging to petty Gaelic landowning septs, carried and transmitted the traditions and experiences of landholding at the level of the tates. The townlands, thus, may be seen as the last remnants of the Gaelic landholding system, in which the residues of former landholding traditions, such as partible inheritance, persisted well into the nineteenth century in many parts of Ireland. In many parts of Monaghan, for example, where in-depth Protestant colonisation did not take place, the strong family farm system with its traditional reliance on inheritance and maintenance of the farm within the kin-group, is most noticeably expressed within the territorial framework of the townland. In the context of an examination of Gaelic Monaghan in the sixteenth century, this appears to be a shadowy territorial manifestation of a very old landholding system.

Acknowledgments This is an expanded version of a paper read to an economic and social history seminar in Trinity College, Dublin, January 1980. I wish to thank Kenneth Nicholls and Bill Smyth of University College, Cork, for their helpful comments.

APPENDIX

Index of planters, 1640

1. Waterhouse Crimble
2. Magdalen Ackeland
3. Lewis Blaney
4. Robert Barckly
5. Arthur Culme
6. Countess of Carlile
7. Roger, William and Robert Holland
8. Four separate planters
9. Heirs of Robert Blaney
10. Lord Blaney

l0a. Heirs of Lord Blaney

11. James Fleming ('Irish Papist') .
12. Heirs Of Christopher and James Fleming (IP)

12a. Mortgaged by heirs of Christopher Fleming

13. Heirs of John Symonds
14. Heirs of Henry Coole
15. Heirs of Claude Hamilton
16. 'Joynture of Mrs Burnett, wife of John Burnett' (IP)
17. James Field
18. Robert Aldridge
19. Nicholas Willoughby
20. Richard Barrett
21. David Barrett

22. Richard Perkins
23. Jacob Leirrey
24. Sir Robert Forth
25. Heirs of Thomas Burnett (IP)
26. Roger Whitehead and Rowland Duffe, on lease from Bishop of Armagh
27. Lord Baron of Louth
28. Lord Baron of Slane
29. Church land previously held by John Hadsor (from 1618)
30. Earl of Essex
31. Church land, 'possessed for years by the Lord of Howth'

Index of Gaelic landowners, 1640
1. Garrett Rooney
2. Heirs of Coll and Bryan McMahon
3. Heirs of Arthur McMahon
4. Edward Owens (?)
5. Bryan McMahon
6. Patrick Barnewall (alias Patrick Don McCabe)
7. Heirs of Tirlogh O'Connell
8. Hugh McMahon
9. Coll McBryan McMahon
9a. Coll McBryan McEver McMahon
10. Hugh McPatrick Duffe McMahon
11. Heirs of Ross 6g McMahon
12. Henry Betagh
13. Heirs of Rory 6g McMahon
14. Heirs of Art 6g McMahon

Index to Ballybetaghs (Figure 1)
(Except where the spelling is very difficult to understand, it is taken from the 1591 Survey. Otherwise, the 1606 survey or BSD are specified.)

Barony of Trough
1. Ballekiltlevan
2. Unidentified
3. Balletonie
4. Balleveigh
5. Ballyareaske
6. Ballymodagh (BSD) (= Ballydavough 1591?)
7. Ballynany]
8. Ballymony (BSD)] in one ballybetagh?
8a. Ballekilmurry]
9. 'Twelve tates' (of McKenna, BSD)
10. Ballynesmere
11. Drombanchor
12. Balleglaslagh
13. Balledrumarall

14. Ballilattin
15. Ballilegacorry (BSD) (= Ballichore 1591?)
16. Balliclanwoyde (BSD) (='12 tates of Clonarde/Clonode' 1591/1606?)

Barony of Monaghan
17. Ballineshalvie
18. Ballimcgarren
19. Balleblagh (in two half sections - only one half identified in Figure 1)
20. Ballereogh
21. Ballyleartie (Ballyfertie, BSD)
22. Ballemorchie (Ballymurphy, BSD)
23. Balleskeaghan (BalIymcskehan, BSD)
24. BallevickenalIy
25. Ballylatlurkan (BSD) (Ballilurgan, 1606)
26. Ballymechan (BSD) .
27. BallytuIlaghcashelI
28. Ballyraconnyle
29. Ballenecorrely (= Ballimcturlagh, BSD)
30. Ballemccowlee (Ballimckowlan, BSD)
31. Ballytyrebrun
32. Ballidenlagh
33. Ballehue
34. Ballymcgowne
35. Ballilecke
36. Balleclonaugre
37. Ballenra (BSD) (= Ballycaslane, 1606)
38. Ballymcenrewe
39. Ballenefaragh
40. Ballicorresoulagh (= Ballicorfingulas, BSD)

Barony of Cremourne
41. Balleglanka
42. Ballevickenailly (= Balliduffy, BSD)
43. Balleskeaghan
44. Ballenecrevie
45. Ballilecke (Ballylacky, BSD)
46. 'Half ballybetagh of Cornebrock' (BSD) (= 'Half bellybetagh of Cargagh', 1591/1606)
47. Drumaghliske (BSD) - Muckno Termon
48. Drum Galvan (BSD) - Muckno Termon
49. Drum McCon (BSD) - Muckno Termon
50. Ballenelurgan (1606 - 2 ballybetaghs) (Ballylurgan, 32 tates, BSD)
51. Balleoghill
52. Ballevicklewlie (Ballymcleholey, BSD)
53. Ballemeighan
54. Ballishean (BSD, 8 tates) (= Ballykillawney, 1606)
55. Ballenlogh
56. Ballenecrave (Ballynecreive, BSD)

57. Ballereogh
58. Ballerawer (= Ballyfremar, BSD)
59. Balleneveaghan
59a. Balledromgor (1606)
60. Ballintamlaght
61. Ballenney
62. Balleportnave
63. Balleloghlaghin (Ballyloghlay, BSD)

Barony of Dartrey
64. Balleroney
64a. Balledderrikiriard (1606)
65. Ballelisnespynan (1/2 ballybetagh, 1591)
66. Ballevallemore
67. Balledromhurke
68. Ballehoran
69. Ballemcgarchan
70. Balledrorngowla
70a. 'Four tates of Edergole'
71. Balledyrrenemoyle (1/2 ballybetagh 1591)
72. Balleviddigan
73. Ballyslaughill (1606)
74. Ballynure (BSD)
75. Balledromarrall (1606)
76. part of Ballecurren (1606.)
77. Ballenelogh
78. Balligolune?
79. Ballecovenche

Barony of Farney
(from BSD)
80. Balliclevan
81. Ballidromlaven
82. Balledromgawney
83. Balliclare
84. Ballihenry
85. Ballironyne
86. Ballikillneveagh
87. Ballifincarne
88. Ballegartcony
89. Balletivedyny
90. Ballitrea
91. Ballishancough
92. Ballitirdoone
93. Balleclogheefe
94. Ballidromrawer
95. Ballidromenir (glebe land?)
96. Ballecockavan

97. Ballydrombannon
98. Balleskallchill
99. Ballikinnaghan

Church lands

A. Six tates of Errigall (BSD)
B. Termon of Dundonagh (4 tates in 1591)
C. Termon of Donagh (1 tate 1591)
D. Termon of Tedavnet (16 tates 1591)
E. Termon of Tehallen (6 tates 1591)
F. Termons of Drumsnatt and Killmore (6 tates each in 1591)
G. Church lands in Clones parish (BSD)
H. Termon of Killeevan (2 tates 1591)
J. Termon of Rackwallace (3 tates 1591)
K. Termon of Clontibret (6 tates 1591)
L. Termon of Tullicorbet (12 tates 1591)
M. See of Clogher (BSD)
N. Termon of 'Aghemollen and Annye' (10 tates 1591)
O. Church lands (BSD)
P. 'Tates belonging to no ballybetagh' (BSD) -church lands?
Q. Ditto - church lands of Donaghmoyne? These are probably too extensive. The BSD also lists twenty-one tates as glebe land belonging to the church of Magheross. Most of these are listed separately as the ballybetagh of Ballidromenir (No. 95).
R. Lands leased from the bishop of Clogher (BSD) - uncertain and scattered throughout the barony of Farney.
S. Lands leased from the bishop of Armagh (BSD) -apparently concentrated in Inniskeen parish.
The map does not separately identify the extensive Termon of Mucknoe. Termons in 1591 which could not be identified were Ballilovan (8 tates); 'Greghlen and the Grainge' (6 tates); Balligolune is probably in Co. Fermanagh.

A considerable number of the tates listed in the BSD as belonging to the See of Clogher, could not be identified.

CHAPTER 5

MORTALITY, CAUSE OF DEATH AND SOCIAL CLASS IN THE BELFAST URBAN AREA, 1970

DENNIS G. PRINGLE

First published in *Ecology of Disease* (1983), 2(1), 1-8.

Following a reduction in the number of deaths from infectious diseases during the past 100 years, most of the major causes of death in developed countries can be classified as degenerative diseases. These diseases, however, are not a simple by-product of the ageing process. Numerous studies have shown that there are significant spatial variations in the incidence of major degenerative diseases, suggesting that there must be something causing these geographical inequalities. To be more precise, there must be factors which are unevenly distributed over space which either result in spatial inequalities in the incidence of degenerative diseases or which influence a person's chances of surviving a degenerative disease once contracted. In either event, a correct identification of the factors might enable preventive measures to be taken to reduce mortality from degenerative diseases.

This is the logic underlying many spatial analytical studies of disease by medical geographers. These studies have been conducted at a variety of scales, but studies at international and inter-regional scales predominate. Studies at an intra-urban level are less common, possibly because mortality data are not routinely published for urban subdivisions [1]. In addition, many studies at intra-urban level investigate mortality from one selected disease rather than mortality from all causes; consequently important relationships between the mortality rates for different diseases may be overlooked. Given that the factors likely to be hypothesised as causes of mortality in a spatial analysis are to some extent a function of the scale of analysis, the relative scarcity of studies of mortality from all causes at intra-urban level may result in important causal factors being overlooked. This study is therefore intended as a supplement to the relatively small number of intra-urban studies which already exist [e.g. 2. 3]. However, it is believed that it also raises a number of questions of broader methodological interest.

Using data on mortalities in Belfast in 1970, this study is an attempt to answer three questions:

(1) Are there significant spatial disparities in life expectancy (measured indirectly using age-sex standardised mortality ratios for deaths from all causes) within cities?

(2) What is the relationship between the spatial variations in total mortality and the spatial variations in mortality for each of the major causes of death? The answer to this question should cast further light on the answer to Question 1. For example, if it is found that there are no significant spatial variations in total mortality, it is useful to establish whether this is because there are no significant spatial variations in any of the major causes of death, or whether it is because areas having a high incidence of one type of disease tend to be 'compensated' by having lower incidences of other types of disease (in which case important spatial variations in mortality might easily be overlooked if one was only to examine the pattern of total mortality). Alternatively, if it is found that there are significant spatial variations in total mortality, it would be useful to know whether these variations are caused by spatial variations in the mortality rate for a single cause of death, or whether they reflect the cumulative effect of several diseases with similar spatial distributions.

(3) Is there a relationship between mortality and social class? If certain social classes are more adversely affected than others by a particular disease, an understanding of why may enable preventive measures to be taken. Such measures, if implemented, might not only prove beneficial to the most disadvantaged classes, but also to society as a whole.

The analysis is conducted at two scale levels. Each of the three questions is first examined at an ecological level (i.e. using aggregated data which refer to spatial subdivisions of the study area). The relationship between mortality and social class is then examined at the individual level (i.e. using data which refer to the deceased individuals, irrespective of their normal place of residence). Many geographical studies tend to confine themselves to an ecological analysis, whereas many epidemiological studies confine themselves to an individual level analysis and thereby exclude the spatial dimension. It is argued here, however, that the relationships between mortality and hypothesised causal factors should, if possible, be analysed at both scale levels – the results at one scale level may provide a partial confirmation or aid a fuller understanding of the relationships observed at the other scale. This argument is developed in the discussion at the end of the paper.

The data

The Belfast urban area (i.e. continuous built-up area) was selected as the study area because of the availability of data extracted from 6,060 death certificates as part of an earlier study of social malaise in the city [4, 5]. The data represent a 100% sample of all those who died in 1970. The civil disturbances were directly responsible for only 17 deaths in 1970 and therefore do not seriously distort the analysis of the major causes of death.

Each mortality was assigned to one of 97 zones depending upon the normal address of the deceased. The zones were delineated in the social

malaise study to contain at least 750 households and to be as socially homogeneous as possible. People who were recorded as living in hospitals or other institutions, or for whom no address was recorded, were excluded from the data set. The analysis is based on the remaining 5940 deaths.

Data on the social class, age and sex composition of each zone were derived from the 1966 Northern Ireland census. The four year time lag between the census and the mortality data introduces a possible source of error into the ecological analysis. The ecological analysis may also be misleading because the zone of residence at the time of death is not necessarily the zone in which the fatal disease was originally contracted due to population movements. However, neither of these problems arise in the analysis of the data at the individual level because this uses information on the age, sex and occupation of the individuals extracted from the death certificates. The results of the individual level analysis may therefore be used as a partial verification of the findings of the ecological analysis.

Results

Intra-urban variations in total mortality

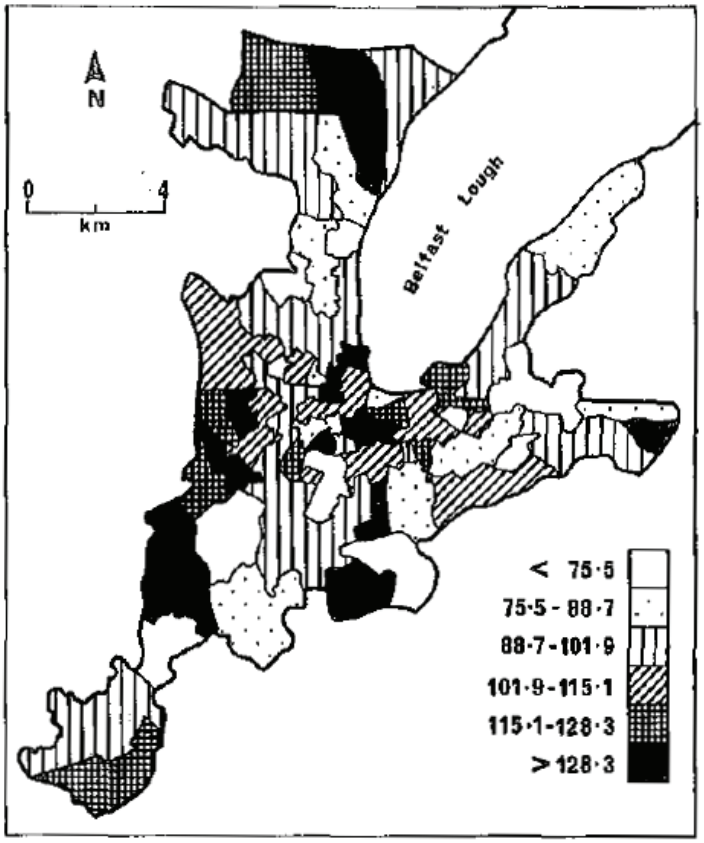
Crude death rates obviously provide a poor basis for comparing mortality in different parts of a city because there are very large variations between areas with respect to age and (to a lesser extent) sex composition. Age-sex standardised mortality ratios were therefore calculated, using the indirect method, for each of the 97 zones to facilitate direct comparison. The indirect method is preferred to the direct method because it is less susceptible to spurious fluctuations when dealing with small numbers.

The values of the SMR's were found to vary from 49.1 to 201.6, suggesting that there are major intraurban differences in total mortality. These extreme values need to be interpreted with caution because they are based on relatively small numbers of deaths (49 and 42 deaths, respectively). However, statistical support is provided by a comparison of the actual numbers of deaths in each of the 97 zones against the numbers expected, given their age and sex compositions, using a chi-squared test. This produces a chi-squared value of 306.0, which is significant at the 99.9% confidence level. It would therefore appear reasonable to conclude that, even allowing for differences in age and sex composition, there are significant spatial variations in mortality rates at the intra-urban level.

A similar result is found if SMR's are calculated for males and females separately. The spatial variations in the SMR values for each sex are found to be statistically significant. The SMR values for males are also found to be significantly correlated with the SMR values for females (i.e. both sexes have a similar spatial distribution of mortality).

The map of the SMR's of both sexes together does not, on first impression, appear to exhibit a high degree of spatial order (Fig. 1). However, closer examination reveals that most of the areas with SMR's greater than 100 are either located in the inner city or else contain high percentages of public sector housing. This suggests that there may be an association between mortality and social class, although it should be noted that some inner city areas with a similar social composition also have low SMR values.

Figure 1. Age-sex standardised mortality for deaths from all causes, 1970.



The major causes of death

The major causes of death (as classified in the Registrar General's Abridged List) in Belfast in 1970 are similar to those found in most developed countries (Table 1). Heart diseases accounted for almost one third of all deaths, followed by vascular lesions, cancers and respiratory diseases as the next most important causes.

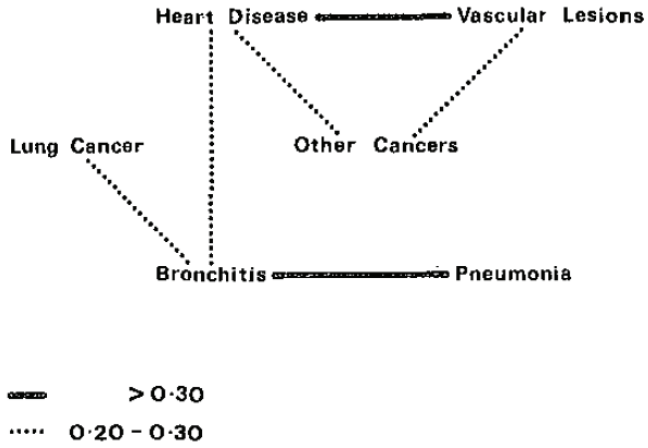
Age-sex standardised mortality ratios were calculated for each of the major causes of death. The correlations between each of the resulting sets of SMR's and the SMR's for deaths from all causes are shown in the first column of Table 2. All correlation coefficients are positive and

significant at the 95% confidence level. Further, the lowest correlations are for the two diseases which accounted for the least numbers of deaths, suggesting that the strength of the relationships between these two causes of death and total mortality may in fact be underestimated because of the low number of cases involved. It would appear reasonable to conclude that the intra-urban variations in total mortality are caused by intra-urban variations in all of the major causes of death rather than simply one or two diseases.

Table 1. Principal causes of death, 1970

Arteriosclerotic and degenerative heart diseases	31.2%
Vascular lesions of the central nervous system	15.2%
Cancers (excluding lung cancer and leukaemia)	13.6%
Bronchitis	8.4%
Lung cancer	4.5%
Pneumonia	3.9%
All other causes	23.2%

Figure 2. Diagrammatic representation of correlations between SMR's for major causes of death.



Examination of the correlations between the major causes of death in Table 2 suggests that they can be subdivided into two groups according to the spatial distributions of their SMR's. This becomes clearer if the higher correlations are shown diagrammatically (Fig. 2). Heart diseases and vascular lesions form the core of one group, with cancers of sites other than the lung associated; and bronchitis and pneumonia form a core of the other group, with lung cancer associated. The two groups are linked by a moderately high correlation between heart disease and bronchitis. A similar clustering effect would be produced if the correlation matrix was analysed using high powered multivariate techniques, such as canonical analysis (e.g. [6]) or factor analysis (e.g. [7]). Using such techniques, one would conclude that the major causes of death in Belfast divide into two discrete disease syndromes: one roughly

corresponding to diseases of the circulatory system, and the other to diseases of the respiratory system.

Table 2. Ecological correlations between SMR's for major causes of death

	All causes	*Bronchitis*	*Pneu-monia*	*Lung cancer*	*Other cancers*	*Heart disease*	*Vascular lesions*
All causes	1.00	0.48	0.31	0.21	0.53	0.72	0.59
Bronchitis	0.48	1.00	0.31	0.23	0.02	0.20	0.02
Pneumonia	0.31	0.31	1.00	-0.04	0.01	0.07	0.03
Lung cancer	0.21	0.23	-0.04	1.00	0.02	0.05	0.01
Other cancers	0.53	0.02	0.01	0.02	1.00	0.25	0.28
Heart disease	0.72	0.20	0.07	0.05	0.25	1.00	0.32
Vascular lesions	0.59	0.02	0.03	0.01	0.28	0.32	1.00

The relationship between mortality and social class

The correlations between the SMR's for deaths from all causes and the percentage of households in each social class (as defined in the Northern Ireland census) are shown in the left hand column in Table 3. The SMR's are significantly and negatively correlated with the two highest social classes, and are significantly and positively correlated with the two lowest social classes. In other words, people living in areas with a high percentage of households in the lower social classes have a higher mortality rate than people of similar age and sex elsewhere.

Table 3. Ecological correlations between SMR's for major causes of death and social class

	All causes	*Bronchitis*	*Pneu-monia*	*Lung cancer*	*Other cancers*	*Heart disease*	*Vascular lesions*
Social class I	-0.35	-0.42	-0.17	-0.22	-0.05	-0.11	-0.09
Social class II	-0.21	-0.45	-0.08	-0.21	-0.05	0.07	-0.06
Social class III	0.09	0.26	0.02	0.12	0.02	-0.06	0.00
Social class IV	0.37	0.50	0.25	0.20	0.09	0.09	0.10
Social class V	0.33	0.45	0.11	0.26	0.05	0.02	0.10

The remainder of Table 3 shows the correlations between social class and each of the major causes of death. The correlations for each cause of death generally have the same sign as those for total mortality, indicating that people living in areas with a high percentage of households in the lower social classes have a higher risk of mortality for every major cause of death *vis-à-vis* people of a similar age and sex living elsewhere. This is consistent with the finding in the previous section that spatial disparities in total mortality reflect similar spatial disparities in each of the major causes of death. However, the strength of the relationship between social class and mortality would appear to vary between causes of death: the

correlations between social class and the SMR's are generally much stronger for diseases in the respiratory disease syndrome (as identified above) than for those in the circulatory disease syndrome.

An individual level analysis

The results of the ecological analysis, with respect to the three questions outline above, may be summarised as follows:

(1) There are statistically significant intra-urban disparities in mortality.

(2) Each of the major causes of death exhibit similar spatial disparities. The spatial distribution of total mortality is a composite of these mutually reinforcing distributions.

(3) The standardised mortality ratios are higher in areas with higher percentages of households in the lower social classes. This relationship, however, is more pronounced for diseases of the respiratory system.

If the mortality data used in this study had been derived from published sources (e.g. reports on vital statistics), one would probably have been obliged to terminate the analysis at this point. However, given that the data were derived directly from death certificates, and then aggregated according to the 97 zones, it is possible to analyse the relationship between mortality and social class at a disaggregated (i.e. individual) level. Although the ecological analysis indicates that there is a relationship between social class and mortality from each of the major causes of death it does not provide any information on the nature of these relationships. A more penetrating analysis of the relationship between mortality and social class is facilitated by an examination of the social class of the deceased at the individual level. This enables the relationships observed above between mortality and social class at the ecological level to be decomposed into two components.

The research design is based on the premise that people living in an area are disadvantaged if either of two conditions exist:

(1) If people living within the area have a greater likelihood of contracting a given disease than people living in other areas. This could be termed the 'incidence' component.

(2) If people living within the area are, for one reason or another, more likely to die at an earlier age from a given disease than people contracting the same disease in other areas. This might arise, for example, if people living in the area contract the disease at a younger age or, if having contracted the disease, they are less likely to survive for a given length of time. This could be termed the 'age' component.

The analysis of the mortality data at the individual level is an attempt to gauge, albeit rather crudely, the relative importance of each of these two components to an understanding of the relationship between mortality and social class for each of the major causes of death.

The percentage of people dying from each of the major causes of death for each social class is shown in Table 4. Social classes I and II are combined because of the small number of people in social class I. The figures in each column total 100% , and indicate the percentage of people in a given social class who die from each of the major causes of death. Thus, it may be seen from the first column that 5.2% of the mortalities in social classes I and II were caused by bronchitis, 3.9% by pneumonia, and so on. By examining the figures in any given row it is possible to compare the relative incidence of a given disease as a cause of death between different social classes. Bronchitis and lung cancer both have a higher incidence amongst the lower social classes: the percentage of people in social class V who died from bronchitis is more than twice that in social classes I and II, while the percentage who died from lung cancer is about 1.5 times higher. In contrast, heart diseases and vascular lesions have a higher relative incidence in the higher social classes. Pneumonia and cancers of sites other than the lung show a slight tendency in the same direction but it would probably be more accurate to regard these results as inconclusive.

Table 4. Percentage of deaths attributed to each cause for each social class

	Classes I and III	*Class III*	*Class IV*	*Class V*	*Total*
Bronchitis	5.2	8.3	8.5	11.4	8.4
Pneumonia	3.9	3.6	3.9	3.5	3.9
Lung cancer	3.7	4.7	4.9	4.8	4.5
Other cancers	14.0	13.9	13.3	13.5	13.6
Heart diseases	34.3	31.4	30.5	29.4	31.2
Vascular lesions	16.6	15.1	15.1	14.9	15.2
Other causes	22.3	23.0	23.8	22.5	23.2
Total	100.0	100.0	100.0	100.0	100.0

The age component may be gauged by calculating the mean age at death for each cause of death and social class (Table 5). For example, the mean age at death of people in social class V who died of bronchitis was found to be 68.50. This underestimates the true mean age at death by about 6 months due to the fact that the death certificates record the age of the deceased at the time of their last birthday rather than at the time of their death, but as each cell in the table is underestimated by a similar magnitude this should not seriously distort comparisons between cells.

Looking first at the mean age of death from each cause for all classes together (i.e. the right hand column in Table 5), it will be noted that deaths from cancer generally occurred about 4 years earlier than deaths

from bronchitis or heart diseases. Deaths from these causes, in turn, occurred on average 4-6 years earlier than deaths from vascular lesions or pneumonia. A person's age at death, therefore, is clearly influenced by the cause of death but variations between social classes in the percentages of deaths attributed to each cause would not by themselves explain the differences between social classes in the mean age at death from all causes (as shown in the bottom row of Table 5).

Table 5. Mean age at death for each cause by social class

	Classes I and II	*Class III*	*Class IV*	*Class V*	*All classes*
Bronchitis	74.48	70.37	68.87	68.50	70.04
Pneumonia	81.69	74.84	78.28	76.03	76.89
Lung cancer	66.01	63.86	66.20	64.15	64.55
Other cancers	66.88	66.75	66.00	67.41	66.84
Heart diseases	73.30	69.75	69.65	69.20	70.26
Vascular lesions	76.85	73.89	73.14	72.75	74.08
All causes	73.12	69.96	69.84	69.46	70.36

Comparison of the figures in each row reveals that there are substantial differences in the mean age at death between social classes for certain diseases. People in the higher social classes who died from bronchitis or pneumonia lived approximately 6 years longer than people in the lower social classes who died from the same causes. There was a similar but smaller disparity of about 4 years for people who died from vascular lesions or heart diseases. However, major differences in the age at death were not apparent for people who died of cancer.

Synthesis

The results of the individual level analysis help to explain the results of the ecological analysis. The major findings of both types of analysis are summarised in Table 6. The strength of the ecological correlations between the SMR's for each cause of death and social class are given in the first column. These may be 'decomposed' into 'age' and 'incidence' components as indicated in columns 2 and 3. This suggests that the nature of the relationship between mortality and social class is different for almost every major cause of death.

The high ecological correlation between deaths from bronchitis and low social class is due to the fact that people in the lower social classes not only have a greater likelihood of dying from bronchitis but they are also likely to die at a younger age compared to people in the higher social classes who die of bronchitis. Pneumonia and lung cancer each record moderately high ecological correlations with social class but the individual level analysis suggests that they do so for totally different reasons. There is little difference in the percentage of people dying from pneumonia between the classes, but people in the lower social classes who die of pneumonia tend to die at a younger age. Conversely, there is little difference between classes in the ages at death of people dying from

lung cancer but there is a relationship between social class and the likelihood of dying from lung cancer as opposed to other causes. Given that deaths from lung cancer occur generally at a younger age than deaths from other causes, this would suggest that people in the lower social classes are more likely to contract lung cancer.

Table 6. Summary of the relationships between cause of death and social class

	Ecological correlation	*Lower age at death*	*Higher incidence*
Bronchitis	High	Lower classes	Lower classes
Pneumonia	Moderate	Lower classes	---
Lung cancer	Moderate	---	Lower classes
Other cancers	Weak	---	---
Heart diseases	Weak	Lower classes	Higher classes
Vascular lesions	Weak	Lower classes	Higher classes

Similar variations are found for the causes identified in the ecological analysis as forming a circulatory disease syndrome. Cancers in sites other than the lung have a weak ecological correlation with social class because of the absence of any major disparities between the social classes in either the likelihood of dying from these cancers or in the mean age at death. There would appear to be at best only a very weak relationship between these cancers and social class. However, this category contains a variety of different types of cancer and it is possible that a strong relationship may exist between some of them and social class.

The ecological analysis suggests that there is only a very weak relationship between social class and both heart diseases and vascular lesions but analysis at the individual level suggests in each instance that this conclusion is misleading. Both diseases are related to social class at the individual level with respect to both age and incidence components but the relationships operate in different directions. People in the higher social classes are more likely to die from heart diseases or vascular lesions than from other causes whereas people in the lower social classes who die from these diseases are more likely to die at a younger age. The age and incidence components therefore tend to cancel each other and so create the illusion that there is no relationship between these diseases and social class when examined at the ecological level whereas, in fact, there are important relationships which only become apparent when analysed at the individual level.

Discussion

The results of this study should be regarded as tentative rather than definitive. The methodology used does not allow the full complexity of the relationship between the age and incidence components to be disentangled whilst the fact that data are only available for a single year limits the confidence which one may place upon the results because of a problem, in certain instances, of small numbers. Nevertheless, it is

believed that this study raises a number of methodological and empirical points worthy of further consideration. For example, the study reaffirms the importance of treating the results of an ecological analysis with extreme caution. If taken in isolation, results of the ecological analysis would have led to the conclusion that the major causes of death form two clusters or syndromes, one of which (i.e. diseases associated with the respiratory system) reflects spatial variations in social class more closely than the other. This, in turn, may have led the researcher to seek reasons why there should be a strong relationship between these diseases and social class but not between social class and the diseases falling into the other cluster.

On the other hand, analysis at the individual level suggests that this line of research might not be particularly productive. The three diseases in the respiratory disease cluster lack a similar type of relationship with social c1ass -- i.e. they relate to social class in different ways, presumably reflecting different causal mechanisms. For analytical purposes it would be futile, therefore, to seek common causal mechanisms by clumping the three diseases together as, for example, in some of the studies which use such techniques as factor analysis. The individual level analysis also suggests that it would be wrong to assume that diseases which do not exhibit a strong ecological correlation with social class (or any other factor) are thus totally unrelated to social class. Heart diseases and vascular lesions were found to have very weak ecological correlations with social class but to have strong but opposite relationships with social class at the individual level. This may well explain why studies of the relationship between cardiovascular diseases and social class have frequently produced contradictory results [8J.

These observations should not be regarded as argument in favour of an individual level analysis instead of an ecological analysis. Ecological analyses obviously entail limitations but so also do individual level analyses. For example, many certificates do not contain information on social class (especially if the deceased was a housewife or retired). Individual level analysis must, of necessity, therefore entail considerable data wastage, and in consequence, possible bias. An ecological analysis may be used to test for bias because the housing market tends to sort people into different residential areas according to social class. This enables one to make an inference about the social class of a deceased person from their normal address. Thus, in addition to providing information about the spatial dimension of mortality, which, in turn, may facilitate an identification of important environmental factors, an ecological analysis may be regarded as a partial test of the validity of the results of an individual level analysis. Ecological and individual level analyses should therefore be regarded as complementary rather than as alternatives. Where possible, mortality data should be analysed at both levels.

Adopting a two-level approach to the analysis of mortality in Belfast in 1970 reveals that the relationships between mortality and social class vary considerably between the major causes of death. This suggests that different causal mechanisms may be involved. Social class, as analysed in this study, may probably best be regarded as a surrogate measure of a wide variety of related phenomena, such as type of occupation, income, housing tenure, housing conditions, education (in the broadest sense), and a wide variety of lifestyle phenomena which may include diet, drinking and smoking habits. The list is virtually endless. Clearly further research is required to establish which particular aspects of 'social class' explain the observed relationships with each of the major diseases, although the findings of the individual level analysis (as summarised in Table 6) may provide some clues.

The age component, for example, may reflect differences in education or in access to medical attention, i.e. people in the higher social classes may have a greater awareness of health risks or be able to take better preventive action in response to early warning symptoms. This might explain why, for most causes of death, people in the higher social classes die at a later age than people in the lower social classes. The major exceptions are cancer victims. The absence of any significant class differences in the age at death of cancer victims might indicate that early identification of symptoms and medical treatment make very little difference to a cancer patient's chances of survival.

The incidence component may reflect class differences in living conditions and lifestyles. People in lower social classes had a greater likelihood of dying from bronchitis or lung cancer (possibly reflecting a higher incidence of smoking), whereas people in the higher social classes had a greater likelihood of dying from heart diseases or vascular lesions. These findings need to be interpreted with care due to the problem of closure, i.e. everyone in the data set died of something so if people in a given social class have a lower incidence for one type of disease they must by necessity have a higher incidence for at least one other type of disease. A detailed interpretation of the incidence component cannot be made without taking into account the age component. The fact that people who die from lung cancer and bronchitis generally die at a relatively young age suggests that people in the lower social classes have a higher incidence of these diseases because they are exposed to factors which cause them, whereas the higher incidence of heart diseases and vascular lesions amongst people in the higher social classes may to some extent reflect the fact that they have a lower incidence of other diseases which generally result in death at an earlier age. In other words, the higher incidence of heart diseases and vascular lesions amongst the higher social classes may be due to a 'residual effect'. These interpretations are highly speculative and more research is required before more substantive conclusions are reached. Nevertheless, the analysis has revealed a number of empirical findings which need to be

accounted for in any theory which attempts to relate mortality and social class. It is hoped that this study may encourage further research in what may well prove a fruitful line of enquiry.

Acknowledgements This paper is a slightly modified version of a paper read at the Conference of the Institute of British Geographers in Edinburgh, January 1983. I would like to thank Dr. Fred Boal and Dr. Paul Doherty for the use of data extracted from the records of the Registrar General as part of a project conducted on behalf of the Northern Ireland Community Relations Commission. I would also like to thank Prof. Richard Preston and Dr. John Sweeney for their many useful comments on an earlier version of this paper.

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CHAPTER 6

THE CHANGING SYNOPTIC ORIGINS OF IRISH PRECIPITATION

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First published in *Transactions of the Institute of British Geographers* (1985), 10(4), 467-480.

Introduction

In terms of its ability to convert water vapour into precipitation, Ireland possesses one of the world's most efficient climatic regimes. This stems essentially from the geographical location of the island, firstly on an oceanic margin where the supply of water vapour is plentiful throughout the year, and secondly, amid the principal depression tracks of the North Atlantic. The condensation forcing mechanisms which this latter ingredient provides are further enhanced by the orographic effects of the relief configuration of Ireland where all the land above 750 m lies within 56 km of the coastline.

Despite the obvious necessity of studying precipitation climatology as a pre requisite in understanding the operation of Irish weather and climate, relatively few investigations have been made. Most, such as Morgan (1953), Dixon (1955), Rohan (1975) and Logue (1971, 1975 and 1978) have concentrated their attentions on statistical analysis of rainfall amounts, irrespective of its origin. This work has enabled a reasonably comprehensive picture of the seasonal characteristics, and extreme event return periods, to be assembled. In terms of studies seeking to relate precipitation to synoptic circulation types, however, less success is apparent. Perry (1972), Houghton and O'Cinneide (1976a) and Mills (1983) have examined spatial contrasts across Ireland in relation to specific circulation types, though often with a rather restricted time period in evidence. The purpose of this paper is first, to extend the utility of such analyses by examining rainfall patterns across Ireland using the most complete observational records available and secondly to make some preliminary comments on the impact which recent circulation changes are having in terms of Irish rainfall characteristics.

Spatial and seasonal distribution of precipitation

A brief examination of Figure 1 confirms the two principal characteristics of the annual precipitation pattern. First, the classic west to east gradient is apparent with isolated mountain locations in the west and south west receiving over 3000 mm annually, while parts of the Dublin area receive less than 750 mm. Secondly, the close relationship between altitude and amount may be inferred. The precise nature of this relationship is as yet unknown, as is, for example, whether or not rainfall amounts increase to summit levels, or show regional variations in rates of altitudinal increase.

Certainly, rain shadow effects can be seen in the lee of the major upland areas, for instance in the lowlands around the Foyle and along the east and south coasts. The most striking anomaly lies in Co. Limerick where conditions more akin to the eastern half of the country extend over a wide area. This is also the only location where the 1000mm isohyet reaches the west coast. The sensitivity of this area, in particular, to recent circulation changes will be demonstrated later.

In beginning to explain this spatial pattern the first point which should be made is that it does not derive from west to east contrasts in rainfall intensity from similar rainfall producing events. This was demonstrated by Logue (1975) by contrasting the rainfall patterns produced by high intensity as opposed to long duration events of the same return period. A weak spatial field was apparent with high intensity precipitation and no marked west-east contrasts existed. This is in agreement with the findings of Bleasdale (1963), Glasspoole (1930) and the Meteorological Office (1975) in Britain. With long duration events, however, the converse was true and the annual precipitation relationships were mirrored to a high degree. This emphasizes the fact that it is more persistent precipitation, rather than a greater yield per unit time, which is responsible for producing the west-east contrast on an annual basis. Mean rainfall intensities at Claremorris (Co. Mayo) in the west, and Dublin Airport in the east, for example, are almost identical, while mean duration of rainfall at the former is over 50 per cent greater. Some of the west-east contrast is, however, attributable to a seasonal imbalance. For most locations the period February-July is the drier half of the year. If amounts during this period are expressed as a ratio of amounts during the remainder, an index of seasonality is produced. Figure 2 shows that, by this measure, western parts have a more seasonal regime than eastern and central Ireland. This characteristic, noted by Logue (1978) is undoubtedly related to the influence of sea surface temperatures. At the Kish Bank in the Irish Sea for example, these range from 6-9°C in early February to 14°C in late August. Off the south west coast, water temperatures seldom fall below 10°C. The temperature contrast which this creates in winter between the ocean surface and the overlying air has a dual effect. First, it triggers convective motions which move with the westerly circulation and release the bulk of their precipitation over western parts.

Secondly, it enables a transfer of sensible and latent heat to frontal systems which are rendered more active at this season in western margins. Both of these aspects are not exclusive to each other, and may be reconciled in the convective shafts which are now known to characterize frontal zones at a mesoscale level (Hobbs and Locatell, 1978). In summer, convective activity switches on to the land, and is more pronounced in the more continental east of Ireland. This area thus has a more even seasonal distribution than western areas, with more tendencies towards a summer maximum. The hundred year record from the Phoenix Park in Dublin shows August to be the wettest month,

rather surprising at first sight in an island often heralded as exemplifying maritime influences par excellence.

Figure 1. Annual average precipitation 1941-70

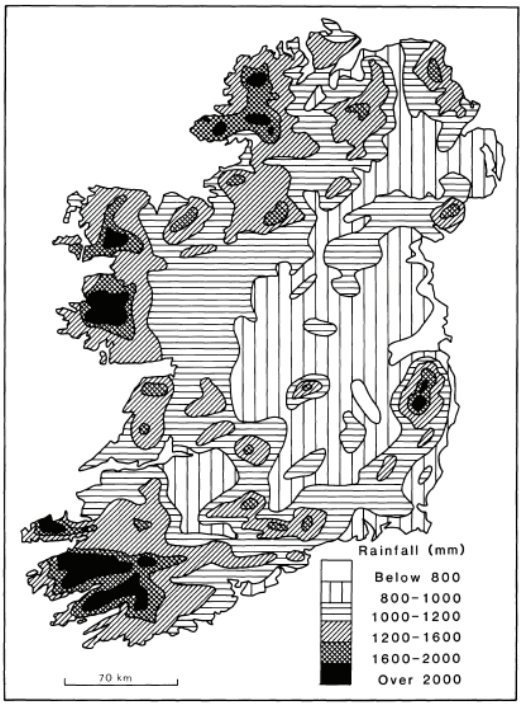


Figure 2. Precipitation Feb-July as a ratio of Aug-Jan

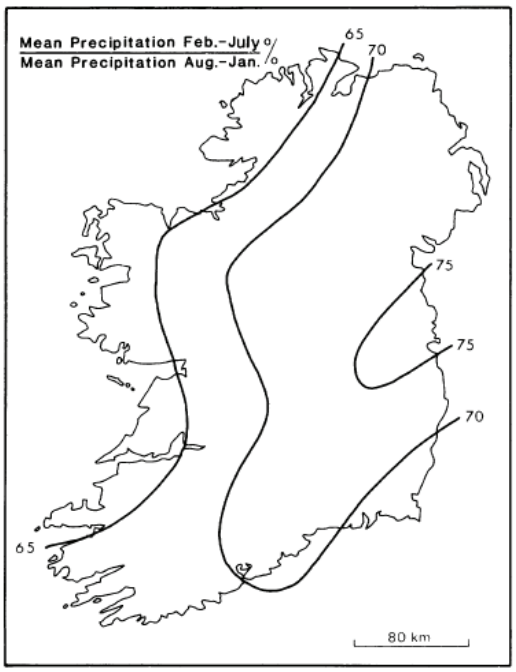


Table I. Principal Lamb Circulation types

Anticyclonic (A)	Anticyclone centred over, near or extending over the British Isles; therewith also cols situated over the area, between two anticyclones.
Cyclonic (C)	Depression stagnating over, or frequently passing across, the British Isles. The further criterion used is that a depression should be centred, or its central isobar on a 4-5 mb spacing should extend over the mainland of Britain or Ireland at some time during the day. Further, individual days between the passing of separate centres over the area are also counted as cyclonic if the main (surface) low pressure axis remains over the area.
Westerly (W)	High pressure to the south (also sometimes south west or south east) and low pressure to the north of the British Isles. Sequence of depression and ridges travelling eastwards across the Atlantic.
Northwesterly (NW)	Azores anticyclone displaced north-east towards the British Isles or north over the Atlantic, or with extensions in these directions. Depressions (often forming near Iceland) travel south east or east south east into the North Sea and reach their greatest intensity over Scandinavia or the Baltic.
Northerly (N)	High pressure to the west and north west of the British Isles, particularly over Greenland and sometimes extending in a continuous belt south over the Atlantic Ocean towards the Azores. Low pressure usually over the Baltic, Scandinavia and the North Sea. Depressions move southwards or south eastwards from the Norwegian Sea.
Easterly (E)	Anticyclones over, or extending across, Scandinavia and towards Iceland. Depressions circulating over the western North Atlantic and in the Azores-Spain-Biscay region.
Southerly (S)	High pressure covering central and northem Europe. Atlantic depressions blocked west of the British Isles or travelling north or north eastwards off the western coasts.

Further complications in the rainfall pattern are hinted at by the existence also of north to south contrasts. These were noted by Morgan (1953) and Perry (1972) and are attributed to preferred depression tracks across Ireland. Such depressions may themselves exhibit considerable diversity and this will also manifest itself in spatial receipt patterns (Thomas, 1960).

The sensitivity of Irish precipitation patterns to circulation types and frequency is thus hinted at and Perry's (1972) assertion that:

> Any long term variations in the atmospheric circulation can be expected to be reflected in changes in the precipitation climatology of Ireland would thus seem worthy of further consideration.

Figure 3. Stations employed in the analysis

The synoptic origins of Irish precipitation

In relating precipitation to circulation characteristics the first requirement is for some form of daily categorization of airflow types across Ireland. This has been done according to a scheme originally devised by Lamb (1950) which involved seven primary circulation categories. In a subsequent revision a further nineteen hybrid types were added to incorporate more complex circulation types into a register extending from 1861 (Lamb, 1972). The categories are considered to be representative of an area (50-60°N and 10°W-2°E) which includes the whole of Ireland although a modified register more appropriate to conditions here is currently under preparation (Betts, 1982). The criteria by which days are allocated to a particular type are well known and can be seen in Table I.

Table II. Mean Daily Precipitation (mm) by Principal Lamb Types

	Lamb Weather Types							
	Anticyclonic	Cyclonic	Westerly	Northwesterly	Northerly	Easterly	Southerly	Unclassified
Ballydehob	1·65	4·22	5·52	1·44	0·95	3·05	7·18	5·19
Clonakilty	1·64	4·02	4·32	1·05	0·71	3·76	7·25	4·76
Roches Point	1·10	3·55	3·11	0·62	0·53	3·36	6·26	4·24
Cork Airport	1·47	4·05	3·62	0·84	0·59	3·59	8·72	5·03
Valentia	1·87	4·52	5·24	1·81	1·50	2·06	9·16	5·11
Kanturk	1·01	3·89	3·69	1·09	0·96	2·63	5·88	3·61
Abbeyfeale	1·02	4·38	5·19	2·98	1·27	1·61	5·03	3·59
Kilmallock	0·95	3·84	3·36	1·64	0·88	2·00	5·48	3·51
Knockaderry	0·82	2·80	2·05	0·59	0·37	2·02	4·77	3·38
Kilkenny	0·73	3·79	2·89	0·89	0·53	1·60	5·53	3·30
Clonmel	0·60	3·22	2·39	1·17	0·63	1·39	5·20	2·81
Hacketstown	0·85	4·53	3·45	1·75	1·06	2·31	6·66	3·93
Rosslare	0·78	4·08	2·98	0·60	0·58	2·20	5·57	3·74
Enniscorthy	0·86	3·63	2·72	0·95	0·60	2·19	6·08	4·07
Shannon	0·84	3·79	4·33	1·57	0·71	1·56	6·19	3·37
Claughjordan	0·65	4·05	3·91	1·51	0·85	1·60	6·42	3·37
Birr	0·65	3·89	3·51	1·22	0·70	1·22	5·82	2·94
Casement	0·67	4·27	3·61	1·07	0·65	2·06	5·75	2·59
Barnadarg	1·19	5·78	4·95	1·76	1·10	1·59	6·92	3·76
Clarinbridge	1·11	4·17	5·00	1·87	1·33	1·40	5·35	3·80
Carrick on Sh.	1·08	3·93	4·23	2·26	1·13	1·41	6·58	3·65
Ballyjamesduff	0·95	4·33	4·17	1·99	0·85	1·77	6·49	3·45
Warrenstown	0·73	4·37	3·36	1·49	0·75	1·99	5·45	3·24
Dublin Airport	0·52	4·46	2·36	1·01	0·66	2·10	3·29	3·03
Belmullet	1·39	5·72	4·92	2·30	1·74	1·12	6·78	5·53
Kilala	1·20	4·07	5·03	2·77	2·25	1·46	6·64	5·37
Markree Castle	1·05	4·04	4·01	3·12	1·71	1·13	5·88	5·04
Clones	0·78	4·12	4·04	2·09	0·71	1·23	5·96	5·24
Dundalk	0·61	3·06	2·06	1·07	0·43	1·31	5·11	2·71
Glenties	1·27	5·91	4·91	5·21	1·62	0·77	6·25	5·85
Malin Head	0·95	4·09	5·18	5·16	1·03	1·04	2·96	5·34
Armagh	0·79	4·00	3·36	1·74	0·87	1·49	5·62	3·00
Ballykelly	1·22	6·14	4·91	4·84	2·22	1·53	6·61	5·92
Belfast	0·79	4·59	3·77	2·15	0·82	1·39	6·24	3·37
Mean	1·00	4·04	3·85	1·83	1·03	1·85	6·04	3·91

Daily rainfall values for 53 stations, for the period from 1941 onwards, were initially assembled. 1941 marks the commencement of records stored on disk by the Irish Meteorological Service. These stations were selected from an inspection of the complete network on the basis of their length, reliability and location. Further processing was then carried out to identify incorrectly entered data and to remove all estimated and cumulative observations. Ultimately, 35 stations were retained for analysis, although at a still later stage one further rejection was made (Swanlinbar) on grounds of possible over exposure of the site. The network (Fig. 3) can be considered representative of conditions in lowland Ireland if it can be shown to be free of spatial bias in its geographical distribution. To investigate this a nearest neighbour index (R) was calculated where:

$$R = \frac{d_{obs}}{d_{ran}}$$

d_{obs} = observed mean nearest-neighbour distance
d_{ran} = expected mean nearest-neighbour distance for a random arrangement of stations.

The nearest neighbour index varies between 0.0, indicating a completely clustered arrangement and 2.15, indicating a completely dispersed pattern. A value of 1.0 indicates a random arrangement. A value for R of 1.14 was obtained, suggesting that a clustered network was not in evidence, and that the network could be considered significantly random at the 0.01 level.

Using the full length of record from each station has the advantage also of minimizing the problems resulting from a lack of synchronization between the Lamb weather types, assigned on a midnight to midnight basis, and the daily rainfall readings, not made until 09.00 hrs on the following morning. This lack of temporal compatibility is, however, not too serious since the Lamb classification is not designed to be used strictly to characterize airflow on a particular day in isolation, but rather to indicate the nature of a sequence of days. In fact the strongest relationships were observed when the rainfall values were not thrown back to the previous day. This suggests that the Lamb categories may not be as applicable to a westerly location such as Ireland as intended, and that they are thus better matched to the last nine hours of the rainfall day rather than the first fifteen.

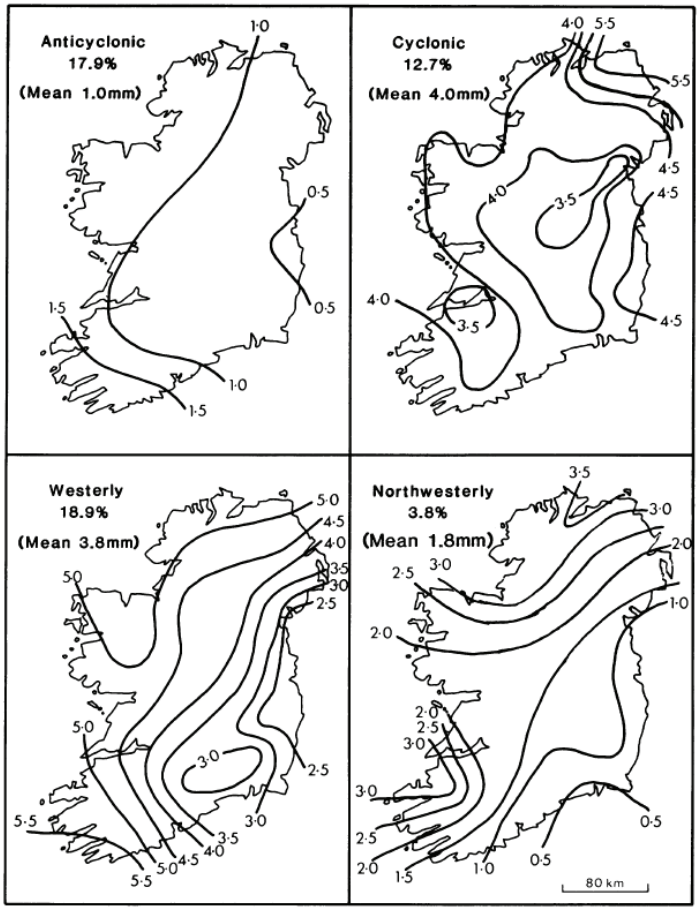
Mean daily rainfall amounts for each of the twenty-seven Lamb weather types were calculated for each station. The remainder of this paper however confines itself principally to examination only of the eight primary circulation categories. The results of these calculations are seen in Table II which shows the considerable variability in rainfall yields apparent with different circulation types. A northerly airflow, for example, produces about 1 mm on average while a southerly flow yields almost five times this amount. The marked rainfall gradients which occur in relation to circulation trajectories is best appreciated, however, if the data are mapped (Figs 4 and 5). It should be emphasized that these maps relate only to the lowlands of which the synoptic stations are representative. No account has been taken of orographic enhancement in upland areas. The maps may, however have some utility for forecasting likely amounts or probability with particular circulation types, especially since they are based on very large sample sizes. For the major circulation categories the mean precipitation amounts were calculated from several hundred days of the particular type. For the three most frequently occurring categories (anticyclonic, cyclonic and westerly) the number of days used for calculation exceeded 2800 at some stations.

Anticyclonic type (Fig.4 a)
This type of circulation involves a high pressure area centred over or extending over the British Isles. As such, the areas closest to the centre of subsidence generally lie on the eastern half of Ireland, with the western half less dominated by high pressure influences, perhaps with Atlantic fronts skirting the western seaboard. Accordingly, a very slack east to west gradient is observed. Rainfall amounts are uniformly small,

although somewhat greater, especially in the south west, than suggested by Houghton and O'Cinneide (1976a). Only along the western seaboard do amounts significantly exceed 1 mm.

Figure 4. Mean Daily Precipitation receipt by Lamb category

(a) Anticyclonic (b) Cyclonic
(c) Westerly (d) North westerly

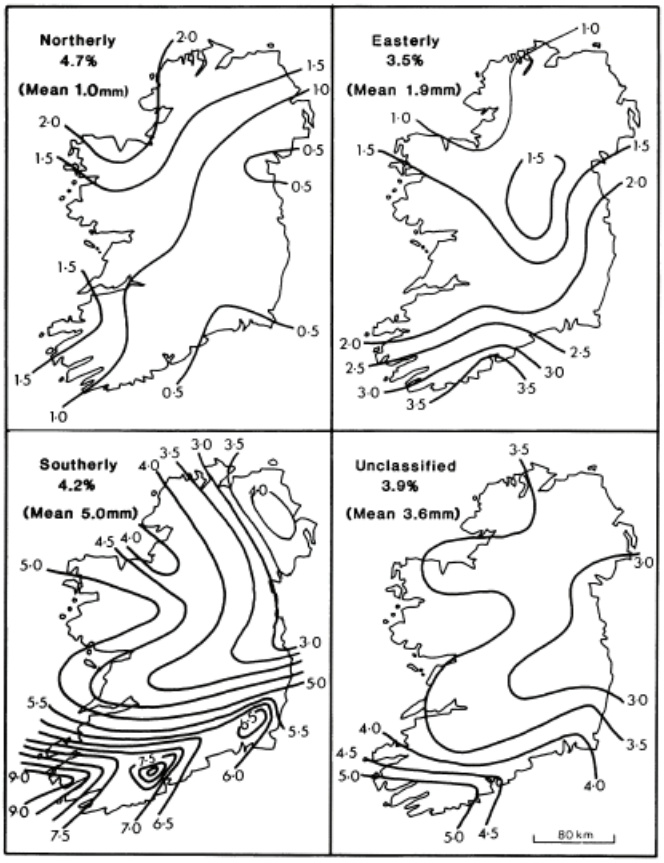


Cyclonic type (Fig. 4b)
A cyclonic circulation implies the movement of a depression centre across Ireland. Over a long period the track taken may vary, promoting again a fairly even distribution of precipitation across the country. In contrast to the findings of Houghton and O'Cinneide (1976a), however, rainfall amounts are not greatest with this circulation type, with the exception of east central Ireland and the extreme north east of Ulster, a finding corroborated by Mills (1983). A noticeable decrease in amounts can be discerned in the interior of Ireland which may be related to a less abundant supply of oceanically derived water vapour in these inland locations. The heaviest receipt appears concentrated along the Co.

Antrim coast and this suggests that the North Channel may be instrumental in producing precipitation activity with unstable north westerly airflows. This is hinted at also in the map of north westerly precipitation although further analysis would be needed to corroborate this hypothesis.

Figure 5. Mean daily precipitation receipt by Lamb category

(a) Northerly (b) Easterly
(c) Southerly (d) Unclassified



Westerly type (Fig. 4c)
A north to south pressure gradient, usually in conjunction with depression passage to the north of Ireland, produces this circulation type. The west to east decline in amounts shown is therefore to be expected, such airflows maximizing orographic influences. In the north and northwest this is the wettest airflow, with amounts typically twice as large as those received in the rain shadow east of the Wicklows. A marked rainshadow in the lee of the Cork-Kerry mountains can also be seen. Westerly airflow is also the main supplier of rainfall around the lower Shannon Basin, which is relatively exposed to in this direction. Amounts generally increase with this airflow towards the north west, an indication

of the role played by the greater proximity of these areas to the depression centres at their most active stages of development.

North westerly type (Fig. 4d)
The extension northwards in mid Atlantic of the Azores anticyclone forces depressions to pass north of Ireland in a north west to south east direction, producing a north westerly airflow. Rainfall receipt thus shows a north-south gradient with a considerable contrast between the north and south coasts. Amounts, however, are relatively light away from north facing coasts, suggesting an important role for elevation and exposure considerations with this airflow.

Northerly type (Fig. 5a)
High pressure to the west of Ireland, with low pressure over continental Europe, produces the driest airflow as far as most of Ireland is concerned. Exposure is again the main control on amounts with northern and western areas receiving rainfall from convective showers triggered by the warming of the cold northerly flow as it traverses warmer ocean. Again a marked shadow can be discerned along the south coast and south of the Mournes.

Easterly type (Fig. 5b)
When depression tracks lie to the south of Ireland the resultant easterly flow is quite dry. Winds are predominantly blowing over land areas and have shed much of their water vapour burden over Britain. Areas in Ireland which receive significant rainfall with such circulations are, as expected, along the east and south coasts. The proximity of the south coast to the depression centres explains its relatively high totals. In the Cork area, for example, amounts may be comparable with those received on westerly or cyclonic airflows. In the north west however, less than I mm is typical. A notable extension of this relatively dry area exists into the area to the west of the Wicklows where shelter from rain bearing easterly winds is provided.

Southerly type (Fig. 5c)
Southerly type circulations result from the presence of blocking anticyclones over central and northern Europe. Atlantic depressions therefore come to a halt west of Ireland and frontal disturbances in association with them may cross Ireland from south to north. A further rain producing mechanism may be envisaged in summer due to the heating of the moist maritime tropical airstream once it crosses on to land. Overall, this is the circulation type which produces the greatest daily rainfall totals. In the south of Ireland, in particular, amounts may be twice as much as with westerly or cyclonic circulations. Almost everywhere mean daily totals in excess of 3 mm are experienced, and much higher falls, over 9 mm, are in evidence in the Cork/Kerry area. The driest areas lie on the east coast north of the Wicklows. A very

striking gradient exists between Dublin Airport and Valentia with this airflow type.

Unclassified type (Fig.5 d)
Days when the circulation did not match any of Lamb's criteria for his seven principal or nineteen hybrid types were allotted to this category. Often the synoptic situation was highly complex.

Such days can be seen to provide a substantive amount of precipitation with some distinctive regional variations. Overall the pattern resembles that for the southerly type, as was noted by Houghton and O'Cinneide (1976a) who suggested that a tendency for a southerly airflow might characterize many of these occasions. In a further study the same authors (Houghton and O'Cinneide, 1976b) analyzed six storms yielding over 50 mm of rainfall. They found in all cases, except one, that the upper airflow was highly meridional, and that such storms tended to be unclassifiable in Lamb's scheme. Much of the pattern for this category may therefore result from slow moving or quasi stationary fronts in association with a southerly airstream.

A number of points emerge from this examination of daily precipitation averages with circulation type. First, despite its relatively small size, Ireland exhibits marked regional contrasts with specific airflow types. Southerly, westerly, and north westerly air-flows are particularly significant in producing west-east contrasts, which are often further exacerbated by topographical effects. Cyclonic and anticyclonic circulations on the other hand promote a more even receipt.

Secondly, heaviest falls are associated with a southerly circulation type, and not cyclonic as claimed by Houghton and O'Cinneide (1976a) on the basis of two years of data. This confirms the findings of Mills (1983) who analyzed the decade 1970-79.

Thirdly, it can be hypothesized that the seasonal imbalance in receipt noted may reflect one or both of two possibilities. Either the seasonal frequency of specific circulation types varies, thus providing a greater frequency of wetter/drier airflows at particular times of the year, or seasonal contrasts in yields may exist within particular airflow types. Daultrey (1984) considered the former hypothesis unlikely and so the latter is investigated here.

The Lamb classification is in effect a means of removing temperature considerations from the more common air mass analysis approach. As such, it has the disadvantage of blurring seasonal differences within circulation types which may arise from thermal controls on the air mass associated with them. Certainly, as Gregory (1964) noted, the classification omits the whole concept of the intensity of development of

the circulation system concerned, and this may be an important consideration at a seasonal level.

Table III. Seasonal precipitation and principal Lamb types

Lamb weather types	*Mean daily precipitation (mm) all stations*			
	Spring	*Summer*	*Autumn*	*Winter*
Anticyclonic	0·81	0·94	1·07	1·40
Cyclonic	3·53	3·64	4·86	4·20
Westerly	3·53	3·06	4·27	4·26
North westerly	1·42	1·13	2·14	2·37
Northerly	1·01	0·73	0·99	1·33
Easterly	1·47	2·32	2·70	1·78
Southerly	4·18	3·92	5·70	5·25

Table III shows the mean precipitation values dis-aggregated by season. In each case receipts are heaviest in the autumn/winter wetter half of the year and in each season southerly airflows are wettest. Only small seasonal contrasts are in evidence with anticyclonic and northerly flows and the main seasonal differentiation is attributable to the other types. The southerly maximum in autumn is particularly striking and seems related to sea surface temperatures, which are at a maximum in early autumn. In fact the general level of enhancement for most categories is relatively consistent, implying the operation of an outside control, such as sea surface temperature, as the major determinant of rainfall receipt. The role of a warm ocean, transferring latent energy to the air and to cyclonic systems in it, may be inferred from Table III as the major cause of the autumn/winter precipitation maximum in most of Ireland. Fourthly, it may be suggested that the annual precipitation map of Ireland is essentially a compendium of these daily averages and reflects the frequency of occurrence of individual circulation types in the course of thirty years. It is apparent, therefore, that changes in the mix of circulation types which occur over time will conceivably alter the annual rainfall map to some degree.

The significance of circulation changes

Over the period 1881-1984 the seven basic Lamb types, plus the unclassified category, accounted for 70 per cent of the daily weather patterns over Ireland, the remainder being attributable to the hybrid circulation categories. Anticyclonic, cyclonic and westerly types are dominant in this 70 per cent and clearly Irish rainfall patterns are primarily determined by precipitation received from the last two types, which account for about 66 per cent of annual rainfall throughout Ireland. Changes in the cyclonic/westerly relationship are thus potentially of significance for the national pattern.

Table IV shows that, in terms of circulation frequencies, the period 1961-84 differs in some key respects from the previous 100 year averages. A 2

per cent increase in cyclonicity, and a 1-4 per cent increase in north westerly weather can be noted. The major feature, however, is the large fall in westerly days. Only slight changes in the other categories are apparent, and since these contribute only small amounts to the annual total precipitation, they are not so significant. These changes are well documented. Sowden and Parker (1981) have suggested that April and August westerlies have undergone significant changes in their frequency over the past 120 years while Jones and Kelly (1982) noted that:

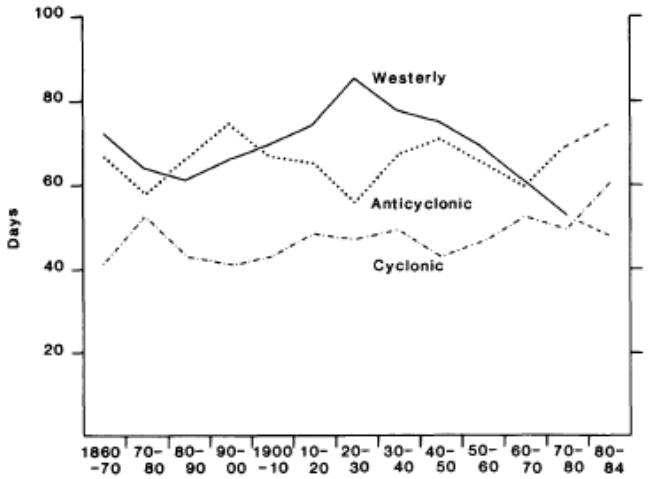
> ...a marked shift towards cyclonic conditions (since the 1950s) had occurred at the expense of westerliness and anticyclonicity.

Table IV. Frequency occurrence of Lamb weather types

Lamb type	*Percentage occurrence* 1861–1960	1961–1984
Anticyclonic	18·0	18·1
Cyclonic	12·4	14·4
Westerly	19·5	15·2
North Westerly	3·6	5·0
Northerly	4·7	4·6
Easterly	3·4	4·1
Southerly	4·2	4·4
Unclassified	3·3	4·9
Anticyclonic N.E.	1·4	1·4
Anticyclonic E.	2·6	2·2
Anticyclonic S.E.	0·9	1·0
Anticyclonic S.	1·1	1·0
Anticyclonic S.W.	0·7	1·0
Anticyclonic W.	4·9	4·0
Anticyclonic N.W.	1·5	1·6
Anticyclonic N.	2·1	2·0
All Anticyclonic sub categories	15·2	14·2
North Easterly	0·9	1·1
South Easterly	1·6	2·0
South Westerly	2·5	3·2
Cyclonic N.E.	0·3	0·5
Cyclonic E.	1·0	1·3
Cyclonic S.E.	0·5	0·4
Cyclonic S.	1·3	1·1
Cyclonic S.W.	0·7	0·5
Cyclonic W.	4·4	2·7
Cyclonic N.W.	0·9	1·0
Cyclonic N.	1·3	1·5
All Cyclonic sub categories	10·4	9·0

These trends are clearly depicted in Figure 6. The substantial reduction in the number of westerly days from over 80 per year in the 1940s to around 50 in the 1970s is particularly striking and has been linked to changing vigour in the global circulation at large. A slight southerly displacement of the circumpolar vortex would bring depression tracks closer to Ireland and simultaneously increase cyclonicity. The diminishing westerly circulation has also been linked to a decline in northern hemisphere mean temperature and to rainfall changes in the Sahel (Lamb, 1982).

Figure 6. Decadal averages of principal Lamb types



The impact of these changes on Irish rainfall patterns can best be appreciated if the makeup of precipitation receipt over two contrasting time periods is examined. Figure 7 shows the relative contribution by circulation type to overall amounts at Valentia, Shannon, Dublin and Malin Head based on the 100 year average 1861-1960. For both Valentia and Shannon westerly rainfall is about twice as important as cyclonic. In the case of Shannon, westerly rainfall is by far the dominant proportion. Southerly and hybrid contributions are obviously restricted in their yield by the shelter effects of surrounding uplands. At Dublin Airport roughly equal contributions from cyclonic and westerly sources may be noted. The same breakdown for 1961-84 (Fig. 8) shows considerable differences. In each case the importance of the westerly source has greatly diminished. At Valentia and Shannon it is only slightly greater than cyclonic, while at Dublin, cyclonic is almost twice as important as the westerly type. The impact of such changes on total rainfall amount may vary from place to place. Over most of Ireland declining contributions from westerly sources have been compensated for by increases in rainfall from the other sources, particularly cyclonic or some of the hybrid categories. The long term trend in rainfall may therefore be unchanged. In some instances, however, the airflows which replace the westerlies are significantly drier and the long term trend may show a slight decline. This appears to be happening at Shannon where, because

of the area's unusually high dependence on westerly rainfall, its vulnerability to a decline is greatest. The relief configuration of the area around Shannon renders it less exposed to rainfall from other directions. An increased frequency of these airflows has not therefore been sufficient to compensate for the westerly decline and a slight negative trend in annual rainfall receipt is apparent (Fig. 9).

Figure 7. Contribution to annual total by Lamb categories, 1861-1960

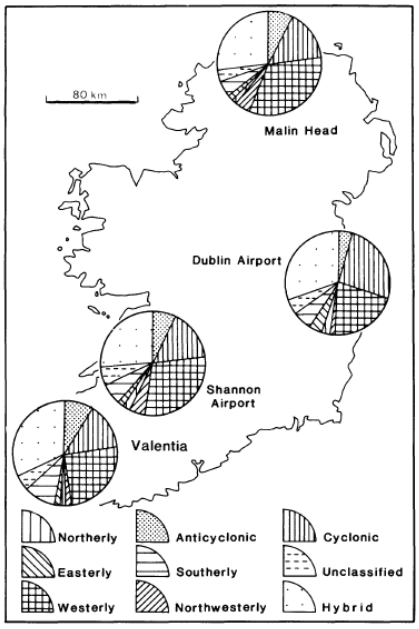


Figure 8. Contribution to annual total by Lamb categories, 1961-1984

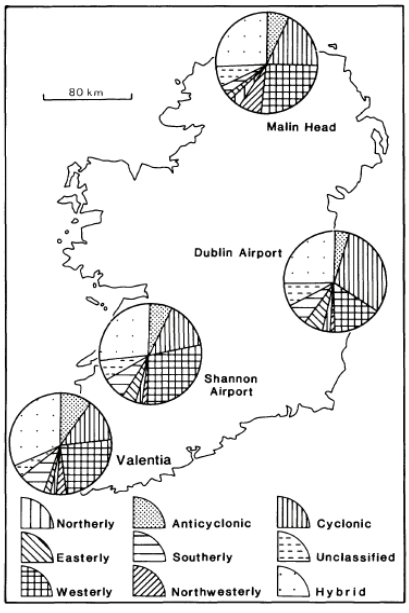


Figure 9. Simple linear trend in precipitation receipt, annually, and by principal Lamb types - Shannon Airport

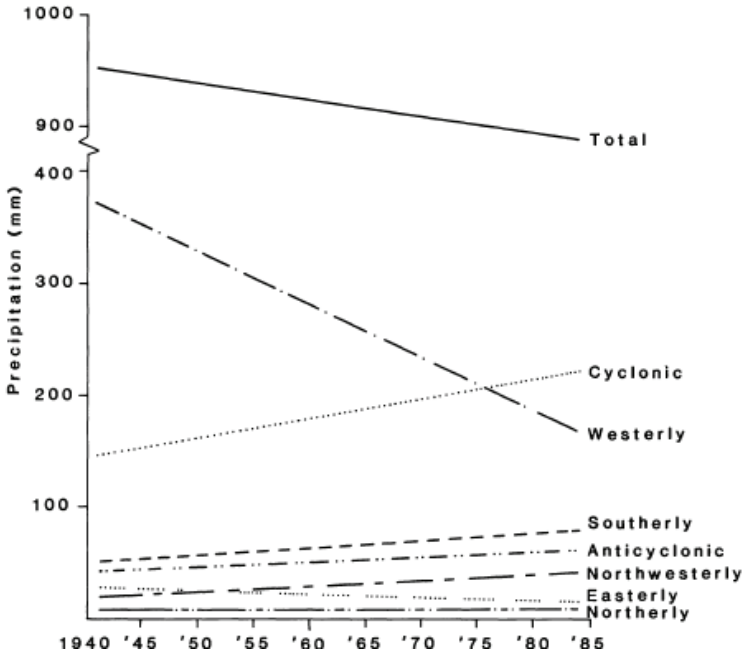
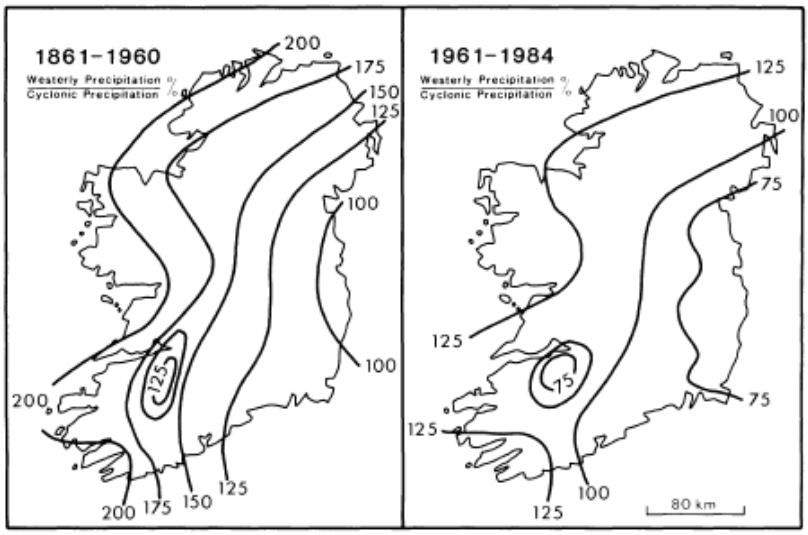


Figure 10. Precipitation received from westerly circulation types as a percentage of that received from cyclonic types (a) 1861-1960 (b) 1961-1984 Regime



A second set of impacts relates to the geographical distribution of annual precipitation. This stems principally from the replacement of precipitation derived from westerly sources by that derived with cyclonic circulation type. Figure 10a shows the ratio of westerly to cyclonic rainfall based on the hundred year circulation averages and the mean

rainfall with each circulation type already derived. Only along the eastern coastline is there a dominantly cyclonic regime. Elsewhere westerly rainfall is much more important, almost twice as much along the north western seaboard. This changes considerably during the period 1960-1984 (Fig. 10b). For this period half of the island falls into each category. The continuation of these trends means that at present, at all locations in Ireland, even on the extreme west coast, cyclonic rainfall is now probably an equal, if not greater, contributor to annual totals than westerly rainfall. The significance of this can be assessed by remembering the spatial differences which were apparent with these two circulation types. Cyclonic rainfall showed little spatial variation, while westerly rainfall produced the west east gradient observed on the annual map. Thus it seems possible that a blur-ring of west-east contrasts may be a consequence of these changes in circulation frequencies. At present this seems to be being masked by increases in rainfall from a combination of other sources and the role of these less frequent circulation types therefore requires further study. The continued growth of cyclonic rainfall at their expense may, however, make discernible changes on the 1961-90 map of annual receipt.

Conclusions

The annual precipitation regime of Ireland shows the effects of complex contributions from a variety of circulation types. Some of these promote marked geographical variations in receipt, related to the influence of trajectory, orographic considerations and the role of sea surface temperatures. Changes in the frequency of these circulation types are occur-ring. The effect of these is to alter the proportion of rainfall received from particular circulation types over time with possible ramifications for long term trends at some locations and for the classic west-east gradient of rainfall in Ireland in the future.

Acknowledgements I would like to express my gratitude to the Irish Meteorological Service, in particular Mr Denis Fitzgerald and Mr Andy McManus, for generously making available all rainfall data relating to the Republic of Ireland to me.

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CHAPTER 7

STRUCTURAL AND FUNCTIONAL PROBLEMS OF COMMUNITY DEVELOPMENT CO-OPERATIVES IN THE IRISH GAELTACHT

PROINNSIAS BREATHNACH

First published in Ó Cearbhaill, D. (1986) *The organisation and development of local initiative*, 8th International Seminar on Marginal Regions, University College Galway, pp.78-108.

Introduction

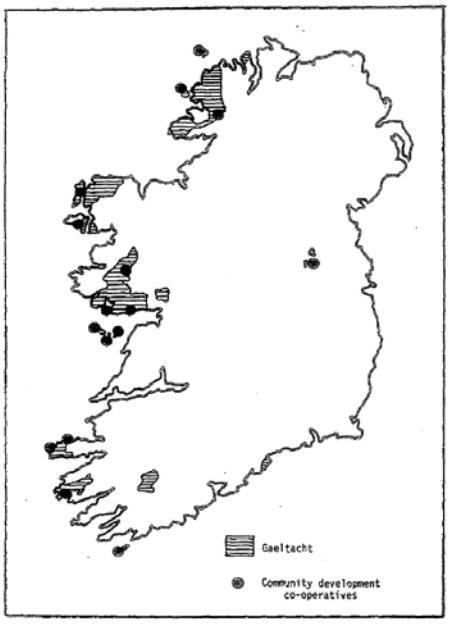
The Irish-or Gaelic-speaking areas of Ireland (collectively known as the Gaeltacht) are mainly scattered along the western seaboard (Map 1) and currently account for only 2.5 per cent of the national population. Since the acquisition of political independence in 1922, the preservation of the Gaeltacht has held a prominent place in Irish national ideology. However Q while a considerable amount of financial resources has been directed towards achieving this objective, it can be suggested that this has not been matched by an equal amount of imagination. Over the last twenty years, the bulk of these financial resources has been focussed on the economic development of the Gaeltacht, in an effort to stem the rapid population decline which was seen as the principal problem facing the Gaeltacht areas. As with the remainder of the west of Ireland, economic development of the Gaeltacht, as far as the Government was concerned, was essentially equated with industrialisation, and a special state agency (previously Gaeitarra Éireann, now Údarás na Gaeltachta – the Gaeltacht Authority) was established to promote the setting up of manufacturing industry in the Gaeltacht. Initially, the main focus was on attracting externally-based (usually foreign) firms into the Gaeltacht, although in recent years, growing emphasis has been placed on stimulating industrial enterprise indigenous to the Gaeltacht itself. Again, this change of emphasis reflects what has been happening at national level

In terms of employment creation, the performance of Gaeltarra Éireann/Údarás na Gaeltachta appears to have been relatively successful by national standards, particularly during the current recession, despite a clear-out of ailing firms following the transition from Gaeltarra to Údarás in 1980. This has been linked, to some extent, with the reversal, in the 1970s, of the long-established pattern of Gaeltacht demographic decline, although clearly many other factors have contributed to recent population growth, such as return migration from a depressed British economy, and the extension of dormitory-type commuter settlement into the hinterland of Galway City.

However, despite this recent economic and population growth, the indications are that the process of language decline continues to operate

within the Gaeltacht, suggesting that while such growth may be a necessary condition of Gaeltacht preservation, it certainly is not sufficient to attain this purpose. Indeed, in at least some instances, it may be that the very policies which have brought about economic improvement have contributed to the process of linguistic decline (Mac an Iomaire, 1983; Keane et al., 1983). There appears to be little evidence of serious thinking in official circles concerning the complexities involved in the maintenance of a minority language and culture: movement towards the development of the type of comprehensive policy required in this context seems to be minimal. Údarás na Gaeltachta had been expected to have a much wider brief than its predecessor, Gaeltarra Éireann, which had functioned almost exclusively as an industrial development agency: indeed, such had been envisaged by the official report which initially recommended the establishment of Údarás (Gaeltarra/SFAOCO Working Party, 1971). However, having already gone through one full five-year term of office, not only has Údarás not acquired any significant extra functions as compared with Gaeltarra, but it has not, apparently, asked for any, as it had been expected to do at its inception in 1980. While there has been an amount of movement into supporting areas of economic activity apart from manufacturing industry, there have been no major initiatives in such areas as education policy, physical and social planning, and community development.. The most recent Údarás Annual Report, for 1983, shows that sums of £85,000 and £40,000 were spent on language and community development, respectively, which, combined, amount to less than one per cent of total spending in that year.

Map 1: Locations of Gaeltacht community development co-operatives



Community development co-operatives: Origins and spread

It would be tempting to perceive the community development co-operative (henceforth CDC) "movement", which spread through the Gaeltacht in the late 19605 and the 19705, as a grass-roots reaction to the failure on the part of Government to introduce the wide-ranging policies required for effective Gaeltacht conservation. Certainly, most CDCs have a strong commitment to the Irish language; in addition, most can claim the involvement of the great majority of the households in the areas which they serve. In many cases, CDCs can count among their "leading lights" individuals who regard the CDCs as more appropriate vehicles for Gaeltacht development than the methods employed by state agencies. Be that as it may, it is clear that Gaeltacht CDCs have failed to develop their full potential as "alternative" development agents, and, indeed, have suffered considerable set-backs during the current prolonged recession, with many cutting back on their activities, and some closing down altogether.

The aim of this paper is to review, briefly, the operating experiences of Gaeltacht CDCs, with particular reference to the difficulties they have encountered, both internally and externally. From this review, some suggestions are developed as regards how the CDC "movement" cant perhaps, be placed on a better footing.

The first Gaeltacht CDC was registered in West Kerry in 1966. Its basic organisational structure, whereby shares were sold to as many households as possible within the "community" which the CDC aimed to serve, has been reproduced by all subsequent CDCs. This structure served two main aims: it facilitated, at least hypothetically, involvement of the "community" in its own development, while at the same time creating a "co-operative"-type entity which would allow CDCs to avail themselves of a management grant provided by the Department of the Gaeltacht specifically for co-operatives. However, as shall be seen the actual structure involved community co-operatives outside the Gaeltacht did not seriously get under way until similar forms of state aid were introduced in recent years as part of the state's effort to stimulate small firm formation. However, despite the availability of the management grant, the state agencies (Gaeltarra/Údarás and the Department of the Gaeltacht) have never taken an active role in promoting CDC formation, by contrast, for example, with the comprehensive programme introduced for this purpose by the Scottish Highlands and Islands Development Board in the late 1970s. Indeed, as will be argued later, one of the key problems faced by Gaeltacht CDCs has been the lack of committed support on the part of the state agencies. The spread of the CDCs, therefore, may be seen largely as a spontaneous development, involving a mix of local initiative and the "demonstration effect" provided by the previous establishment of CDCs in other Gaeltacht areas.

The establishment of the proto-typical CDC in west Kerry in the mid-1960s coincided with the gradual articulation on the part of the less developed west of Ireland for a greater share in the rapid national economic growth which was taking place at this time. This so-called "Save the West Campaign" was given an added vibrancy and sharpness in the Gaeltacht by the emergence of a Gaeltacht Civil Rights Movement, many of whose members became actively involved in the creation of local development groups, which in some cases formed the springboard for subsequent CDC formation. The Government responded to this agitation with a vigorous policy of western industrialisation, implemented, in the case of the Gaeltacht, by Gaeltarra Éireann. This, however, did not halt the impetus for CDC formation, which continued through the 1970s until by 1977, a total of 16 in all had come into existence (Table 1).

One of the distinguishing characteristics of Gaeltacht CDCs has been their emphasis on the development of indigenous natural resources, including agriculture, forestry, fishing, tourist resources (including the Irish language itself), and traditional handcrafts (For further information on the activities of Gaeltacht CDCs, see Commins et al. (1981), Johnson (1979), and Trevelyan (1980)). Consequently, their focus has been quite different from that of industrial development agencies, with their emphasis (at least until recently) on imported firms producing consumer and high-technology goods. One could, therefore interpret the development activities of the CDCs as *supplementing* those of the state; alternatively, one could suggest that the CDCs' preoccupation with natural resources simply reflects the confined nature of traditional horizons and skills among the Gaeltacht population. At the same time, there is no doubt that for many CDC activists, the preference for natural resource development is ideological: i.e. that the development of indigenous resources under indigenous control offers better prospects for the preservation of the distinctive cultural characteristics of the Gaeltacht.

Apart from natural resource development, a second major dimension to the activities of the CDCs has been service provision, thereby making up for deficiencies in this respect on the part both of the public and private sectors. Thus, many CDCs have become involved in installing and maintaining piped water supply systems, generating electricity (especially on offshore islands), supplying agricultural and hardware requisites, running retail shops, and providing community facilities. While these have, in many cases, contributed in a major way to improving the quality of social life in the Gaeltacht, they have also facilitated economic development (e.g. better tourist facilities and power supply for industry). Many CDCs are also directly involved in cultural activities (e.g. music, dancing, drama, Irish language classes).

Table 1 shows the level of fulltime employment provided by the Gaeltacht CDCs as reported in their latest returns to the Registrar of Friendly Societies. The amount of jobs involved is modest, relative to a total Gaeltacht population of 80,000 and a total of 4,000 jobs created with the assistance of Gaeltarra Éireann/Údarás na Gaeltachta. However, survey data indicate that Table 1 understates the actual amount of employment directly created by some CDCs via subsidiaries, joint ventures, direct spin-offs, etc. However, what is disturbing is that the two CDCs with far and away the best employment creation record – Comharchumann Chois Fharraige and Comharchumann Forbartha na nOileán – both ceased operations in 1984 due to financial difficulties. The loss of the second of these was particularly significant in that it had become the main local source of employment in a remote area where Gaeltarra/Údarás has made little impact. In addition, whereas a new CDC has been established to replace Comharchumann Chois Fharraige and continue some of its functions, such has not been the case with Comharchumann na nOileán.

It would be a mistake, however u to equate the economic impact of the Gaeltacht CDCs with the number of full-time jobs which they have provided. Much of this impact has been felt in terms of expanding the income-generating ability of existing local producers (e.g. land reclamation, agricultural marketing) or reducing their costs (e.g. agricultural supplies), and in providing part-time employment (e.g. bog drainage, provision of accommodation for Irish language students, home knitting). As regards the latter, CDCs may be seen as adapting themselves to the established pattern of occupational pluralism in Gaeltacht areas, thereby contributing to cultural conservation, in contrast to the preoccupation of Gaeltarra/Údarás with the provision of full-time employment, which can occasion difficulties of cultural adaptation (Regan and Breathnach, 1981; Breathnach, 1985). One may also mention a number of other less direct and less quantifiable, but not necessarily insignificant, benefits accruing from CDC activities, including the boosting of community morale and confidence and the inculcation of technical and organisational skills within the Gaeltacht population (Breathnach, 1984a).

Operational problems experienced by Gaeltacht CDCs

The development impetus generated by the Gaeltacht CDCs in the 19705 has largely petered out during the current prolonged recession, dating from about 1980. No new CDCs have been established since 1977 (there is still some scope for additional CDCs), existing COCs have had to cut back on their activities, and, as seen already, two of the largest CDCs have gone out of business altogether. Their most recent returns to the Registrar of Friendly Societies showed nine of the sixteen CDCs reporting a net loss over the previous year's operations, while only seven of the fifteen which provided relevant information had accumulated reserves, the remainder having accumulated losses. Indeed, the financial

Table 1. Gaeltacht community development co-operatives: Shareholdings and employment

Name of CDC	*Year of Found-ation*	*Latest accounts*	*No. of share-holders*	*Paid-up share capital (£IR)*	*Share capital per member (£IR)*	*Full-time employees*
CHORCA DHUIBHNE	1966	1983	891	40,320	45.3	9
IORRAIS	1967	1981	846	13,346	15.8	19
CLEIRE	1970	1983	505	10,916	21.6	8
DHUICHE SHEOIGHEACH	1970	1980	511	9,083	17.8	7
ACLA	1970	1981	734	8,962	12.2	4
THORAI	1970	1983	56	1,400	25.0	-
ARANN	1971	1980	375	15,215	40.6	8
CAOMHAN	1971	1983	184	6,820	37.1	13
CHOIS FHARRAIGE	1971	1981	596	21,586	36.2	43
RATH CAIRN	1972	1983	837	15,000	17.9	7
NAOMH FHIONAIN	1973	1982	244	17,001	69.7	10
LEITH TRIUGH	1973	1983	156	857	5.5	2
LAR THIR CHONAILL	1974	1979	480	6,516	13.6	2
INIS MEAIN	1976	1983	123	5,426	44.1	20
NA NOILEAN	1976	1981	1,389	35,708	25.7	47
ARAINN MHOR	1977	1980	172	8,050	46.8	7
TOTAL			8,099	216,206		206
AVERAGE			506	13,513	26.7	13

(1) As supplied to Registrar of Friendly Societies.
(2) May not include employment in subsidiaries and associated companies.

position of many CDCs would be even worse were it not for considerable assistance from the Department of the Gaeltacht. While many of these recent difficulties are due to factors outside the control of the CDCs, there is no doubt that the situation has been greatly aggravated by a number of potentially avoidable inadequacies in their operational environment. Some of these will now be discussed, with a distinction being made between those problems considered to be internal to CDCs themselves, and those of an external nature although, as will be seen, there may be considerable interaction between the two.

Internal problems

The spontaneous development of Gaeltacht CDCs has meant a reliance on local activists with few of the formal skills required in administering business organisations; the peculiar nature of the CDCs meant that, in addition to the technical skills involved in running a "normal" business enterprise, further skills in the realm of communications and

interpersonal relations were needed given the fact that shareholders, employees, and clients were, for the most part, all embraced by the same close-knit community framework. Thus, organisations requiring a wider range of administrative skills than normal usually found themselves under the control of individuals with few formally-acquired skills at all. This applies not only to the elected management committees, but also to the appointed professional managers who, in the majority of cases, seem to have been selected either from among the initial groups of enthusiasts involved in the establishment of the CDCs, or from among outsiders whose primary motivation was a commitment to the Gaeltacht or the Irish language. In either case, a lack of formal management training appears to have applied, with the result that, whatever their broad principles may have been, they quickly became preoccupied with the detail of day-to-day management, with little time, or energy, left over for overall appraisal of how, or where, things were going. While one may suggest that the latter was a function which was primarily the responsibility of the management committees, it is noteworthy that the tendency was to appoint managers with strong personalities who may, whether wittingly or unwittingly, have been inclined to dominate their management committees who, in turn, may have tended to adopt a "let things alone" attitude, particularly when, at least during the 1970s, most of the CDCs were doing well commercially.

The main point here is not so much that the CDCs were incompetent in terms of day-to-day management – although this may have been the case occasionally – but rather that there were serious defects as regards overall long-term planning. This applies both to the setting, and monitoring, of broad objectives, and the formulation of specific plans in order to achieve these objectives. As regards the first of these, one may note two problem areas in particular: (1) firstly, within management committees, differing views concerning what the overall goals of the CDC are, or should be, giving rise to conflicts which frequently remain unresolved, and may not even be brought out into the open, due to the lack of interpersonal skills on the part of those involved; and (2) secondly, an absence of unity of vision as between manager and management committee, with the manager frequently taking the lead either because of his (all CDC managers are men) strong personality or because he, at least, has a clear view of where the CDC is going.

The absence of rigorous medium-term planning also appears to have been a deficiency which has come home to roost for many CDCs in recent years. The expansionary environment which prevailed for much of the 1970s encouraged them to over-extend themselves, where, with hindsight, a more prudent approach would have been more advisable. In this respect, it is noteworthy that it is mainly the most ambitious CDCs, with the widest range of activities, which have encountered the most severe difficulties in the current recession, leading, as noted already; to closure in two cases. It may be that these particular CDCs aimed to

become rival development agencies to Gaeltarra/Údarás in their respective areas: whether or which, their subsequent failure constitutes a considerable set-back to the CDC movement in general.

It would, however, be unfair to expect the CDCs to meet these deficiencies from within their own resources: they are, after all, small organisations with limited financial, technical and personal resources, which have emerged in localities which, because of a long history of underdevelopment, are themselves resource-deficient. In order to achieve their full potential, therefore, they need various types of assistance from external sources. In relation to the problems identified above, for instance, there is a need for various forms of education and training relevant to the very specific needs of CDCs. In this respect, one may draw attention to the programme for fostering CDCs operated by the Scottish Highlands and Islands Development Board (henceforth HIDB). This includes in the present context, training seminars for managers and management committees, availability of expert advice from HIDB personnel and consultants, assessment of medium-term development plans which must be produced by CDCs and sanctioned by the HIDB before HIDB financial aid is forthcoming, regular (in some cases, monthly) reporting of accounts, and the formulation of a training programme designed to provide a supply of people with skills geared to the specific management needs of CDCs (Breathnach et al., 1983). While further references will be made to the HIDB's CDC programme, it is worth noting at this stage that this programme was formulated after an examination of the Irish experience of CDCs, and was designed to overcome many of the problems, such as those identified above, which were seen to arise in the Irish case.

Apart from factors outside their control, and the possibility, in some cases, of managerial inadequacies, there is one aspect of the organisational structure of the CDCs which has contributed to their financial difficulties. This is that, in order to allow as many households as possible in each community to become shareholders, while maintaining the traditional feature of co-operatives that each shareholder has an equal share, the cost of shares has been kept at a low level which, in turn, means that CDCs have been faced, from day one, with a very narrow equity base. Table 1 shows that the average amount of share capital per shareholder is less than £27 which, given that the average CDC has just over 500 shareholders, means that the average level of total share capital is £13,500 – a rather modest base upon which to build. This means that CDCs have had to resort to a lot of loan capital in order to finance their activities, and while this was tolerable in the early 1970s when interest rates were low and economic expansion the norm, the combination of high interest rates and economic recession in more recent times has meant that, in many cases, these loans came to act as millstones around the necks of the CDCs.

Again, learning from the problems apparent in the Irish situation, the HIDB, in its CDC programme, introduced the concept of an establishment grant, whereby the HIDB provides an initial grant equivalent to the amount of share capital raised by a new CDC which, apart from encouraging CDCs to maximise the cost of their shares (which, on average, are about four times the level of the Irish CDCs – see Breathnach, 1984a) makes a substantial contribution to the avoidance of over-indebtedness in the crucial early years of operation. The Department of the Gaeltacht recently made available a similar scheme, on a once-off basis, to apply to additional share capital raised by Irish CDCs.

Perhaps an ironic aspect of the shareholding structure of CDCs is that, while designed to facilitate community involvement in their activities, the indications are that it is failing as regards this objective. The available evidence (Breathnach, 1984b) shows that most residents of the areas served by CDCs, although positively disposed to the efforts being made by them, take little interest or active involvement in CDC affairs, and that this applies almost equally to shareholders as to others. This cannot be regarded as surprising, because apart from their initial capital contribution, and attendance at general meetings, little opportunity for ongoing involvement is provided for ordinary shareholders.

It is on the basis of the latter observation that it was remarked earlier in this paper that the status of CDCs as true "co-operatives" is doubtful. Indeed, one of the central tenets of co-operative theory – i.e. that benefits should be distributed in accordance with the input of each member – clearly does not apply to CDCs. In the case of the Gaeltacht CDCs, these benefits can conceptually be divided into two categories: those that are distributed widely through the community (such as electricity supply" piped water supply, land reclamation and bog development, agricultural supplies, and provision of accommodation for students attending CDC-run Irish language colleges) and those that are more narrowly focussed (such as horticultural and fish-farming projects, handcrafts and printing). Not surprisingly, the evidence is that while the first category of benefits is widely appreciated within the "client" communities, the same does not apply in the second case and, indeed, complaints have been voiced by shareholders when other families, and not their own, have obtained employment from these more narrowly-based projects (Breathnach, 1984b, 1984d). Accordingly, in order to maintain at least the "community", if not the "co-operative" , nature of the CDCs, it may be suggested that they should confine their activities to those of the first category above (i.e. of broad community benefit), with the more narrowly-based projects of the second category possibly being set up as independent workers' or producers' co-operatives, financed and operated solely by those directly involved (with levels of share capital being set realistically in relation to anticipated returns) – although even

here the CDCs could have an important promotional and supporting role (Breathnach, 1983b).

Apart from restricting the range of their activities, one might suggest that some CDCs could restrict the geographical area which they are currently attempting to serve. This refers to those CDCs which possess a core area of intense community identification and a wider operational area (Breathnach, 1984b, 1984d). Exclusive concentration on the core area may help to maximise mutual identification between community and COC, with consequent benefits in terms of community support. Instead of serving neighbouring communities which do not themselves have a CDC, existing CDCs might be better off to encourage CDC formation therein, with the possibility of subsequent inter-CDC co-operation where considerations of scale economies warrant it.

External Problems

Perhaps the key area of dissatisfaction concerning their external relations voiced over the years by the Gaeltacht CDCs has been the nature of the support provided by state agencies, particularly the Department of the Gaeltacht and Gaeltarra Éireann/Údarás na Gaeltachta. There *has* been a considerable flow of financial aid from these agencies to the CDCs, running at about £500,000 (i.e. over £30,000 per CDC) per annum in recent years. However, most of this aid is of an *ad hoc* nature, and much of it is in reaction to crisis situations at individual CDC level. Unlike the HIDB, the Irish state agencies have no comprehensive programme for promoting and supporting CDCs as such which would, for example, relate the provision of aid to progress along agreed medium-term development plans. Apart from financial aid, CDCs have various other requirements regarding, for example, marketing, product development, and legal and accounting advice which they cannot provide themselves due to their limited resources. Again, in the Scottish case, the HIDB has been providing such support services to a considerable extent, whereas, for the most part, the corresponding Irish agencies have not. The situation for the Irish CDCs is rendered all the more difficult by the division of grant-aid functions between the Department of the Gaeltacht and Údarás, which makes the formulation of coherent policies regarding the CDCs all the more problematical.

Ultimately, the essential complaint of the CDCs is that there has not been recognition at official level that they have a special, and potentially central, role to play in achieving the essential goal of Gaeltacht preservation. The strong community bases and networks which they seek to foster provide, in their view, the best prospects for cultural vibrancy and continuity. Simultaneous development in the economic, social, and cultural spheres, which the CDCs also aspire to, is of particular significance in this context, and contrasts with the fragmented and partial approaches of the relevant state agencies. At the moment, many CDCs are attempting to act as both economic and socio-cultural development

agencies, and argue that Údarás na Gaeltachta, due to its traditional orientation towards dealing with specialist business personnel from externally-based firms, finds it hard to deal with such broad approaches to development. In addition, there is a feeling that Údarás personnel, being used to dealing with hard-nosed business people, are at best suspicious, and in some cases dismissive, of the "amateur" nature of those involved in running the CDCs. Once again, there is a strong contrast here with the HIDB, where key personnel are quite sympathetic to the special character of CDCs, and tolerant of the inevitable mistakes they make in striving to establish themselves as viable entities.

These problems are likely to continue as long as Údarás remains essentially a business-support agency rather than an agency for general socio-economic development of the Gaeltacht. The lack of comprehensiveness in Údarás's functions means that a wide variety of other state agencies – most of them centralised and operating along functional lines – also impinge upon Gaeltacht development, and consequently upon the CDCs: indeed, having to deal with what at times appears to be a bewildering array of such agencies itself can place a considerable strain on the already overworked managerial resources of the CDCs. It may be that the status of the CDCs in official eyes might be greatly enhanced if they became linked with a reformed local government structure wherein more power was placed in the hands of local communities. A model has been suggested elsewhere (Breathnach, 1983b; see also Commins, 1982) in which CDCs would be recast as the "development arms" of a comprehensive network of Gaeltacht community councils with real powers and funding to match. However, while there has been much talk over the years about local government reform along these lines, there has been absolutely no corresponding action, and this situation is likely to remain so as long as representative politics in Ireland remains focussed on the cultivation of local power bases rather than national issues.

A possible alternative approach to the provision of support services to CDCs would be for them to join together in a co-operative federation. There already exists an association of Gaeltacht CDCs (which is not comprehensive in its membership) but this has functioned mainly as a medium for the exchange of information and as a lobby for placing pressure on politicians and state agencies. Its development has been constrained by the lack of time available to CDC managers to devote to it, due to the myriad other pressures under which they work. The development of a federation with a central office providing specialist information, and exploiting economies of scale in areas such as bulk purchases and transport services, would need an initial input of support from outside. In Scotland, the HIDB is currently exploring the possibility of establishing such a federation covering, at least initially, the Outer Hebrides, with the aim of thereby transferring to the CDCs themselves many of the services currently being provided by the HIDB, partly in

order to encourage the CDCs to move out from under the protective wing of the HIDB (and partly as a cost-saving exercise at a time of cut-backs in budgets of state agencies). It is doubtful that, even if all the existing Gaeltacht CDCs in Ireland were to join together in federation, between them they would have the scale of operations to justify a sophisticated system of support services. This raises the possibility of co-operation with the growing number of similar organisations, with similar needs, in non-Gaeltacht areas. However, there would be even greater problems here of finding an appropriate agency to perform the necessary initiatory functions. Unfortunately, the Irish Co-operative Organisation Society, to which many CDCs are affiliated, remains an organisation dominated by large agribusiness co-operatives, with little time to devote to the peculiar needs of "small fry" such as the CDCs.

A final external problem experienced by many CDCs has been that, despite their heavy dependence on loan finance, they have had difficulty in some cases in raising this finance, mainly because of a suspicious attitude on the part of the commercial banking system to what are unusual business enterprises. Ireland is virtually unique in Europe in not having a co-operative banking system, attuned to the specific needs of co-operatives, and CDCs probably have suffered particularly from this deficiency. The Credit Union system may have the potential to fulfil this function, and there have been some interesting experiments in attempting to link this system to community development initiatives, but as yet this potential remains largely untapped.

Summary

This paper has been concerned with examining the operational experiences of community development co-operatives (CDCs) in the Irish Gaeltacht. Emerging initially at a time of growing agitation concerning the lack of development in the west of Ireland in general in the mid 19605, their subsequent growth and spread continued despite a major programme of western industrialisation sponsored by the state, until eventually sixteen in all had come into existence. In terms of their focus on the development of indigenous resources and service provision under community control, their simultaneous pursuit of social, cultural, and economic development, and their tendency to provide opportunities for multiple income sources, the Gaeltacht CDCs make a sharp contrast with the approach to development associated with the principal state agency involved in Gaeltacht development, Údarás na Gaeltachta, with its emphasis on an "urban" model of providing full-time employment in manufacturing industry, with a heavy reliance on externally-sourced resources of capital, enterprise, and materials.

Many Gaeltacht CDCs have been experiencing operational difficulties over the years, and particularly during the current recession. Some of these may be seen as internal, and some external, to the functioning of the CDCs themselves. Among the principal internal problems identified

were a lack of appropriate management and administrative skills among those involved in running the CDCs (this observation by no means applies to all CDCs or all those personnel involved); among the problems deriving from this area of weakness, particular attention was placed on deficiencies relating to the specification of clear objectives and the implementation of proper planning procedures. Other internal problems identified included undercapitalisation arising from the peculiar shareholding structure of CDCs; lack of real involvement on the part of the "community" with respect to what are supposed to be "community" co-operatives; unequal distribution of benefits within the community (at least with respect to some CDC activities); and over-extended areal coverage on the part of some CDCs.

As regards external problems, the main focus of attention was the lack of adequate support mechanisms from, in particular, state agencies. This was attributed largely to a lack of commitment on the part of the main agencies involved to the CDCs as having potentially a key role to play in pursuing the common goal of Gaeltacht preservation. The lack of comprehensive powers on the part of any single agency with respect to Gaeltacht development – defined in the broadest manner – leads to a lack of coherence in attitudes to *inter alia* CDCs, as well as producing a proliferation of agencies which places strains on the meagre administrative resources of the CDCs. The unusual nature of CDCs also generates credibility problems, not only with respect to state agencies, but also with respect to financial institutions, which has proved to be particularly problematical given the dependence of the CDCs in the past on loan finance.

A number of possible solutions to many of these problems were put forward. However, perhaps the single most important need is for a single state agency with a range of powers and functions to match the range of aspirations of the CDCs themselves. Only then is one likely to get an institutional perspective capable of comprehending the diverse nature of the CDCs, and in a position to provide a cutting edge to the CDCs in the pursuit of their objectives. Indeed, one could then envisage the CDC as acting, in many ways, as the local agents of this real Gaeltacht Authority a function which would be greatly enhanced in the event of an effective devolution of significant local government powers to the level of the local community.

At the same time, one is wary of community development groups – of whatever make-up – becoming too dependent on state support. Hence the need for closer co-operation between CDCs themselves, both to form an effective political lobby (so crucial to the way public resources are allocated in our particular type of "democracy") and to provide central support services. The possibility of joint action between Gaeltacht and non-Gaeltacht CDCs was also raised in this context.

Some reorganisation of the internal functioning of CDCs was also proposed. In particular, a distinction was made between activities of broad community benefit, which should be maintained as appropriate activities of "community" co-operatives, and activities whose benefits are more narrowly distributed. As regards the latter, whereas CDCs could continue to promote and foster such activities, it was suggested that they be constituted as producers'/workers' co-operatives, in which case there would be a more direct link between contributions and benefits. Finally, it was suggested that CDCs might restrict their activities to their "home" areas, in order to foster a closer identification between co-operative and community.

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CHAPTER 8

THE EVOLUTION OF ESTATE PROPERTIES IN SOUTH ULSTER 1600-1900

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First published in Smyth, W.J., Whelan, K., Hughes, T.J. (1988) *Common ground: essays on the historical geography of Ireland presented to T. Jones Hughes*. Cork: University College Cork, pp. 84-109.

Introduction

The estate system of the eighteenth and nineteenth centuries, by which the country was divided up among a relatively small number of landowners, has been of special interest to historical geographers. In spite of what Jones Hughes calls these 'elusive territorial entities',[1] there has traditionally been a fairly stereotyped view of the system in which most aspects of life and landscape were seen to be controlled by the dominant landowning class living in the Big House and owning extensive tracts of land. Latterly, historians and historical geographers have demonstrated by means of numerous case studies of management strategies on individual estates that the estate system was extremely complex in its operation, that its territorial and tenurial framework was extremely varied and that the agents of social and economic change were quite diffuse.[2] The variety in the territorial impact of estates is missed because the great majority of properties cannot possibly be studied in any detail. The absence of estate records for many, especially smaller, estates and the sheer impossibility of studying all of them, should not blind us to the opportunities offered by some of the major land surveys of the past three hundred years. These contain a limited but regionally comprehensive range of data which has been most successfully mined by historical geographers. Jones Hughes has made considerable use of the Griffith Valuation as a source for studying post-Famine landholding conditions. In general, however, relatively little attention has been paid to the usefulness of the Griffiths Valuation in a study of the territorial extent of the estate system in the mid nineteenth century. The other major sources which have been highly regarded by geographers are the great surveys of the seventeenth century which accompanied the

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[1] T. Jones Hughes, 'Landholding and settlement in the counties of Meath and Cavan in the nineteenth century' in P. O'Flanagan, P. Ferguson and K. Whelan (ed.), Rural Ireland 1600-1900: modernisation and change (Cork, 1987), pp 104-41.

[2] A.A. Horner, 'The scope and limitations of the landlord contribution to changing the Irish landscape 1700-1850' in V. Hansen (ed.), Collected papers presented at the Permanent European Conference for the study of the rural landscape (Copenhagen, 1981), pp 71-8; W.J. Smyth, 'Estate records and the making of the Irish landscape: an example from Co. Tipperary' in Ir. Geogr., 9 (1976), pp 29-49; W.A. Maguire, The Downshire estates in Ireland 1801-1845 (Oxford, 1972).

plantations. These offer an opportunity to examine the emergence of the estate system from a poorly-understood medieval property framework.[3]

The purpose of the following study is to use some of these sources to examine firstly, the variety, extent and territorial structure of landed estates in the mid nineteenth century in the south Ulster counties of Cavan and Monaghan and secondly, to outline the origins and territorial evolution of these structures from the seventeenth century. South Ulster has little to tell us about the medieval precedents of estate holdings such as those in Leinster or other Anglo-Norman colonised regions, but Cavan and Monaghan both offer the opportunity to study the transitions in landownership and the emergence of new structures in one of the last Gaelic regions in Ireland. Monaghan particularly has the advantage of exhibiting a variety of economic and colonisation experiences which were independent of any plantation scheme, experiences which characterised the greater part of Ireland in the seventeenth century.

Nineteenth Century estates in Cavan and Monaghan

Estates exceeding 2000 acres have been mapped from the Griffith Valuation (Figs. 1 and 2). Two-thousand acres was chosen as the break-off point in order to isolate the pattern of larger estates in the region and, by excluding the smaller estates, to go some way towards eliminating the effect of principal tenants or middle men on the valuation lists. As Jones Hughes points out, this region represented the westernmost extent of Ireland's most complicated network of great landed properties.[4] In Monaghan and Cavan, the ten most valuable estates in each county averaged £12,000 and £8,000 respectively. Although there was nothing in south Ulster to compare with the Downshire or Duke of Leinster estates or the extensive properties of the Earl of Bantry or the Earl of Lucan - all of which exceeded 70,000 acres - the estates of south Ulster in general were larger than the average estates in counties Louth, Meath or Tipperary, for example. The Farnham (29,500 acres), Shirley (26,300 acres), Annesley (24,000 acres) and Bath (23,000 acres) estates were important properties by Irish standards in the mid nineteenth century.

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[3] J.H. Andrews, Plantation acres - an historical study of the Irish land surveyor and his maps (Belfast, 1985); W. Nolan, Tracing the past; sources for local studies in the Republic of Ireland (Dublin, 1982); the following is a list of sources of published and unpublished maps of landownership, based, for the most part, on the mid-nineteenth century data in the Griffith Valuation: J. Burtchaell, 'Nineteenth century society in county Waterford', Decies, 30 (1985) pp 25-34; D. Gahan: 'The estate system of Co. Wexford 1641- 1876' in K. Whelan (ed.), Wexford: history and society, (Dublin, 1987), pp 201-2; W. J. Smyth, 'Land values, landownership and population patterns in Co. Tipperary for 1641-60 and 1841-50: some comparisons' in L.M. Cullen and F. Furet (ed.), Ireland and France 17th-20th centuries (Paris, 1980); P.J. Duffy, Population and landholding in County Monaghan: a study in change and continuity, unpublished Ph.D. thesis, N.U.I.; P. J. Carty, The 'historical geography of County Roscommon, unpublished Masters thesis, U.C.D., 1970; W. Nolan, Fassadinin: land settlement and society in south-east Ireland 1600-1850 (Dublin, 1979); J. Edwards, A rural geography of County Louth, unpublished Masters thesis, U.C.D., 1965.

[4] Jones Hughes, op. cit.

Most of the principal estates in Monaghan were located in the lowland, most favoured regions of the county. The Leslie, Anketell, Rossmore, Lennard and part of the Lucas estates were located on the limestone lowland extending south-westward from north Armagh. The Madden, Ker, Dawson, Verner, Leslie, Hope, and Tempktown estates were located in the drumlin lowland extending across the middle of the county. Although the Bath and Shirley estates encompassed most of the extensive barony of Farney, their cores were located in the southern well-drained lowland of the county abutting on counties Meath and Louth. In general in Co. Monaghan, all those estates over 2000 acres were located below the 300 foot contour on the better drained and highest-valued land. This cursory description does not take account of the many fragments of large estates which lay in hilly, poorer regions. The major territorial components of the estates, however, were most favourably located with the outlying fragments probably reflecting a process of secondary land acquisition by the landowning family (Fig. 1).

The pattern of estates in Cavan (Fig. 2) did not have such a clear cut relationship with topographical conditions. Although the Farnham, Lanesboro and Saunderson estates were mainly concentrated in the richer lowlands of the barony of Loughtee, the most significant groups of large estates were found in the hilly country of the east of Cavan and in the mountainy terrain of Tullyhaw in the north-west. The lower land of the mid county was dominated by smaller and extremely fragmented estates. This pattern presumably reflects the peculiar origins of most of the Cavan properties.

In addition to mapping estate boundaries, Figures 1 and 2 also show the location of houses and demesnes as recorded in the first edition of the six inch Ordnance Survey maps and the distribution of properties whose owners resided outside either county. Absentee ownership of properties of 500-2000 acres are also included in the maps. Figures 1 and 2 therefore, attempt to show the territorial pattern of larger estates, their degree of fragmentation, the landscape impact of the estate system as reflected in desmesnes and houses and the territorial. pattern of absenteeism among landowners. Absenteeism has been seen to be important by historians in studying the management of estates in the eighteenth and nineteenth centuries.[5] Figures 1 and 2, however, only partially reflect the problem of absenteeism in that they do not take account of the persistence of absenteeism over the preceding century. Although in some cases absentee landowners lived quite close to their Cavan properties, as with the Headford estate with its headquarters near Kells, Co. Meath or the Dease estate based in Westmeath, in general the maps probably understate the extent of absenteeism in that having .a Cavan or Monaghan address was no guarantee of residency. The earl of

[5] A.P.W. Malcomson, 'Absenteeism in eighteenth century Ireland' in Ir. Econ. Soc. Hist., 1 (1974), pp 15-34.

Dartrey, for example, with a mansion near Rockcorry in Co. Monaghan lived much of the time in London. Shirley with a house outside Carrickmacross, also had estates in Warwickshire and only built his Monaghan house in the early nineteenth century. Nesbitt had a house in both Cavan and London.

Figure 1. Monaghan estates in mid-nineteenth century

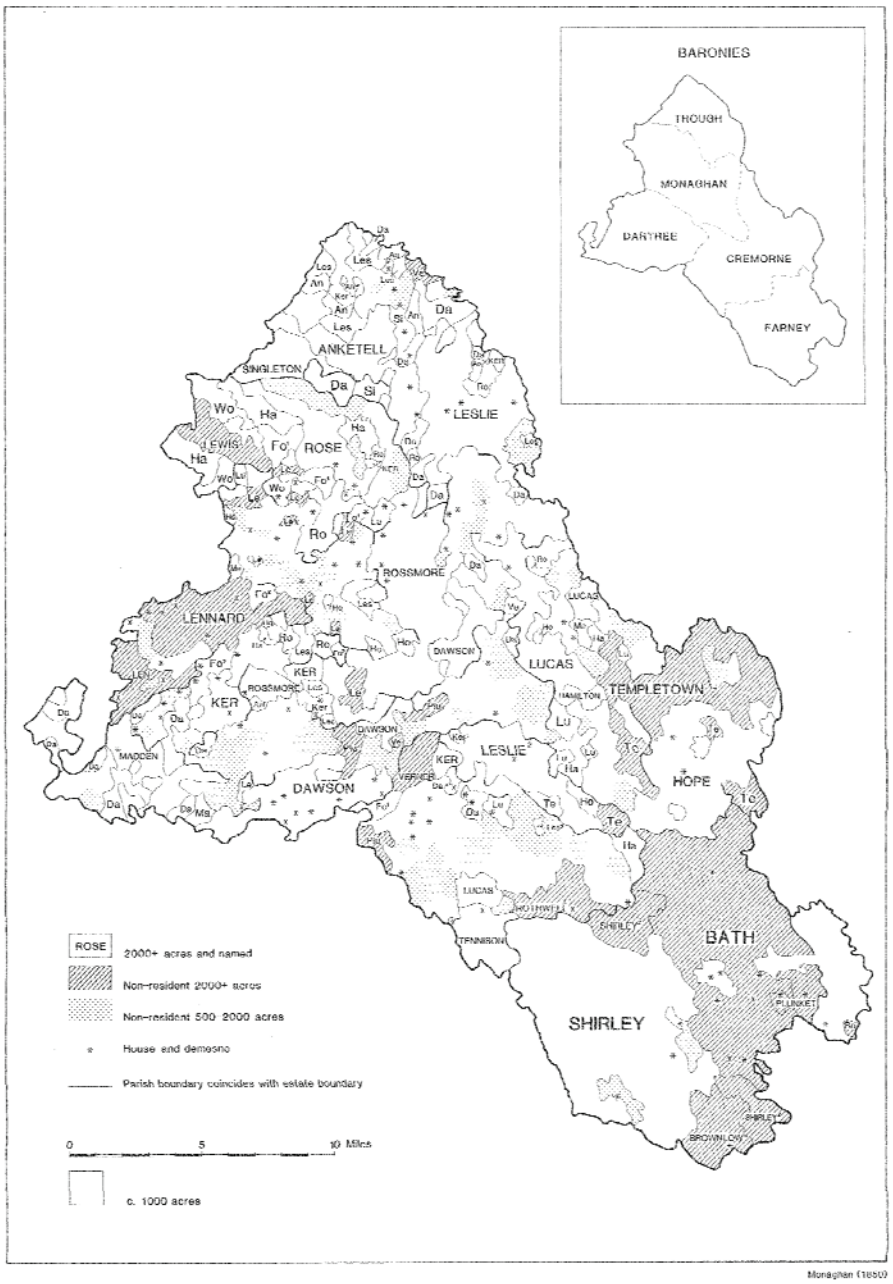
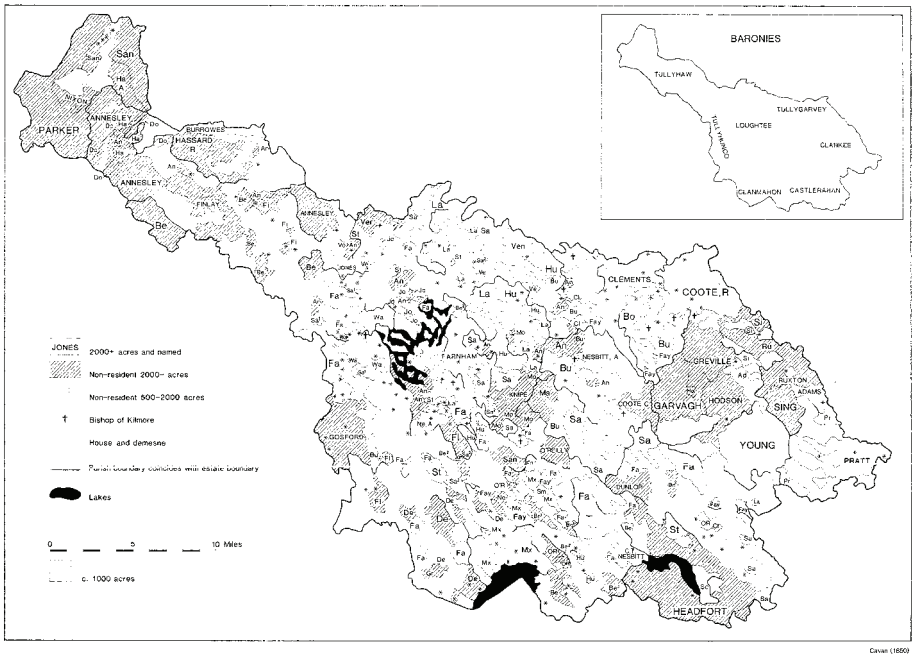


Figure 2.



Index to Figures 1 and 2:

Except where indicated in brackets below, the first *two* letters of the landowner's name are printed on the map where the property is too small to include the whole name.

CAVAN:

Adams, Benjamin
Annesley, Earl of
Beresford, Lord (Be)
Beresford, John (Be 1)
Beresford, J.D. (Be 2)
Boyle, Maxwell
Burrowes
Clements, Theophilus
Coote, Richard
Coote, Charles
Dease, Gerald
Dobbs, Leonard
Dunlop, Mrs
Farnham, Lord
Fay, James
Finlay
Fleming, Major General
Garvagh, Lady
Gosford, Earl of
Greville, Col.
Hassard, Alexander
Hassard, Richard
Headfort, Marquis of
Hodson, Sir George
Humphreys, William
Jones, John C
Knipe, John
Lanesboro, Earl of
Marley, Louisa
Maxwell, Somerset
Moore, Samuel
Nesbitt, C T
Nesbitt, A
Nixon
Parker
Pratt, Col.
O'Reilly, Anthony
Ruxton, William
Saunders, Richard (San)
Saunderson, Col. Alex (Sa)
Saunderson, Mrs Mary (Sa 2)
Scott
Smith, William
Singleton, Henry
Storey, Jane
Venables, Rev E B
Verner, John
Young, Sir John (Lord Lisgar)
Wallace

MONAGHAN:

Anketell, William
Bath, Marquis of
Brownlow, William
Dawson (Lord Cremourne)
Forster, Sir George (Fo 1)
Forster, William (Fo 2)
Hope, Ann Adile
Hamilton, James
Ker, Andrew
Lennard, Sir T.B.
Leslie, Sir John
Leslie, Emily (Les 2)
Lewis, Henry
Lucas, Edward
Madden, John
Plunket, Rt Hon
Rose, Gertrude
Rossmore, Lord
Rothwell
Shirley, Evelyn P
Shirley, Horatio (Shirley 2)
Singleton, Thos Crawford
Templetown, Viscount
Tennison, William
Verner, Sir William
Woodwright, William

Table 1. Resident / non-resident properties (1876)

Estate Size	Cavan	Monaghan
2,000 + acres		
Resident	20	18
Non resident	22	8
500-2,000 acres		
Resident	34	21
Non resident	84	40
100-500 acres		
Resident	94	66
Non resident	153	88

Source: Return of owners of land 1876

As in Ireland as a whole, the rate of absenteeism was higher among the smaller estates, reflecting the fact that small properties often represented the scattered fragments of a bigger estate. Almost half the properties of 500-2000 acres in Cavan were held by owners living outside the counties neighbouring on Cavan, or outside Ireland. Thirty of them lived in Dublin and twenty-four outside the country. Strictly speaking, residency within Cavan or Monaghan (the criterion used in Table 1) may not have been a valid reflection of active interest in his property by the owner. Given the highly fragmented nature of properties, especially in Co. Cavan, many tenants must have found themselves far removed from their landlord. The Earl of Dartrey, for example, had land all over Co. Monaghan; some of the lands in north Monaghan were more than twenty miles from the home estate. The estates of Farnham and Saunderson showed even more extensive dispersal within Cavan. However, the Annesley and Garvagh estates were much worse off, with their owners resident in Counties Down and Londonderry respectively.

The maps for Cavan and Monaghan illustrate the reality of landownership in an extensive part of Ireland at the mid nineteenth century. The pattern is quite different from the stereotyped image of an extensive, consolidated and well-ordered estate landscape. Significant numbers of estates were fragmented, nonresident bits and pieces. Undoubtedly, the combination of fragmented properties and high rates of absenteeism resulted in wide variations in leasing arrangements, rental valuations and general management of estates, all of which had important landscape repercussions which would have contrasted with a greater territorial, tenurial and managerial uniformity on the bigger, consolidated properties.

Cavan in particular exhibited extensive fragmentation, with large areas also characterised by high rates of absenteeism. The Annesley, Beresford, Farnham, Saunderson and Burrowes properties especially were scattered

through much of the county. The Saunderson estate of 12,000 acres was divided into a dozen fragments. In addition, extensive areas of the county had no resident owner within the county. The barony of Tullyhaw, characterised by poor mountainy land was largely comprised of large absentee properties. Monaghan exhibited less fragmentation and less extensive absenteeism, which combined with the comparatively smaller size of the county would suggest closer links between tenants and landowners.

In south Ulster, the settlement contribution of the bigger, residential estates was significant and when one considers that the major landscape repercussion of rental incomes was expressed in the form of houses and demesnes, then the regional implications of even occasional residency were significant. The plantation villages of Bailieboro, Cootehill, Virginia and Butlersbridge reflect in their very names the role of powerful colonial land ownership structures. In Monaghan the same pattern was repeated in the creation of Rockcorry, Newbliss, Glasslough, Scotstown and Smithboro. More extensively, housebuilding and the creation of gardens and demesnes in the eighteenth century has been seen as a hallmark of a vibrant local landowning class.[6] The distribution of demesnes in Cavan and Monaghan reflects the differential impact of estates in that the bigger properties with residential owners were more actively involved in a variety of aspects of colonisation and settlement of their properties. Thus in Cavan, houses and demesnes were notably absent in the eastern and southern parts of the county with the exception of two concentrations in the extreme south around the Headford estate which had a history of large-scale landlord improvements. Areas of absentee properties or areas of small, and thus more often absentee estates, had little evidence of demesnes. The particularly high rate of fragmentation of estates in Cavan accounts for the dearth of demesnes. The Farnham estate had some notable demesnes at the estate core around Cavan town but all its other fragments in the south county area have few if any demesnes. The same was true of the Saunderson, Burrowes, Humphries and Storey estates. The Annesley estate and other large non-residential properties in the east and north-west of the county were notable for the paucity of demesnes. In Monaghan, the link between larger estates and more favourable land is clearly expressed in the pattern of demesnes. Non-residential estates, especially those below 2,000 acres, are widely dispersed through the centre of the county and contain very few demesnes. Though the Bath estate was a most extensive absentee property in south Ulster, its southern portions contained a number of demesnes representing the large farms of favoured tenants of this important English landowner.

It is no coincidence that other aspects of social and economic life were influenced by estate size and often the presence or absence of the estate

[6] T. Jones Hughes, 'Village and town in mid-nineteenth century Ireland' in Ir. Geogr., 14 (1981), pp 99- 106.

owners. Smaller fragmented or absentee properties, for example, were often characterised by disorderly farmholdings and higher population densities resulting from an influx of land hungry families in the pre-Famine period. In general, management policies tended to be better on larger estates where professional agents might be employed. The smaller properties had higher rates of absenteeism and greater turnover in ownership; tenant witnesses to the Devon Commission agreed that landholding on bigger properties was better than on small estates.[7] One would tend to find therefore that the big estate regions, especially where the owners had been resident, had above average farm sizes, significant numbers of Protestant farmers and a sprinkling of demesnes with possibly an estate village contiguous to the landlord's mansion.

It is impossible to adequately assess the geography of mid-nineteenth century estates without reference to the origin of the structures which had such an influence, negatively as well as positively, on life and landscape in south Ulster. The patterns depicted in Figures 1 and 2, therefore, are best explained in terms of confiscation, settlement and sales of land in the preceding three centuries.

Emergence of estates 1600- 1641

Undoubtedly a major portion of the landowning class of the nineteenth century traced its origins to the seventeenth century land confiscations and this was especially true of areas beyond the influence of the medieval English colony. In spite of this social upheaval in landownership, is there any evidence of continuity in territorial landholding structures between the seventeenth and mid nineteenth centuries in these regions? Historical geographers have emphasised that the Irish landscape is fissured by a network of ancient territorial boundaries, especially baronies, parishes and townlands. These structures have been responsible for facilitating far-reaching continuities between land properties in Gaelic and modern Ireland.[8] In the following examination of the evolution of territorial estates in the early seventeenth century, the main sources used are the surveys conducted by the English administration while it was pursuing its various policies in Ireland. In the absence of the Civil Survey for Cavan and Monaghan, the more summary data in the Book of Survey and Distribution (B.S.D.) have been used as well as earlier plantation surveys.[9]

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[7] P.J. Duffy, 'Irish population and landholding structures in the mid-nineteenth century' in Maynooth Rev., 3 (1977), pp 3-27; P. Connell, Changing forces shaping a nineteenth century Irish town (Maynooth, 1978).

[8] P. Robinson, The Plantation of Ulster (Dublin, 1984); P.J. Duffy, 'The territorial organisation of Gaelic landownership and its transformation in Co. Monaghan 159 1- 1641' in Ir. Geogr., 14 (198 l), pp 1-26; ibid., 'Patterns of landownership in Gaelic Monaghan in the late sixteenth century' in Clogher Rec., 10 (1981), pp 304-22.

[9] See Duffy, 'Territorial organisation'; for Monaghan material see Fiants Ire., Eliz. I, pp 184-94; Inq. cancell. Hib. reper, ii (Ulster); Cal. S. P. Ire, 1606-9, pp 161-86; R. Hunter, The Plantation of Ulster in counties Armagh and Cavan, unpublished M. Litt. thesis, T.C.D., 1969; Figure 5.4 is based on Hunter's detailed map of the Cavan Plantation and Figure 5.6 is

The key to reconstructing the pattern of lands in the seventeenth century is contained in the persistence of the small territorial unit known today as the townland. Figures 3 and 4 are based on the assumption that the place names from the seventeenth century surveys can be matched fairly reliably with the townlands of the nineteenth century Ordnance Survey. While there may be difficulties with individual matching, the exercise is justified by Andrews's observation that the Ireland of the early seventeenth century possessed a network of small land divisions which were 'too firmly grounded in popular consciousness to be ignored'.[10] The townland unit and occasionally other earlier land holding units such as ballybetaghs formed the bases of all grants and purchases of land. Although the actual boundaries may not have been precisely defined, in general the territorial units have endured and Raven's maps of the tates of Farney in 1634 compare remarkably favourably with the Ordnance Survey in shape and extent.[11]

It is necessary to separate the discussion of Monaghan and Cavan because as a result of rapidly changing English strategies in Ulster in the first few years of the seventeenth century both counties came to epitomise different policy formulations. Throughout the sixteenth century the Cavan and Monaghan areas - the Gaelic lordships of Breifne and Airghialla - pursued a similar borderland strategy between O'Neill of Ulster on the one hand and the Pale on the other. In 1591, the government had succeeded in abolishing the McMahonship and had established some legal semblance of freeholding ownership under English law. Following the Nine Years War, this division of the county was confirmed in 1606 and the Commissioners planned to carry out a similar division of Cavan and Fermanagh. The sudden departure of the Ulster lords in 1607 however, resulted in a change of policy, culminating in the radically different plantation scheme implemented in Cavan and the bulk of Ulster.

Monaghan 1606

The pattern of landownership in the 1606 division of Co. Monaghan is summarised in Figure 3. Approximately 60 per cent of the county was divided among a dozen major Gaelic families, former lords of the territory of Airghialla and more than three hundred of their former followers, who now had the status of freeholders. The remainder of the county was allocated among a handful of planters. In the main, Gaelic land ownership structures were comparatively unchanged under the 1606 agreement. The ballybetagh formed the basis of the land division and all the chief families held from one to five ballybetaghs, representing a

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partly based on Hunter's map of the Cavan Plantation in 1641 and the Annesley copy of the Book of Survey and Distribution, N.L.I.

[10] Andrews, op. cit., p. 32.

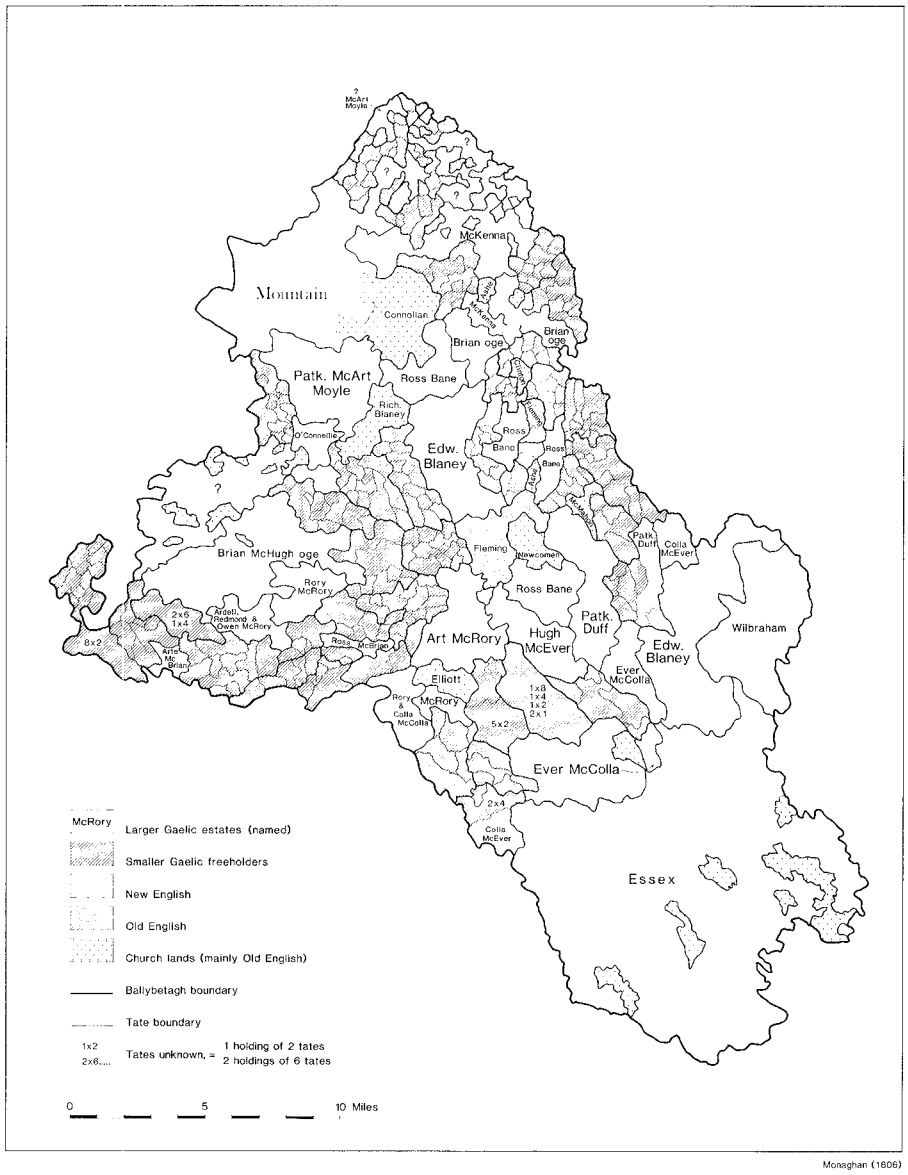
[11] P.J. Duffy, 'Farney in 1634; an examination of Thomas Raven's survey of the Essex estate' in Clogher Rec., ll (1983), pp 245-56.

residual reflection of sixteenth century Gaelic structures. As a general rule, most of the better land was held by the chief families. The purpose of the Monaghan agreement, and similar policies elsewhere in Ireland, was to reduce the economic and political power of the chief families by roughly equalising their estates and by detaching them from their subservient families. The *lucht tighe* group in Monaghan barony, who had held the McMahonship throughout much of the sixteenth century, had their lands divided among the main branches of the family represented by Patrick McArt Maol and Ross Bán McMahon. The abolition of the McMahonship allowed the entry of the first substantial planter in the person of Edward Blaney, seneschal of Monaghan, into the former mensal lands of the McMahons. Apart from McKenna in the north of the county, the remaining chief families were McMahons. Brian McHugh Óg held four ballybetaghs in Dartrey, in addition to smaller estates held by McRorys; Ever McColla McMahon was confirmed in three ballybetaghs in Cremourne, soon to be expanded to five when Art McRory was attainted for treason.

The freeholder properties consisted of some thirty ballybetaghs running through the south of Dartrey into Cremourne and Monaghan baronies, representing the less desirable hillier lands of the region. The ballybetaghs were divided in fractions among 317 individuals, 124 of whom were reidily identifiable as McMahons. South Cremourne was allocated to O'Cleareanes and O'Duffies as well as McMahons. Dartrey had McMelaghlins, McDonnells and McRorys as well as the ubiquitous McMahons. The sub-ballybetagh properties varied from one-tate units to half ballybetaghs (8 tates) as outlined in Figure 3.

The pattern of Gaelic landownership was accompanied by the initial stages of colonial penetration of the area, reflecting a wider process of colonial land acquisition throughout the Gaelic regions of Ireland. Some of these properties were small and had originated in the later sixteenth century. For example, the church and termon lands had been given mainly to palesmen in 1591. Christopher Fleming, a merchant from the Pale, had acquired two ballybetaghs in Monaghan in the late sixteenth century. In the 1606 division, soldiers of the Monaghan garrison were allotted the tates of Irishmen who had been killed in the Nine Years War. Blaney was given two ballybetaghs in Cremourne in addition to the mensal lands of Monaghan. In 161 1, he also acquired Wilbraham's grant of the termon lands of Muckno adjoining his Cremourne lands. Finally, by a grant of 1575, the Earl of Essex had held almost all of the barony of Farney, though he had never attempted to plant or settle it.

Figure 3. Ownership of land in Monaghan 1606



The 1606 division ensured that a substantial portion of the McMahon territory remained in the hands of Gaelic families, though they were considerably restricted in their economic status by having their estates reduced in size and by losing their freeholders. This experience was shared by other Gaelic regions such as Connaught and north Wexford[12]

[12] M. O'Dowd, 'Gaelic economy and society' and R. Gillespie, 'The end of an era: Ulster and the outbreak of the 1641 Rising' in C. Brady and R. Gillespie (ed.), Natives and newcomers: essays on the making of Irish colonial society 1534-1641 (Dublin, 1986); H.A. Goff, The changing pattems of landownership in the barony of Scarawalsh, Co. Wexford 1540-1640, unpublished Masters thesis, Maynooth, 1980; ibid., 'English conquest of an Irish barony: the

which through the 1620s and 30s became the object of growing attention from Old English and New English speculators. The Monaghan area, though it escaped the Ulster Plantation soon found itself surrounded by extensive and active plantation settlements and inevitably came under pressure from enterprising newcomers.

The Cavan Plantation

The shape of the plantation grants in Cavan was controlled by the existence of earlier property allocations which could not be overridden by the plantation programme. Church lands had been either reserved for the bishop of the diocese or, in the case of termon and monastic lands, had been granted to palesmen or New English representatives. To a greater extent than in Monaghan, there was a high level of land purchase in Cavan by the Old English.[13] Gaelic Breifne had maintained fairly strong economic links with the Pale so that by the early seventeenth century, Nugents, Plunketts, Flemings, Talbots and Tyrrells from Westmeath and Meath held estates in Cavan (Fig. 5.4). Some of these, such as Fleming, were allowed to retain their estates in the Ulster Plantation. Others were granted servitors' proportions in lieu of their earlier acquisitions.

The outline proposals for the Ulster Plantation envisaged the establishment of Scottish and English undertakers to plant their lands with settlers, while British servitors (mainly English officers) and native freeholders were to develop and secure their land allocations independently. Undertakers, servitors and native Irish would receive grants of 2,000, 1,500 and 1,000 acres in specifically allocated precincts. Only servitors and Gaelic grantees were allowed in the same precinct. This basic outline shaped the ultimate territorial pattern in Figure 5.4. As Robinson points out, the paper proposals had to compromise not only with pre-existing English properties, but also with the geographical reality of well established territorial divisions[14] Thus the pre-plantation territorial system largely shaped the plantation allocations and Bodley's 1609 survey with its detailed outlines of contiguous polls helped this transition.[15] 'Precincts' were based on the Gaelic 'territories' (later baronies) of Cavan and the ballybetaghs and polls of Breifne were adopted by the plantation commissioners. The result was that, in spite of the apparently radical upheaval in landownership in Cavan, the ultimate territorial pattern of estates was not radically different from the ballybetaghltate structure of Monaghan which did not experience such a proprietorial upheaval.

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changing patterns of land ownership in the barony of Scarawalsh 1540-1640' in Whelan (ed.), Wexford pp 122-149.

[13] R. Hunter, 'The English undertakers in the Plantation of Ulster 1610-41' in Breifne, 4 (1973), pp 47 1-99.

[14] Robinson, op. cit., p. 89

[15] J.H. Andrews, 'The maps of the escheated counties of Ulster 1609-10' in R.I.A. Proc., 74C (1974), p. 164

Figure 4. The Ulster Plantation in Cavan 1610-20

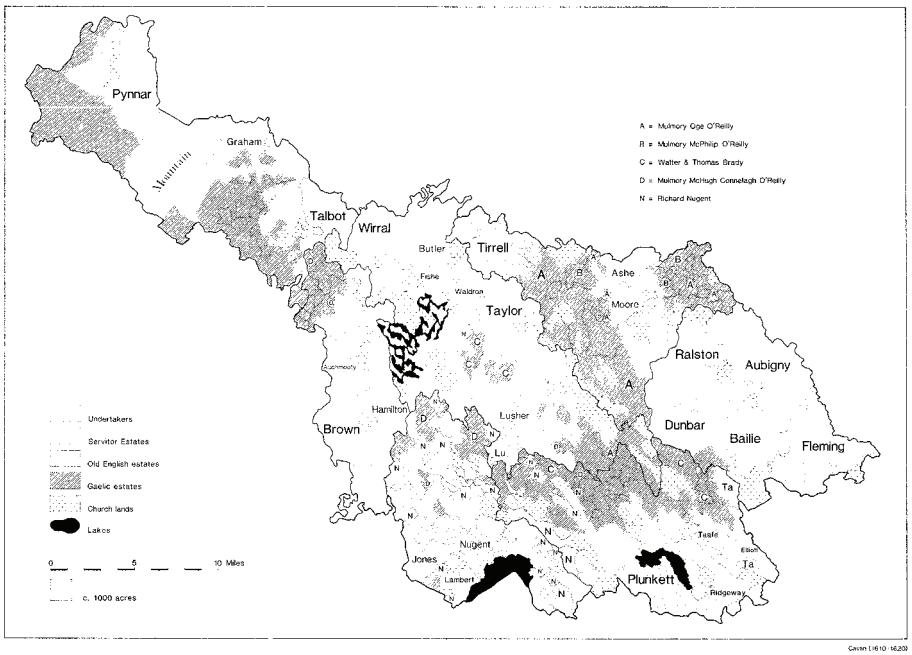

Figure 4 shows the pattern of estates which resulted in the establishment of substantial English and Scottish undertakers in the baronies of Loughtee, Tullyhunco and Clankee respectively. The greatest effort was made to carve out compact estates for the undertakers, because of their importance to the overall scheme. Such a prerequisite was not so necessary with the servitors, and was even less so with the Gaelic grantees, and this policy is reflected in the map of their properties. In Loughtee, for example, there were seven English undertakers holding most of the barony, together with six small older Gaelic and Old English estates.[16] The baronies of Tullyhunco and Clankee at either extremity of the county, were allocated to eight substantial Scottish undertakers, together with Fleming's large estate in the south-east of Clankee and some small Gaelic properties in the north of Tullyhunco. It is not possible to check the truth of Robinson's suggestion that the principal undertakers occupied the demesne ballybetaghs of the chief Gaelic lords, because the proposals for the earlier division of Cavan among its native population have not survived.[17]

There is a similarity between Monaghan and Cavan in the juxtaposition of large estates with extensive areas of smaller, fragmented estates. These are attributable to the mixture of smaller servitor estates with a varied and fragmented series of Old English properties scattered through the south of the county. There was also a belt of generally small, fragmented Gaelic estates which abutted closer to the undertaker estates than was

[16] Hunter, 'English undertakers' p. 472.
[17] Cal. S.P. Ire., 1606-8, p. 164.

envisaged in the outline plans. In Cavan, many of the servitors were palesmen already holding land in Cavan as well as in Meath, Westmeath and Monaghan, who were involved in the English administration - people such as Sir Thomas Ashe, Sir Oliver Lambert, Sir John Elliot and Sir James Dillon. This involvement of Old English Pale interests in Cavan had important implications for the disposal of land in the later seventeenth century. Under the plantation scheme the most loyal Gaelic freeholding families were selected as well as reliable members of the chief families. The latter were given servitors' proportions and the former one or two polls each. As in other planted regions, the majority of smaller Gaelic landowning families were deliberately reduced to tenant level,[18] a fate that contrasted with the smallholders' experience in the unplanted Monaghan area. Fifty-eight native grantees were allocated 22 per cent of the land of . Cavan which was a considerable contrast with conditions in Monaghan. Most of these were in small estates, though there were a number of substantial Gaelic properties also. Mulmory Óg O'Reilly for example, obtained a large estate of 3000 acres in Tullygarvey. In a few cases they were given the lands which they had occupied in pre-plantation times, but in general the Gaelic grantees' estates were disjointed, kin groups were separated[19] and it is clear that their land allotments were low in the scale of priorities of the plantation planners. The fragmented nature of Mulmory McHugh's lands in Tullyhunco and Clankee, and Mulmory Óg's estate in Tullygarvey demonstrates this.

Changing landownership structures up to 1641

The first half of the seventeenth century witnessed a relatively sudden change in the nature of landownership and in attitudes to the management and disposal of land in regions of former Gaelic hegemony. Although the Gaelic system was enormously varied and complex in its regional manifestations, the imposition of much more individualised and commercial concepts of landownership represented a great change. Plantation regions especially experienced a sudden jolt, not only in the confiscation of large swathes of land, but in the intrusion of a new and energetic ethnic group in the midst of the native population. The lands which continued in Gaelic occupation in both Monaghan and Cavan were subjected to unprecedented pressures which affected their survival as land entities and which emanated from the presence of English adventurers in the new economic conditions that developed with the elimination of the endemic raiding and warring which characterised the sixteenth century. The principal actors in all this were the New English who could generally be characterised as Protestant, opportunistic, office-laden and often corrupt in their endeavours to advance their careers, the Old English who were Catholic, loyalist and opportunistic and the Gaelic Irish who were Catholic and defensive in outlook. Although some of the latter saw opportunities in the new situation, the majority were

[18] R. Gillespie, Colonial Ulster: the Settlement of East Ulster 1600-1641 (Cork, 1985), p. 119
19. Hunter, Armagh and Cavan, p. 239.
[19] Hunter, Armagh and Cavan, p. 239.

increasingly baffled by the developing trends in the 1620s. Gillespie introduces a fourth group: English merchants with venture capital who came to Ireland during the Wentworth administration.[20] Of these groups, the Gaelic Irish lost out persistently and this is well reflected in the experience of many Monaghan properties which had the initial advantage of fairly large compact home estates.

The changed social and economic environment of the 1620s opened up possibilities of property accumulation for some Gaelic families.[21] The bigger landowners especially benefited at the expense of the smaller freeholders in Sligo, Wexford and Galway. In Monaghan, Col1 McBryan McMahon, grandson of Ever McColla, amassed extensive estates in Cremourne at the expense of the smaller freeholders (Fig. 5). In Cavan, Philip McMulmory O'Reilly had bought extensive lands by 1641 and Philip McHugh O'Reilly had accumulated a large estate in Tullygarvey (Fig. 6). In general, however, Gaelic landowners, large and small, were characterised by an apparent inability to cope with the new demands of landownership. The crown rents and their poorer farming techniques meant that they were in constant difficulties. In 1624, Blaney, now Governor of Monaghan, was complaining of the McMahons' unwillingness or inability to pay rent and of the waste which characterised the whole country.[22] Sales of land or more commonly mortgages which were not redeemed before 1641 represented the most significant change in the map of estates. Many Gaelic landowners were hampered by their tradition-bound, loyal but inefficient tenants who would rot or could not pap rents and who could not easily be replaced by new settlers. The tcnants of Captain Hugh O'Reilly of Tullygarveykere reported to be ploughing by the tail in Pynnar's survey (1619), though in spite of this technical drawback, his son Philip managed to assemble a large property by 1641. Gaelic pastoral practices, with widely dispersed cattle herds, were incompatible with the new strictly-defined territorialisation of landownership. The kin-linked ballybetaghs within a broad framework of territories owned largely by septs had been adaptable to such a cattle economy. The Ulster Plantation structures, which introduced new owners and often dispersed the kin-related Gaelic landholders, had a disruptive impact on the Gaelic community in Cavan. In Monaghan, which retained a substantial part of the traditional structure, the effect was probably less traumatic. Finally, though many Gaelic families adopted the English inheritance practice of primogeniture, many continued to fragment their properties up to 1641 through partible inheritance. Patrick McKenna, for example, dispersed his 1606 estate among his sons, as well as selling large parts of it to English planters. Mulmory McHugh Connelagh's estate in Cavan was divided among his three sons and two grandsons by 1641.

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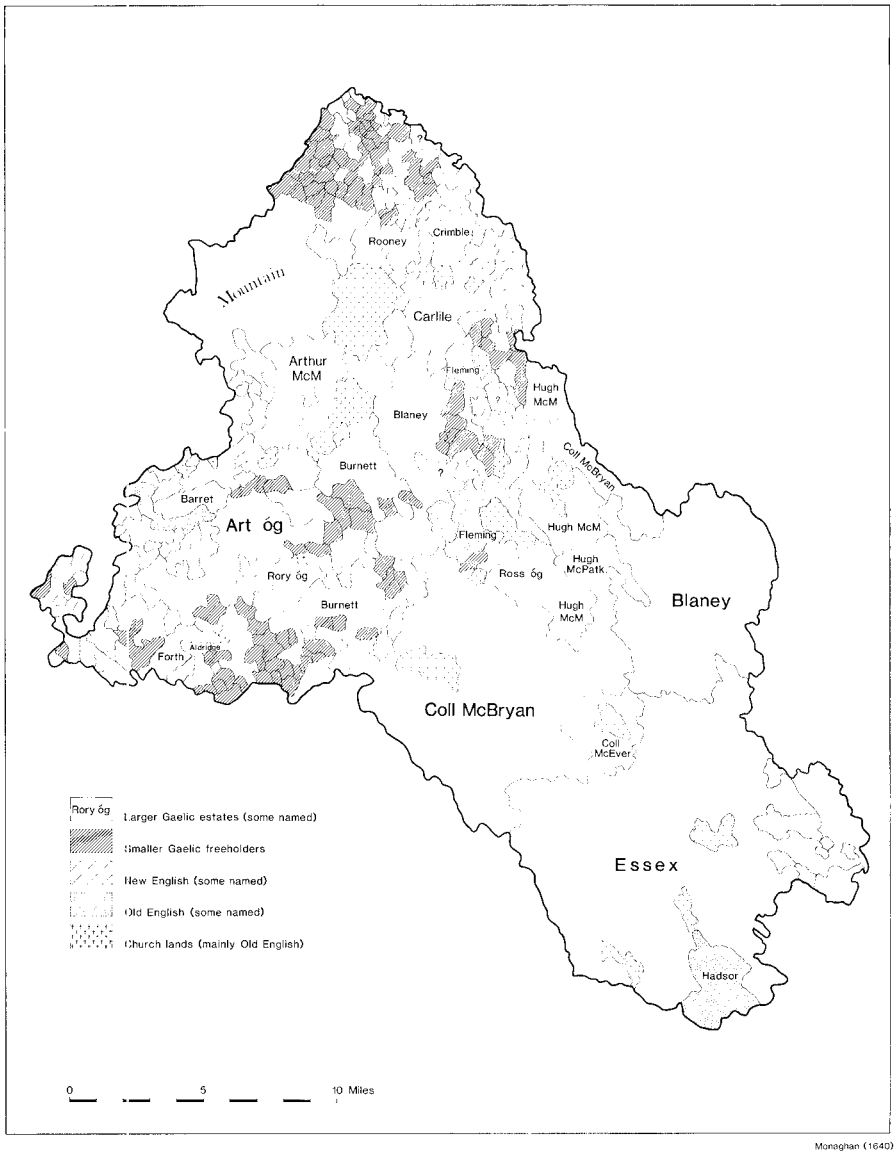
[20] Gillespie, '1641 Rising', p. 198.

[21] A. Clarke, 'Ireland and the general crisis' in Past and Present, 48 (1970), pp 78-99; O'Dowd, op. cit., p. 142; Goff, op. cit., pp 165-6.

[22] E.P. Shirley, History of County Monaghan (London, 1879), p. 121

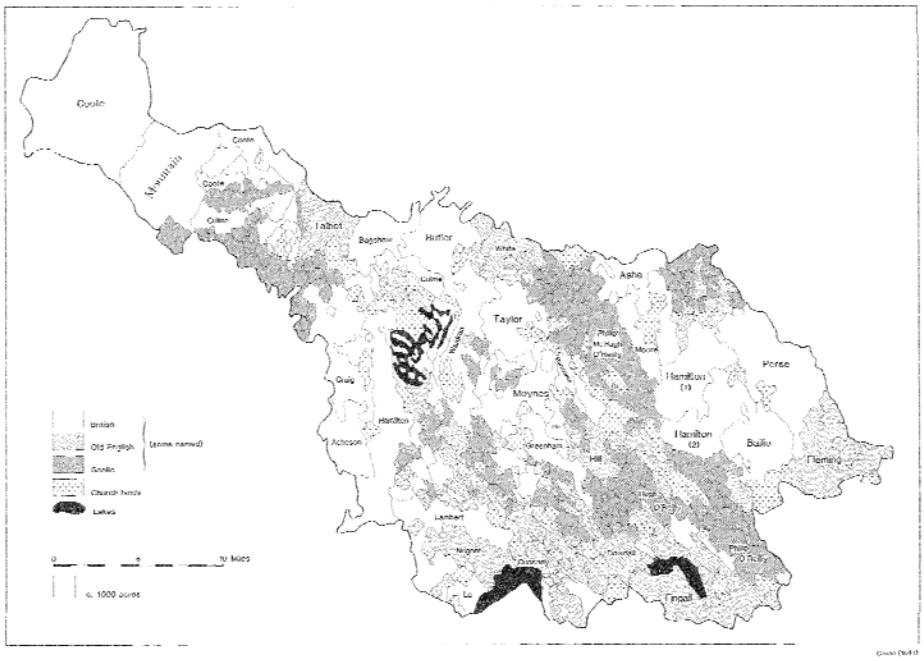
Figure 5. Principal Monaghan estates 1641



Overall, Gaelic-held land dropped to less than 40 per cent of the total in Monaghan by 1641, and from 22 per cent to 16 per cent in Cavan. The major development in Monaghan was the sharp reduction in the small freeholder properties, giving way principally to planter estates of either Old English or New English origin. McKenna sold large parts of his lands to several English buyers. Patrick McArt Mao1 sold to Edward Blaney while Ross Bán sold to Christopher Fleming. In Cavan, Brian Coggie O'Reilly sold to Henry Hickfield. McKiernans sold to Craig. By 1622, John Burnett, an Aberdeen Catholic who had come to Monaghan early in the seventeenth century, had made up to thirty-six land purchases from Irish and English alike.[23]

[23] Irq. cancell. Hib. repert., ii, 1622; R. Hunter, Armagh and Cavan, pp 331-2.

Figure 6. Principal Cavan estates 1641



The planter estates were not immune to change either and during the early seventeenth century a great many alterations took place in the lay-out of properties and in the personnel involved. A majority of the planters were unable to cope with the extent and the frontierlike conditions of their estates. Many of the English undertakers in the barony of Loughtee, for example, came from not especially wealthy county families in the south of England.[24] Even more of the servitors were in dificulties, holding government offices that were expensive to maintain.[25] Their problems were exacerbated by overreaching themselves in acquiring too much land or, as a result of inaccurate surveying, ending up with estates vastly bigger than they could handle. Although many undertakers were only interested in asset-stripping their properties, those who tried to develop their lands found it difficult to attract desirable tenants and often lost effective control of their estates by granting away much of it in fee farm grants. The Earl of Essex's huge estate did not particularly enrich him and his 1634 survey of the estate was probably carried out with a view to selling it. Although he never actually sold it, he did lease it out in large sections usually to palesmen like Robert Talbot of Carton, Co. Kildare.[26] Gillespie's survey of the problems of the planters of east Ulster[27] could be applied with even greater validity to south Ulster: a shortage of capital, an absence of merchant capital in towns and

[24] Hunter, 'English undertakers', p. 478.
[25] See, for example, P. Roebuck, 'Chichester and the making ofa great Ulster estate' in R.I.A. Proc., 79C (1979), pp 1-25.
[26] Lease 1637, Longleat Library; see Duffy, 'Farney in 1634'.
[27] Gillespie, Colonial Ulster, p. 127.

difficulties in getting tenants of substance represented big stumbling blocks to developing a marginal and underdeveloped countryside.

By 1622, only three of the seven original undertakers were resident in Loughtee in Cavan (Fig 6). The tradition of absenteeism resulting from land speculation began early among the undertakers and servitors of Cavan. Bagshaw, who bought Wirral's estate in Loughtee in 1622, was a civil servant living in Dublin. Perse, who bought Hamilton's estate in Clankee, was the Lord Deputy's secretary and also possessed land in Westmeath. Chichester, the Lord Deputy, was a notable speculator in Ulster estates. As Canny has pointed out, speculation in forest land or grazing land with little or no residency requirements was rife in the 1630.[28] Sir Charles Coote, with 38,000 acres in Cavan, was vice-President of Connaught and held extensive lands there. The Earl of Annesley, though not holding lands in Cavan at this stage, was involved in land deals throughout east Ulster and Wexford and was involved in the assembly of Edward Dowdall's property in Cavan.

Servitors were particularly active in land deals in Cavan and adjoining areas. Hugh Culme bought lands in Tullyhaw from Gaelic owners. Arthur Colme also with an estate in Tullygarvey, had land interests in Monaghan. Sir James Craig brought 2,000 acres from the McKiernans. In the 1630s, John Chapman, with land in Longford, and Henry Crofton, with land in Leitrim had bought into Tullyhaw. Sir William Hill of Allenstown in Co. Meath bought about 9,000 acres from O'Reillys and Bradys in Loughtee and Tullygarvey. The result was fragmentation and, particularly among servitors, consolidation of properties initially laid out by the Ulster Plantation. What began on paper as a uniformly blocked-out territorial system was altered throughout the 1620s and 1630s and the conditions of the plantation settlement could not be fulfilled.

By 1641, there were little more than a dozen significant Gaelic estates in Monaghan (Fig. 5). Apart from an exceptional concentration of approximately 40 McKennas in the north of the county, there were no more than 50 small estate owners in the rest of the county, a considerable reduction from the 1606 Division. In Cavan, Gaelic landowners declined from about 58 in the Ulster Plantation to about 45 in 1641. While the ambitious plantation schemes of the sixteenth and early seventeenth centuries were significant in their impact on the landholding structures of Ireland, equally important was the process of attrition of Gaelic estates through what was the more common process of property change - land purchase or mortgage by Old English and New English speculators. The change in ownership with its concomitant implications for indigenous society and culture, occurred over a half century along a broad frontier

[28] N. Canny, 'Migration and opportunity; Britain, Ireland and the New World' in Ir. Econ. Soc. Hist., 12 (1985), p. 9

where the receding Gaelic world was penetrated by an increasingly vigorous new world of English and Scottish adventurers.

The post-Cronwellian pattern

What Bottigheimer called the 'monumental transformation' of Irish land between 1653 and 1660 was the last major influence on territorial structures of land ownership in south Ulster.[29] Both Cavan and Monaghan' counties were reserved for disposal to the army. Ultimately all Catholic-owned lands were confiscated. The extensive involvement of Ulster Gaelic families in the 1641 Rising meant the inevitable forfeiture of their estates. Indeed the very survival of Gaelic social and territorial structures in Monaghan up to 1641 facilitated the involvement of most of its landowning families in the Rising. Consequently the pattern of new estates emerging after 1641 was based on the distribution of Catholic property at that time. A number of pre-Cromwellian Catholicowned estates survived, principally those of Old English families in Cavan who either had influential contacts during the Cromwellian Plantation or after the Restoration which resulted in their properties being wholly or partially reinstated.[30] In this context, the Restoration had little impact on Monaghan: only Fleming's estate survived until the Williamite confiscations. In Cavan, as in parts of Leinster, the Nugents, Plunketts and Flemings obtained full or part restitution of their lands.

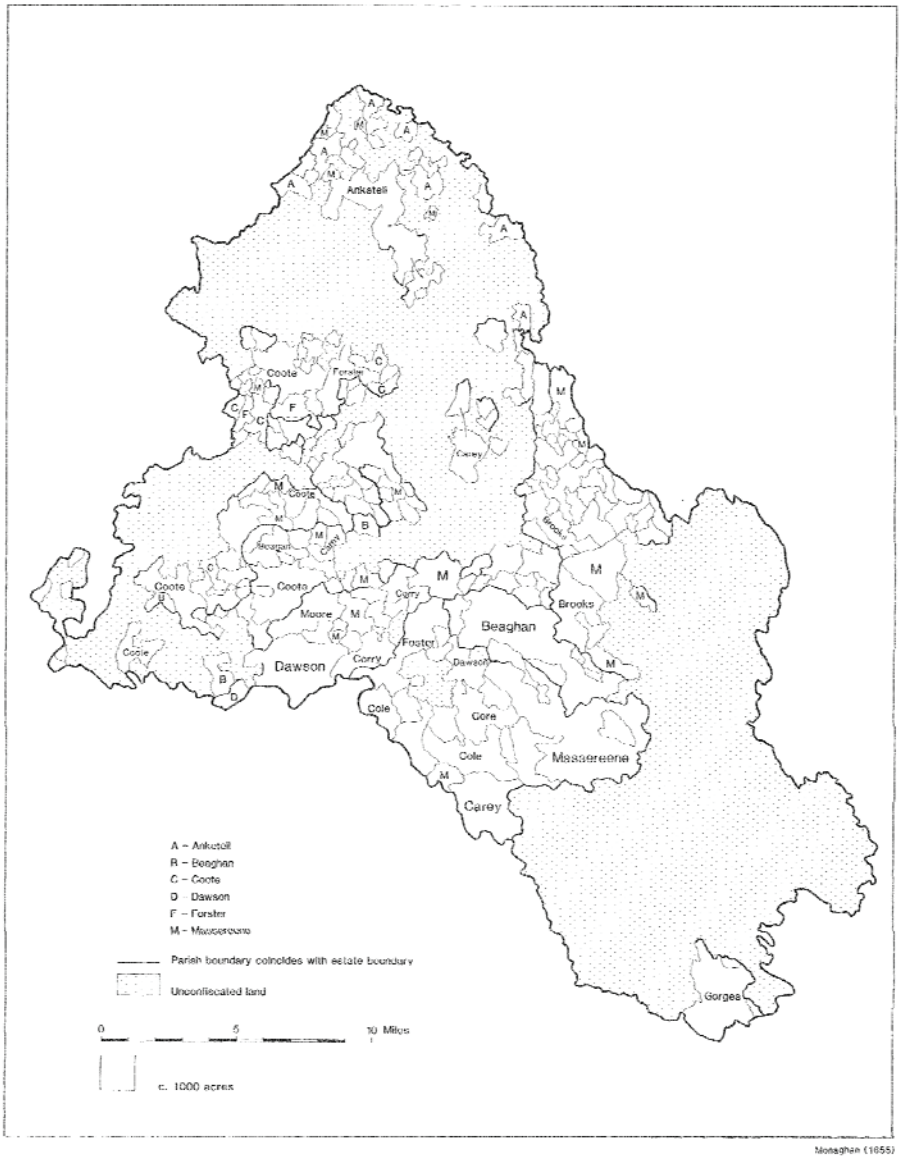
In Figures 7 and 8, therefore, only the forfeited Gaelic or Old English lands were granted out under the Cromwellian settlement. To facilitate the settlement, denominations in each barony were arranged in files of contiguity and lots were drawn for the appropriate amount of land.)[31] Thus, unlike land acquired by purchase, where some element of territorial continuity might be expected, the allocation of confiscated land by lots would have resulted in a complete break with the pre-existing order. Only a subsequent discerning purchase of shares would have consolidated an otherwise fragmented property landscape.

The pattern of Cromwellian estates, however, was much more than a simple transfer of Catholic lands to soldiers in lieu of arrears of pay. Many years elapsed between the proposal to use Irish land to finance the military campaign in Ireland and its eventual translation into land grants, and a great many adventurers and soldiers were unable or unwilling to wait. Bottigheimer estimates that only 7500 soldiers (out of 35,000) and 500 adventurers (out of c. 1,500) were confirmed in their estates by 1670.[32] The imposition of a reluctant soldiery on the lands of Ireland established the conditions for considerable speculation. The ultimate map of Cromwellian estates in south Ulster, therefore, represents much more

[29] K.S. Bottigheimer, English money and Irish land (Oxford, 1971), p. 139.
[30] K.S. Bottigheimer, 'The restoration land settlement in Ireland' in I.H.S., 18 (1972), pp 19-20.
[31] J.P. Prendergast, The Cromwellian Settlement of Ireland (Dublin, 1875), p. 115.
[32] Bottigheimer, English money, p. 140.

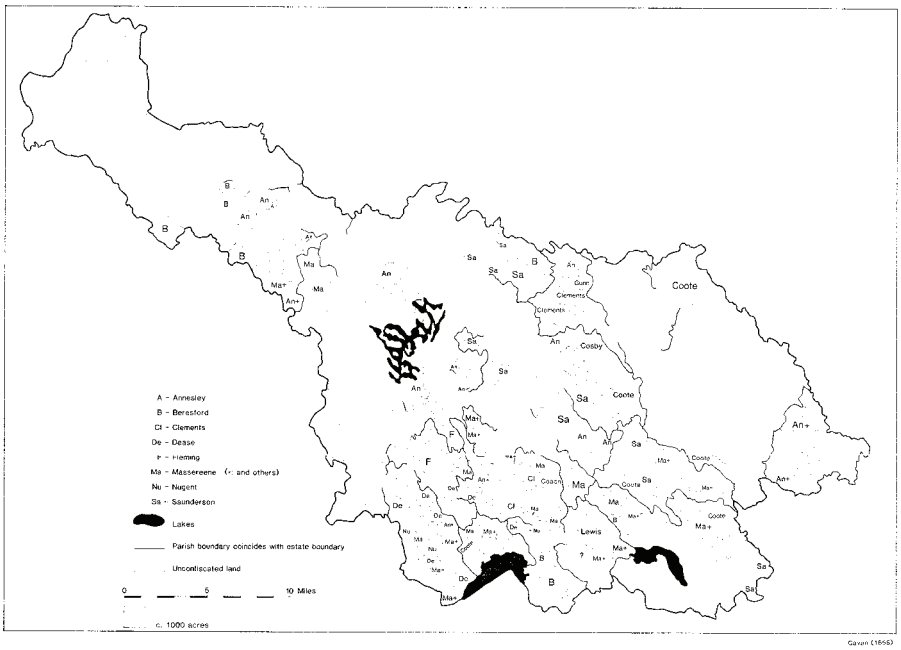
a predatory pattern of Commonwealth and to a lesser extent Restoration speculation in land than it does the draconian plans of the plantation commissioners in Dublin. The emergence of about twenty large estates in both counties is a testimony to the ultimate failure of the plantation.

Figure 7. Cromwellian grants in Monaghan



The impact of speculation on the morphology of these new land units is well illustrated in the case of Monaghan and Cavan. In both counties there was a clear dichotomy between large, fragmented and far-flung properties on the one hand, and very small, individual units on the other. Although the geography of the new grants was influenced to some extent by the method of allotment, there were many local variations in practice, much concealment of lands and a fair amount of disorder on the ground.

Figure 8. Cromwellian grants in Cavan



The overwhelming majority of the south Ulster grantees were officers. Of the 49 new names in Monaghan after 1641, 42 were enrolled as soldiers and one - Lord Massereene (John Clotworthy) - appears in the adventurers' list. Of approximately 70 new names in Cavan, 60 were soldiers. [33] In southern parts of Cavan, a patchwork of properties representing new Cromwellian owners such as Massereene, Beresford, Lewis, Cooch, Coote, Clements and Burton were intermixed with remnants of the restored pre- Cromwellian estates of Lambert, Nugent, Dease and Plunkett. The extensive Gaelic lands of 1641 stretching northwards through the centre of Cavan were taken over mainly by Saunderson, Annesley, Cosby, Clements, Gunn, Battally and smaller grantees. Thomas Coote also amassed an extensive estate in Tullygarvey in place of several small Gaelic properties. The Gaelic estates in the north-west barony of Tullyhaw were principally taken over by Annesley, Massereene and Beresford. The south-eastern 1641 estate of Garrett Fleming was divided up among Annesley, Coote, Cooch and others with small portions restored to Fleming.

In north Monaghan, the remnants of the McKenna estates were reassembled under the Cromwellian settlement by Mathew Anketell. In the baronies of Monaghan, Dartrey and Cremourne, the extensive Gaelic lands were replaced by large, mainly officer, landholdings - Coote, Beaghan, Carey, Dawson and others including the ubiquitous adventurer Massereene. The pattern in Monaghan was more consolidated than in

[33] Rec. comm. Ire. rep., 1821-25 (Enrollments of certificates of soldiers and adventurers, 1666).

Cavan, probably reflecting the nature of the baronial allocation of land shares among the soldiers' and the subsequent selective concentration of shares by astute speculators. The delineation of some of the new properties, however, suggests the persistence of estate units from the 1641 period. Thus, for example, Massereene appears to have obtained the ballybetagh of Ballilecke belonging to Hugh McPatrick Duffe McMahon in 1641, while Sir Henry Brookes got the ballybetagh estate of Hugh McMahon. The break up of Col1 McBryan's large estate in Cremourne in some cases restored the earlier ballybetagh structures. In Dartrey, Coote obtained the intact ballybetagh estate of Rory Óg McMahon. Such continuities cannot be coincidental and suggest the operation of local irregular arrangements, as implied in Prendergast's suggestion that in some cases officers divided up baronies by agreement.[34] Certainly in a period of postwar instability and economic decline, the temptation to hold together older properties complete with their tenantry must have been considerable.

The most dramatic illustration of an extensively dispersed estate is represented by the grants of Lord Massereene, an original investor in the Cromwellian enterprise in Ireland who acquired properties all over the country in the 1650s. As a result of purchasing soldiers shares, his name appears throughout the length and breadth of Monaghan and Cavan. He possessed extensive properties in Cremourne and Dartrey, also had exclusive shares in holdings in a dozen Cavan parishes, with over thirty instances of lands shared with up to three others. Others with extensive and fragmented properties which clearly resulted from the incremental accumulation of soldiers shares were Peter Beaghan in Monaghan and the Earl of Annesley in Cavan. The latter was involved in over twentv shares, with other holdings in a dozen Irish counties. Annesley as a commissioner of ;he Act of Settlement was alleged to have assisted in expediting patents for land in return for the favour of a proportion of the property. For this reason he found himself in possession of substantial quantities of inferior land in many regions.[35] Thomas Coote, besides acquiring an extensive estate in Tullygarvey was also involved (in many cases with Massereene) in properties throughout Cavan, Monaghan and the midlands. In Monaghan, he had extensive lands in Dartrey, not far from his large Cavan property. Massereene, Annesley and Coote were the biggest speculators, with interests in other regions throughout Ireland. Most of the remaining Cromwellian grantees in south Ulster had their interests confined to Cavan and Monaghan. The most important speculators are named in Figures 7 and 8.

There was, therefore, a very active market in soldiers' shares in the 1650s and officers obviously had the greatest opportunity to buy up their soldiers shares. Cornet John Mulholland's troup was assigned lands in

[34] Prendergast, op. cit., p. 95.
[35] P.H. Hore, 'The Barony Forth' in Past, 2 (1921), 52-3

Dartrey and though Phelimy McKenna was paying cash for Mulholland's troopers' debentures in 1658/9,[36] it is likely that Mulholland's estate was largely made up of his soldiers' shares. Captains Carey and Anketell, Colonels Saunderson, Coote, Cole and Foster were all officers in a position to speculate in land in selected baronies. Papers relating to the Dawson estate in the 1650s show clear evidence of the acquisition of soldiers' debentures by Cornet Richard Dawson.[37]

The majority of new landowners in south Ulster were distinguished from the preceding group by the comparatively small size of their properties and by being confined mainly to one barony. This group probably reflects the allocation of genuine soldier grants. Cornet Walter Corry may have settled on his due allotment in Monaghan, though it is doubtful if a Cornet would have been owed eighteen tates worth of arrears. He may have added slightly to his original share. Many others had small holdings of one or two tates or polls. They often appear as a group in the 1666 enrollments, like frontiersmen collectively guarding their small acquisitions.[38] Unlike the large landholders, most of them resided in south Ulster, and the hearth money rolls for Monaghan in 1663 and 1665, for example, list twenty-three of the new names, all of them smallholders. Of the larger grantees, only Anketell, Foster, Mulholland and Pockeridge were resident. Later in the 1688 list of attainted persons by James 11, all of these new Cromwellian colonists are conspicuously present.

The roots of the nineteenth century estates

The geography of the estate system in south Ulster in the mid nineteenth century can be substantially understood in terms of the major upheavals in land ownership in the seventeenth century. By concentrating on the major estates, it is possible to discern significant links with the seventeenth century and earlier and, while a complete explanation must take account of property changes in the eighteenth century, it is possible in some cases to interpolate the effect of these changes on the ultimate shape of the south Ulster properties.

In Cavan and Monaghan the relationship between parishes and baronies and the territorial structure of estates is shown in Figures 1 and 2. Baronies formed important spatial parameters for both the Ulster plantation and the Cromwellian settlement. The parishes in Monaghan were closely associated with ballybetaghs which survived in fairly complete form until the mid seventeenth century. In Cavan the effect of the barony divisions is evident in the remnants of Ulster plantation estates in Tullyhaw, Tullyhunco and Clankee, while the impact of Cromwellian speculation is evident in the baronies of Clanmahon and Castlerahan. Parish boundaries which have been included in Figures 1

[36] P. Ó Mórdha, 'Colla Dubh McMahon, his ancestors and descendants' in Clogher Rec., 7 (1974), p. 198.
[37] Dartry estate papers (Dawson family), P.R.O.N.I. D.305315.
[38] Rec. comm. Ire. rep., 1821-25.

and 2 where they coincided with the boundaries of estates over 2,000 acres, were not as important in Cavan as in Monaghan. In the latter, the importance of the parish boundary as an estate boundary reflected the continuing influence of early seventeenth century structures, even through the disruptive Cromwellian period. There was often a clear concentration of new estates in specific parishes reflecting the earlier evolution of ballybetagh estates.

Although none of the Gaelic landowning families who were so prominent in the early seventeenth century survived, the territorial legacy of their estates often continued into the nineteenth century. In Monaghan, shades of the ballybetagh properties of 1606 are evident in Figure 2, though there was considerable disturbance by piecemeal purchases and Cromwellian grants up to the 1660s. Small, widely-dispersed fragments which are clearly evident in Figure 2 represent additions to properties mainly in the eighteenth century. The Shirley and Bath estates of Farney preserve the sixteenth century geography of that barony intact. The late sixteenth century Essex grant was divided in the 1690s between two heiresses. The Brownlow estate represents a ballybetagh in Farney which appears to have been leased in perpetuity in the very early stages of the Essex property. The Rossmore estate in Monaghan and the Hope and Templetown properties in Cremourne reflect the original Blaney grant of five ballybetaghs in the early seventeenth century. Though it was acquired by a series of purchases in the late seventeenth century, the Lucas estate is essentially the 1606 property of Hugh McMahon. Leslie's estate in north Monaghan consists chiefly of five ballybetaghs which originally belonged to McKennas and McMahons and were ultimately bought by Leslie in the later seventeenth century. The Lennard estate in Dartrey can be traced back to the late sixteenth century disposal of the Clones monastic lands. Very few of the large Gaelic estates survived intact and the geography of the estates in the nineteenth century must be explained in terms of the fragmentation of Gaelic property as a result of English purchases and later Cromwellian speculation. Many of the smaller nineteenth century estates, while often corresponding with poorer, hillier parts of Monaghan, also reflected areas where the last Gaelic small landholders held out and where smaller Cromwellian grantees ended up. In these comparatively unattractive districts, estates remained small and were of little interest in the land market. Even where larger Cromwellian estates were assembled in these kinds of regions by Massereene and others, they were subsequently dismantled. Survival of the bigger Cromwellian estates, such as those of Dawson or Anketell, occurred in better, more viable agricultural lands and many of them, particularly exemplified by Dawson's purchase of the Corry and other estates in the late seventeenth and eighteenth century, expanded their initial acquisitions. Other estates, such as the Tennison, Rothwell or Madden estates were purchased in the late seventeenth or early eighteenth century from the original large Cromwellian grantees. Ker's estate, for example, was built up in 1730 around the core of

Nicholson's Cromwellian grant and Leslie's Cremourne estate was bought from Edmond Beaghan of Norfolk in 1720.[39]

In Cavan, the undertaker baronies had a lasting impact. Thus, the Gosforth (Acheson) estate in west Cavan remained unchanged from the original Ulster plantation grant. Similarly the Young estate, around the town of Bailieboro, is the direct descendant of Bailie's Ulster plantation grant. The Garvagh, Greville, Hodson, Ruxton and Singleton estates represent divisions of original Ulster plantation undertaker properties. In all cases, the nineteenth century families had bought or married into them.

Few of the Ulster plantation estates remained as large as they were initially. In many cases, the estates were too extensive and due to reclamation or indebtedness, parts were hived off for sale. As with larger properties in poorer areas of Monaghan, a number of the undertaker estates deliberately located in the early seventeenth century on essentially marginal lands were unable to develop. The early absenteeism here is a reflection of the lack of viability of these properties as focal points for new settlers. Burrowes' nineteenth century estate began with part of Fishe's undertaker estate in 1629.[40] T'he core of the extensive Farnham estate was Waldron's Ulster plantation grant. The Lanesborough (Butler) estate is based on a contracted version of the original Ulster plantation grant to Butler. The other significant survivors from the early seventeenth century were the Fleming and Dease estates, attenuated remains of much more extensive properties. The extensive Plunkett estates in south Cavan had been acquired in total by Taylor (later the Marquis of Headfort) in 1660. Lord Fingall (Plunkett) only held 30 acres in Cavan in the mid nineteenth century.

More so than in Monaghan, the Cromwellian grants, had a significant fragmentary impact on the property landscape of Cavan, with a complex mosaic of new landshares established by 1660. Extensive properties like Saunderson's, Beresford's, Annesley's and Coote's originated here. Considerable shuming of the mosaic in subsequent years resulted in the emergence of many of the nineteenth century estates. Much of the Farnham estate, for example, was built up out of the scattered Massereene shares. Burrowes expanded into part of Clement's lands and incorporated all of Culme's 1641 property. Pratt's large estate focused on the medieval core of Cabra Castle in the south-east of the county represents the accumulation of Cromwellian grants by the successful in-marriage of a Meath grantee. Others, such as Boyle and Nesbitt, came into the county in the late seventeenth century. Boyle bought up part of Moore's Ulster plantation servitor grant and the Nesbitt family had

[39] Leslie of Ballybay estate papers, P.R.O.N.I., D.3406.
[40] Hunter, Armagh and Cavan, p. 300.

married into-the Cromwellian Cosbys, whose estate formed the base of the Nesbitt property.

The marriage patterns and settlements of landed families in Cavan and Monaghan are important in explaining much of the emerging estate system. While inability to produce sons often resulted in changing the name of the estate, many men· marrying in adopted their wife's family name to preserve it on the estate. Marriage settlements occasionally resulted in the division of estates, as with the Essex estate in the later seventeenth century, or in the consolidation of properties as with Pratts in Cavan. In general, fragmentation of estates on marriage was avoided as much as possible and some families went to considerable lengths to preserve the integrity of the estate. The Blaney estates were twice sold in the later seventeenth century and twice recovered by astute marriages of successive lords Blaney to the heiresses of the property.[41]

Conclusion

While there was a considerable level of change in landownership throughout the eighteenth century, the major territorial parameters of the nineteenth century estate system in south Ulster were laid down in the seventeenth century. Comparatively minor modifications to the structure occurred subsequently. The geography of the mid nineteenth century estates was complex in its origin and in its territorial manifestation. The extensive numbers of small and fragmented properties, many with a long pedigree of speculative and absentee owners indicate that the estate system was not the monolithic and territorially all embracing system that is commonly believed. Large areas of south Ulster, and large sections of the population, existed beyond the walls and windows of a Big House and undoubtedly such a highly varied territorial structure, matched by equally complex tenurial systems must help to explain the variety in social and economic conditions in nineteenth century Ireland. Recent work in Wexford and Tipperary helps to underline the regionally contrasting experiences of landownership in Ireland and especially underscores the contrasts between Ulster on the one hand and Munster/south Leinster on the other.[42]

This extensive but shallow-rooted system was totally dismantled in the late nineteenth century. Its legacy is as varied and elusive in south Ulster

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[41] Shirley, op. cit., p. 213; A.P.W. Malcomson, 'The Earl of Clermont: a forgotten Co. Monaghan magnate of the late eighteenth century' in Clogher Rec. 8 (1973), p. 25.

[42] W.J. Smyth, 'Property, patronage and population: reconstructing the human geography of mid seventeenth century Tipperary' in W. Nolan (ed.), Tipperary: history and society (Dublin, 1985), pp 104-38; Gahan, op. cit.; while Gahan notes that 'Catholic' landowners had increased significantly in Co. Wexford by 1876, accounting for nearly one-half of all the landowners, and overwhelmingly concentrated in the under 100 acre category, the trend in south Ulster was much less significant. Examination of the names of landowners in the 1876 list suggests that c. 16 per cent in Cavan (one-third of whom were O'Reillys and Bradys) and 9 per cent in Monaghan (none of whom were McMahons) possessed 'Catholic' names and were principally found in the under 50 acre class.

as its territorial structure. Few of the family names in Figures 5.1 to 5.8 remain. Exceptions like the Leslies in Glaslough, the Shirleys of Lough Fea or the Maxwells of Farnham continue to live in small demesnes lopped like branches from the trunks of their estates, surrounded by decaying walls and ivy-clad trees, the 'embers of an older order'.[43] A few titles of honour, like the Baronet of Bailieboro, which accompanied formerly extensive estates continue in the pages of *Burke's Peerage* with English addresses and London clubs as meaningless reminders of a vanished ascendancy. The better drained, more fertile regions of Cavan and Monaghan, still reflecting a viable husbandry of two hundred years are dotted with country houses and demesnes, the endownment of a rich and generally resident landed class. In some cases, though the owners were permanently absent, the property was large and valuable enough to warrant a careful management which is still reflected in the landscape. In these regions around Glaslough, Monaghan, Clones and Cavan towns, and in outlying districts around Bailieborough, Virginia, Kingscourt, Rockcorry and Cootehill are the remains of a Protestant settler population in a network of solid farms. In many hilly and remoter districts, however, even the most assiduous searching reveals little trace of the 'estate system' either in house, farm, field boundary or folk memory.

Acknowledgment I wish to thank Mr Jim Keenan, cartographer in the Department of Geography, Maynooth, for the painstaking care which he lavished on the maps in this paper.

[43] T. Jones Hughes, 'Irish landscape studies' in Baile (1979), pp 3-60.

CHAPTER 9

FLAX CULTIVATION IN IRELAND: THE DEVELOPMENT AND DEMISE OF A REGIONAL STAPLE

W.J. SMYTH

First published in Smyth, W.J., Whelan, K., Hughes, T.J. (1988) *Common ground: essays on the historical geography of Ireland presented to T. Jones Hughes*. Cork: Cork University, pp. 234-252.

> Ah, it was a tedious old crop, flax, right enough, and it was a hungry greedy crop too, but the fields around the Cleggan were good flax fields, and there was money in it. I miss it, its beautiful blue colour. The fields were the colour of a summer sky, and when it was scutched it was so golden that it burned and glimmered as the sun and moon had mixed and fallen on it.[1]

Throughout much of his writings tom Jones Hughes has returned again and again to the theme of Irish regionalism. Notwithstanding his acknowledgement of the role of cultural, and indeed ethnic, factors in the identification of patterns, he has most frequently employed economic variables in a search for regional indicators. His classic cartographic portrayal of the extend of eighteenth and nineteenth century landlord improvements was based on a detailed interpretation of the Griffith Valuation, and analyses of agricultural statistics provided him with the configuration of major regions of economic specialisation in post-Famine rural Ireland.[2] Even his more recent writings have placed considerable emphasis upon economic data, as witness his mapping of farms with a valuation of one hundred pounds or more.[3] While the ultimate goal of all this analysis has been to identify and measure the nature, scale and intensity of spatial differentiation within this island, and while he would probably recoil from being labelled an economic geographer, it is nonetheless apparent that Tom Jones Hughes's writings suggest a strong interest in regional economies, their landscapes and their socio-cultural manifestations. This essay seeks to identify the agricultural background of probably the most distinctive regional economy to have matured in nineteenth century Ireland, the linen industry of the northern half of the country. Specifically, this essay will explore the regional dimension of flax cultivation and its immediate proto-industrial offshoot, scutch milling. The secondary stages of textile production – the spinning, weaving and bleaching processes – do not form part of the present study.

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[1] P. Devlin, *The far side of the Lough* (London, 1983), p. 63.

[2] The use of economic indicators is most evident in the essay 'Society and settlement in nineteenth century Ireland' in *Ir. Geogr.*, 5, 2 (1965), pp 79-96.

[3] T. Jones Hughes 'The large farm in nineteenth century Ireland' in A. Gailey and D. Ó hÓgáin (ed.), *Gold under the furze* (Dublin, 1984), pp 93-101.

In pursuing this geographical investigation of Irish flax cultivation, the framework of a model of staple production is employed as in intellectual tool of considerable relevance. The staple theory, as it is sometimes called, was the distinctive creation of great Canadian economist, Harold Innis, whose life's work was devoted to analysing the dynamics of the economy of Canada, a country which throughout the nineteenth century was overly dependent upon a limited number of staple goods produced for export.[4] Throughout that century Canada remained heavily dependent upon primary production, industrialisation was severely impeded, and regional economies were intimately linked with export markets principally in the United States and Britain. Despite the very obvious differences which distinguish Ireland and Canada, the staple model does provide, nonetheless, a useful framework for analysing Irish regional and economic development. As with Canada, Ireland was heavily dependent upon the export of a few staples, largely agricultural in origin, and in both countries the nature of the staple and the staple and the character of the export demand had a profound internal regional impact. Inherent in this staple model is the identification of a basic commodity which 'sets the general pace, creates new activities and is itself strengthened or perhaps dethroned, by its own creation'.[5] The creation of new activities may be interpreted as economic multipliers acting within a system wherein production of a staple good may generate forward linkages in the form of processing industries, thus creating secondary growth. The extent to which such forward linkages may be created secondary growth may be created has an obvious impact upon the nature of the regional economy of the area of primary production. In the case of Ireland the linen industry represents the most successful example of an economic multiplier or forward linkage in that a sophisticated industry of world significance was generated, at least initially, by a local staple product, flax. Beyond the realm of the linen industry, however, the success of Irish forward linkages was markedly curtailed and there remained a disproportionate dependence on the export of largely unprocessed agricultural good. Although south-east Ireland, for example, articulated a sophisticated agricultural economy based on arable farming, stock raising and dairying, its processing industries were limited in their long term impact. While this region occupied a significant niche in the Atlantic provisions trade of the eighteenth and early nineteenth centuries, and contained a series of forward linkages in the form of flour-milling, butter-making, meat-curing, coopering and even ship-building, the impact of these industries was spatially confined to the hinterlands of the major ports, and by 1830 the provisions trade was in decline.[6] Elsewhere,

[4] A good discussion of staple theory is by one of Harold Innis's students, M.H. Watkins, 'A staple theory of economic growth' in W.T. Easterbrook and M.H. Watkins (ed.), *Approaches to Canadian economic history* (Toronto, 1967), pp 49-73.

[5] Easterbrook and Watkins, *op. cit.*, p. 54.

[6] J. Mannion, 'The Waterford merchants and the Irish-Newfoundland provisions trade' in D. Akenson, (ed.), *Canadian papers in rural history* (Ontario, 1982), iii, pp 178-204; also in L.M.

Irish agriculture generated local industries in the form of brewing, distilling, tanning, and woollen manufacture, but in terms of geographical extent, complexity of forward linkages, numbers employed, and length of survival these examples, while regionally important, did not match the success recorded by the linen industry and its basic staple ingredient, flax. The success of the flax staple and its attendant textile industry is clearly expressed by the fact that by 1780 the value of exported linen, yarn and flax was worth more than the combined values of exported cattle, meat, dairy products and grain.[7] Clearly, flax cultivation was of national significance but its regional dimensions and its immediate proto-industrial linkage, scutch milling, have received little attention from either historians or historical geographers.

The nature of the flax staple

A domesticate of the Mediterranean basin, the flax plant (*linum usitatissimum*) was introduced into north-western Europe by the Romans. As an industrial crop it took its place in European agriculture alongside the cultivation of hemp, and dye plants such as madder and woad and from the Early Middle Ages onwards it was especially popular in France, Flanders, Germany, Britain and Ireland. In succeeding centuries it extended to the Baltic States, throughout much of European Russia and into the North American colonies. In its geography the plant demonstrated its great tolerance of a wide range of climatic and edaphic conditions. Its optimum requirements coincided with those of middle latitude temperate climates where a moist spring growing season was coupled with summer conditions which were neither too arid nor too hot. Too dry a summer tended to produce rough quality fibres. Reputed to be an exhaustive crop, flax grew best on the alluvial loams and moderately heavy clays supplemented by heavy manuring.[8] The plant was extremely versatile and could be grown for either its fibrous content or for its seeds, the inputs for a textile industry and a linseed oil industry respectively, and in those regions wherein the plant was grown for the provision of fibre it was sown in a broadcast fashion with the seedlings closely spaced, thereby encouraging the growth of tall stems of between twenty and forty inches. Much of the Irish, British and French flax was grown in this manner, whereas in Flanders, Holland and the Baltic States, the plant was planted less densely and was cultivated for both its seeds and fibre. In the North American colonies the plant was grown mainly for seed.

As in industrial crop, flax was at once the agricultural basis for a textile industry and also a crop that required considerable processing before it

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Cullen and P. Butel (ed.), *Nègoce et industrie en France en Irlande aux XVIIIe et XIXe siècles* (Paris, 1978), pp 27-43.

[7] C. Gill, *The rise of the Irish linen industry* (Oxford, 1925), p. 178.

[8] See A.J. Warden, *The linen trade* (London, 1867), p. 14. The idea that flax was a very exhaustive crop is now disputed. Decline in the crop's yield under a system of continuous cultivation is now attributed to disease rather than soil exhaustion.

even left the agricultural sector. Planted in the manner of cereal crops in late April or early May,[9] flax required twelve to fourteen weeks to mature and during its growing season it demanded relatively little care for, since it was harvested by hand pulling, little attention was paid to weeding except during the early growing stages. A landscape of flax growing was, therefore, frequently untidy, abundant in weeds, and dissatisfying to eighteenth century agricultural reformers. Arthur Young in his tour of Ireland in the late 1780s exclaimed of the flax growing region in the north of Ireland

> Agriculture is there in ruins; annihilated; the whole region is the disgrace of the kingdom; all the crops you see are contemptible; are nothing but filth and weeds. No other part of Ireland can exhibit the soil in such a state of poverty and desolation.[10]

From harvest time at mid-August onwards, however, the seemingly neglectful cultivators were thrust into a season of continuously heavy, back-breaking and frequently unpleasant work. The flax plant was not shorn by scythe, sickle or reaper, but was hand pulled and laboriously tied in sheaves. Although its short tap roots made pulling somewhat easier than might otherwise have been the case, it was nevertheless a demanding task made none the more pleasant by the presence of thistles, docks and the other weeds in whose midst the pullers worked.

After being pulled the sheaves of flax were stoked to ripen in the sun for one to two weeks and, where required, the seeds were at that stage separated from the stems by a process of rippling on iron combs made by the local blacksmith. The sheaves of flax were then placed, weighed down with stones, in a large pool of stagnant water known as a flax hole which was generally twelve to eighteen feet wide and three to four feet deep.[11] There the flax would remain for approximately two weeks during which time the smell and slimy nature of the water indicated the progress being made in the breaking down of the hard outer bark of the plant and the dissolution of the glutinous substances within. Following this retting process the sheaves were pulled out of the water by barefooted men standing knee high in the flax hole, and spread over the grass to dry or, less frequently, taken to drying kilns.[12] The final process, the scutching and hackling of the flax, was embarked upon when the retted sheaves had dried sufficiently. The scutching process consisted of smashing the outer shell of the stalks with a heavy roller and the through graded combs in

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[9] Much of the seed used in Irish and Scottish flax cultivation was imported from North America, Russia and Holland. A good description of the cultivation of the crop is to be found in J. Bell and M. Watson, *Irish farming 1750-1900* (Edinburgh, 1986), pp 156-78.
[10] A. Young, *A tour in Ireland* (Cambridge, 1925), p. 100.
[11] Warden, *op. cit.*, p. 32.
[12] W. Greig, *General report on the Gosford estates in County Armagh 1821* edited with an introduction by F.M.L. Thompson and D. Tierney (Belfast, 1976), p. 205.

order to separate fibres into bundles of equal length and quality. From the mid eighteenth century onwards, and especially from the early nineteenth century the scutching process was generally performed in a small mill[13] but prior to that flax was hand-scutched by the growers themselves. Towards the end of the nineteenth century flax in west Donegal was still scutched by spreading the sheaves along a road surface and crushing it will a large millstone drawn by a horse.[14]

Only after the harvesting, rippling, retting, scutching and hackling processes had been terminated was the agricultural side of the operation complete. The fibre was now ready for spinning by either the agriculturalist's wife, or for sale in a flax market. The intensive nature of the preparatory stages demanded much in terms of time, labour and skills, and flax cultivation was not therefore a pursuit that could be easily engaged in by agriculturalists unfamiliar with its demands. Flax growing for fibre was really only possible in densely-populated regions where family labour was cheap and abundant and throughout Europe there was a correlation between high population densities and cultivation of the crop. So demanding of labour was the crop that the French in the eighteenth century generally considered it to be part of *jardinage*, along with the cultivation of vegetables, fruit and flowers.[15] A corollary of the intensive nature of the processing of the crop was that flax was usually grown only in very small patches. In Flanders it was estimated that a family could be supported by the cultivation of as little as 0.65 hectares of the crop[16] and in the late eighteenth century Ulster Arthur found 'no flaxfarmers, scarce any but what is raised in patches by the cottars'.[17] By its nature the flax staple generated a demand for not only cheap seasonal labour but also a whole set of forward linkages in the form of retting and scutching facilities. In turn the provision of these forward linkages was to have a reciprocal effect upon the distinctive regional geography of flax cultivation in Ireland.

The distribution of flax cultivation

Although present in Ireland long before the arrival of the Normans,[18] flax was not considered a crop of major significance until the eighteenth century. From the establishment of the Board of Trustees of the Linen and Hempen Manufactures in 1711 a concerted effort was made to encourage the development of a competitive Irish linen industry and as a means of underpinning the success of the industry the Board's Trustees sought to ensure a regular supply of the staple ingredient, local flax. In its

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[13] Gill, *op. cit.*, p. 264.

[14] An illustration of a mill wheel being used to crush flax is to be found in E. McCracken, *The Irish woods since Tudor times* (Newton-Abbot, 1971), p. 51.

[15] B.H. Slicher Von Bath, *The agrarian history of Western Europe A.D. 500-1850* (London, 1963), p. 124.

[16] Silcher von Bath, *op. cit.*, p. 271.

[17] Young, *op. cit.*, p. 10.

[18] Warden, *op. cit.*, p. 389 refers to descriptions of flax cultivation which appear in the Brehon laws.

very first year of operation the Board imported a cargo of high quality flax seed from Holland in order to improve the quality of the Irish crop and during the first quarter century of its existence (1711-36) the Board expended £3,300, or fifty-eight per cent of its total budget, on encouraging cultivation.[19] During the period 1738-57 the Trustees continued to expend more than forty per cent of their budget in encouraging flax cultivation[20] and these efforts continued right up until the demise of the Board in 1828. The task of the Board was twofold: to increase the total acreage of Irish flax and, secondly, to establish a strong basis for flax cultivation outside of Ulster. In the first of these tasks the Board was moderately successful and with encouragement the total acreage of flax increased steadily to 80,000 acres in 1800, and 140,000 acres by 1825.[21] Less success was achieved in the attainment of the second ideal. From the beginning of the eighteenth century Ulster had provide the main core of the Irish linen industry, and although this core extended during the course of the century from central Ulster into the southern margins of the province, and into north Leinster and north Connaught,[22] the main linen producing region remained north of a line running from Drogheda to Sligo. The efforts of the Linen Board, and the plantation of Protestant weavers in Munster by individual landlords did little to alter this basic geographical pattern. In 1784 it was estimated that of a total linen output of 48,700 yards, more than 80 per cent was manufactured in the northern province.[23] This pattern of regional concentration of manufacturing was largely a duplicate of regional specialisation in flax cultivation.

Evidence for the spatial extent of flax cultivation in the late eighteenth century is provided by an amazingly detailed document originating in the Linen Board in 1796. In that year the Trustees devised a new scheme for promoting the cultivation of flax.

> To the person who should sow between the 10th day of March and the 1st day of June 1796, with a sufficient quantity of good sound flax seed, any quantity of land, well prepared and fit for the purpose not less than 1 acre – 4 spinning wheels, 3 roods – 3 ditto, 2 roods – 2 ditto, 1 rood – 1 ditto. And to the person who should sow in like manner any quantity of like land not less than 5 acres, a loom, or wheels, seeds or hatchells to the value of 50 shillings, and for every five acres over and above the first five a premium.[24]

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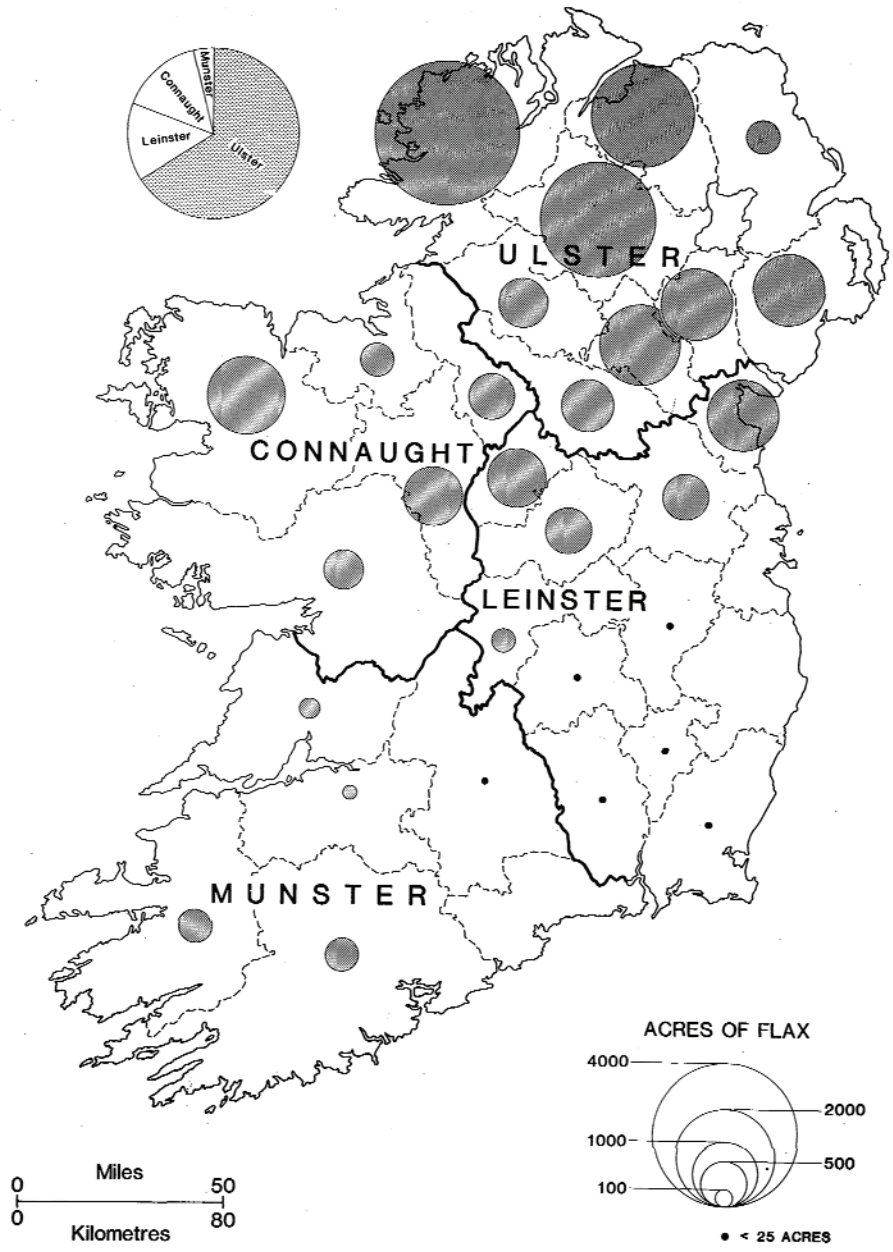
[19] Gill, *op. cit.*, p. 72.
[20] *Ibid.*, p. 194.
[21] Warden, *op. cit.*, p. 411.
[22] W.H. Crawford, *Domestic industry in Ireland* (Dublin, 1969).
[23] Gill, *op. cit.*, p. 162.
[24] Trustees of Linen and Hempen Manufacturers, *Premiums for growing flax* (Dublin, 1796).

The Trustees subsequently published a list of all recipients of these premiums giving the name, parish and county of origin, and nature of award. Almost 55,000 growers submitted claims to the Linen Board, seeking premiums on more than 22,000 acres of flax.[25] Strikingly, two-thirds of the claimants had grown only one rood of the crop, ninety percent had sown an acre and under and less than one per cent had sown a minimum of five acres. Clearly, it was a crop grown in small quantities, often supplying little more than the spinning capacity of the grower's family and although it as, by definition, a cash crops its role was that of supplement rather than a dominant element in the agricultural economy. As Figure 1 demonstrates the main core region of cultivation was to found in Ulster wherein two-thirds of the crop was grown; adjoining counties in north Leinster and north Connaught represented a contiguous extension of the Ulster core. Forty per cent of the national total was produced in counties Donegal, Tyrone and Derry and the importance of the crop in these three counties was matched by an equally striking lack of emphasis upon flax cultivation in the main textile producing counties, Antrim and Down. In its geographical distribution flax tended to attain greatest popularity on the heavier and wetter soils of the western counties where it gave rise to a local forward linkage, spinning. Additional forward linkages in the form of weaving and bleaching, while evident in the western region, tended to be more concentrated in central and eastern ulster, especially in the linen triangle linking Belfast, Dungannon and Armagh. Thus as the degree of complexity in technique of production increased, and with it a corresponding dependence upon capital investment, the regional expression of the economic linkages became more spatially confined. In order to extend the core region of the manufacturing stages of the linen industry the Linen Board had sought to first extend cultivation of the basic staple ingredient; hence, the premiums offered in 1796 linked the diffusion of spinning and weaving technology with encouragement of flax cultivation, and not with a view to weakening the importance of the industry in Ulster but rather with the ambition of extending throughout the whole country the prosperity seemingly accruing to the northern province.

[25] A scheme to encourage flax growing in Scotland in 1780 had led to a total of 3,943 acres being sown by 1,569 claimants of a premium. See A.J. Curie, *The Scottish linen industry in the eighteenth century* (Edinburgh, 1979), p. 71. A good account of the regional dimension of flax growing in the eighteenth century Scotland is also to be found in W.H.K. Turner, 'Flax cultivation in Scotland: an historical geography' in *Trans. Inst. Brit. Geog.*, 55, (1972), pp 127-43. Turner indicates that the crop had virtually disappeared by the nineteenth century.

Figure 1. Flax cultivation 1796



The activities of the Linen Board were only partially successful and for the next century there remained unresolved the problem of diffusing a more intensive cultivation of flax into the southern provinces of Ireland. More significantly, it proved impossible to sustain a regular production of flax after the initial stimuli of the innovators waned. In 1816 Peter Besnard, a Linen Board inspector, acknowledged that there had been a considerable slippage in the production of flax in Munster: 'On the rich

grounds of Limerick, Tipperary, Clare etc. the high price of corn and cattle produced so much wealth, with such ease and so little trouble to the land occupier, that these pursuits, which gave useful employment to the numerous poor, were either neglected or totally abandoned.' [26] Munster, he pointed out, was producing only one-tenth as much flax as Ulster (Table 1).

Despite expansion in the national flax acreage to 140,000 acres by 1825, Ulster by the latter date still contributed two-thirds of the crop.[27] In 1828 the support premiums for the cultivation of flax were terminated upon the dissolution of the Linen Board and this, coupled with a growing agricultural recession, led by 1840 to a fifty per cent reduction of the 1825 flax acreage.[28] The decline of the crop in the years immediately before 1845 is difficult to explain, and hints at the crop's extreme sensitivity to fluctuating yields, price changes, official subsidies and import competition. In short, the production of an industrial crop such as flax by thousands of Irish farmers in the pre-Famine era points to the staple's keen price responsiveness to changing conditions within a market economy and raises questions about the extent to which many of even the smallest farmers of rural Ireland could be described as being engaged in a purely localised subsistence economy. As has been observed of flax growing in contemporary Europe: 'It goes without saying that with an agriculture so adapted to growing for the market rather than the farmer's own needs, a money economy prevailed.[29] The market responsiveness of flax was further enhanced by the fact that they crop was regarded as a risky venture, subject to extreme harvest fluctuations, and hence most likely to be engaged in when prices were high, and correspondingly neglected in times of declining prices. The overriding control of market forces continued to direct the cultivation of flax and only in Ulster did the staple control of market forces maintained the status of a mainstream economic activity. In 1841 the Flax Improvement Society was formed to popularise the crop [30] and in 1866 the Flax Extension Society was constituted by northern industrialists with the object of promoting 'the skilled growth and handling of the flax crop, and to give facilities for the purchase of seed and the sale of the fibre.[31] The long term effects of both associations were negligible.

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[26] P. Besnard, *Observations on promoting the cultivation of hemp and flax and extending the linen and hempen manufacturers in the south of Ireland* (Dublin, 1816), p. 10.
[27] Gill, *op. cit.*, p. 294.
[28] W.G. Rimmer, *Marshalls of Leeds: flax spinners 1788-1886* (Cambridge, 1960), p. 243.
[29] Slicher Von Bath, *op. cit.*, p. 242.
[30] Bell and Watson, op. cit., p. 156.
[31] *Annual report of the Flax Extension Association* (Belfast, 1870), p. 6.

Table 1. Flax acreage 1814

Ulster	*acres*	*Munster*	*acres*
Antrim S.	2,275	Tipperary	200
Antrim N.	5,575	Clare	100
Armagh	15,000	Kerry	800
Londonderry	15,166	Limerick	1,750
Tyrone E.	2,500	Cork N.	230
Tyrone W.	9,755	Cork S.	3,600
Donegal	5,400	Waterford	40
Down E.	3,760		6,720
Down W.	2,607		
Fermanagh	1,800		
Cavan	3,000		
Monaghan	5,425		
	72,263		

In the fifty years following the Famine the acreage under flax fluctuated wildly, growing from a base of 91,000 acres in 1850 to a peak of 301,000 acres in 1864, and declining to 35,000 acres at the close of the century as shown in Figure 2.[32] Undoubtedly the peak period of flax cultivation was the decade of the 1860s during which more than 200,000 acres were grown in most years. At no other time in Irish history, either before or since, did flax occupy such a major niche in the agricultural system. The peak of its popularity was largely due to the effect of the cotton famine of the 1860s and the corresponding rise in linen production as manufacturers strove to take advantage of the vacuum in the textile trade. Similarly the flax acreage increased by fifty per cent during the years 1878-81, another period of cotton slump. The economist Ó'Gráda has interpreted nineteenth century fluctuations in the supply of flax, wheat, oats, barley, mutton and poultry in terms of the continued responsiveness of those products to changing prices[33] and this conclusion supports that suggested by Barrington in 1926; 'there is not a scintilla of evidence to suggest that the Irish farmer has regulated his productive activities other than in accordance with the economic tendencies of his time.[34] Contemporary observers were also aware of the rational economic tendencies of Irish farmers and in 1862 the Inspector of Factories noted that the supply variations were

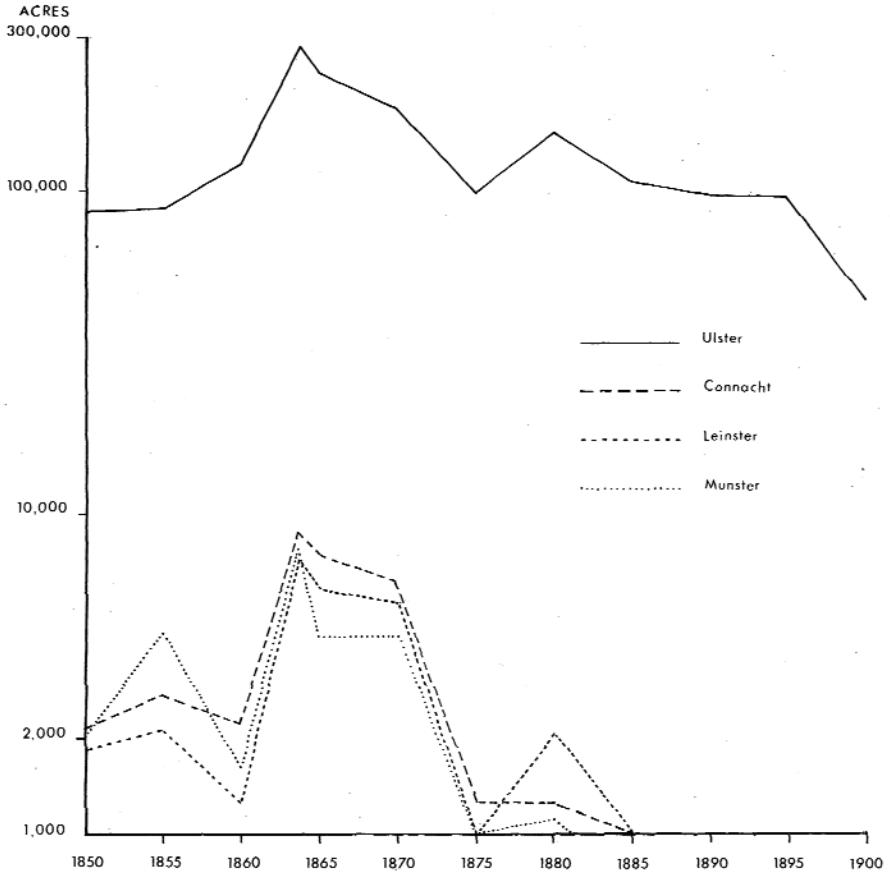
> …chiefly caused by the comparative price of grain. When grain brings a high price the breadth of crop under flax is

[32] Figures for the acreage under flax were compiled by the Flax Supply Association of Ireland, *Annual Reports*, especially 1879, 1895 and 1905.
[33] C Ó'Gráda, 'Supply responsiveness in Irish agriculture during the nineteenth century' in Econ. Hist. Rev., 28, 2 (1975) pp 312-17.
[34] T. Barrington, 'A review of Irish agricultural prices' in *Stat. Soc. Ire. Jn.* 15 (1926-7), p. 279.

> diminished, while if it remains at a low rate, the farmer is naturally induced to sow more flax seed.[35]

The speculative nature of the crop is a satisfactory explanation for the rise in popularity of flax in the years indicated in Figure 2; but the long term trend of decline initiated during the last third of the nineteenth century, is also reflective of the nature of the staple and the changing structure of Irish farming. The harvesting and scutching of the flax crop was exceedingly labour intensive and best suited to cultivation in small plots.

Figure 2. Flax acreage 1850-1990 by province



But as rural outmigration became a feature of life in post-Famine Ireland and labour costs gradually increased, the crop could no longer be as profitably harvested by a family whose sons and daughters were now settled in Belfast, Liverpool, Toronto or Boston. This factor was compounded by the steady increase in farm sizes and the elimination of

[35] *Inspector of Factories: Reports with appendices for the half year ending 30 April 1862*, p. 114, H.C. 1862. [C3029] xxii.

many of the small holdings upon which flax had been traditionally grown, for as was observed in 1862

> There is another influence working against an increase of flax cultivation in Ireland, namely the gradual introduction of the Scotch and English system of tillage farming on a large scale. As farms increase in size and the labour becomes dearer, it is probably that flax will be even less grown. It is essentially the small farmer's crop, sown by himself, and cleaned, pulled, steeped, and even scutched by his wife and children.[36]

This tradition of small patches of flax which in aggregate contributed a crop of major proportions had been the support of the cultivation of the staple since the early eighteenth century and that tradition persisted until the eventual disappearance of the crop. As late as 1904 the Flax Supply Association reported that three-quarters of all Irish flax was grown in plots of less than two acres (Table 2). It was the weakening of this tradition of micro-scale cultivation in Irish agriculture and growing competition from cheaper imported flax that inevitably spelled an end for the cultivation of Irish flax.

Table 2. Irish Flax Growers 1899 and 1904

Size of flax plot	*1899* (%)	*1904* (%)
0.25 - 1 acre	38.6	37.9
1.25 - 2 acres	36.6	39.7
2.25 - 3 acres	17.0	14.5
3.25 - 4 acres	5.8	4.9
4.50 acres and upwards	2.0	3.0

Fluctuations in the acreage of flax in the second half of the nineteenth century had marked regional implications. As Figure 2 indicates the major share of the crop was produced in Ulster. At no time in the period 1850-1900 did the northern province produce less than ninety per cent of the crop and indeed after 1885 the annual combined production of Leinster, Munster and Connaught amounted to less than one per cent of the national total: Ulster dominance had been replaced by an Ulster monopoly. The economic historian, Kennedy,[37] has recently noted that in the period 1850-1910 flax cultivation displayed a greater degree of regional specialisation than any other crop. Only during periods of exceptionally high prices was this degree of specialisation relaxed and

[36] *Idem.*

[37] L. Kennedy, 'Regional specialisation, railway development and Irish agriculture in the nineteenth century' in J.M. Goldstrom and L.A. Clarkson (ed.), *Irish population, economy and society* (Oxford, 1981), pp 173-93.

thus in the years 1862-66 when the national flax acreage increased by 75 per cent, the recorded provincial increases were: Ulster 67 per cent, Munster 227 per cent, Leinster 785 per cent and Connaught 352 per cent. It was the provinces outside of Ulster that most clearly demonstrated the speculative nature of the crop, while the northern region tended to remain a steadier core of production and at all times produced the bulk of the national acreage.

The regional implications of the data illustrated in Figure 2 are analysed in greater details in Figures 3, 4 and 5 which map the production of flax, on a Poor Law Union basis, for the years 1851, 1865 and 1900 respectively. At the time of the agricultural census of 1851 (Fig. 3) the dominance of central and north-western Ulster in flax cultivation was evident, but, strikingly, flax was also being cultivated in at least a limited manner in every one of the one hundred and sixty-three Poor Law Unions in the country, albeit in some unions the amount grown did not extend beyond ten acres.

Figure 3. Flax acreage as a percentage of arable land 1851 (Poor Law Unions)

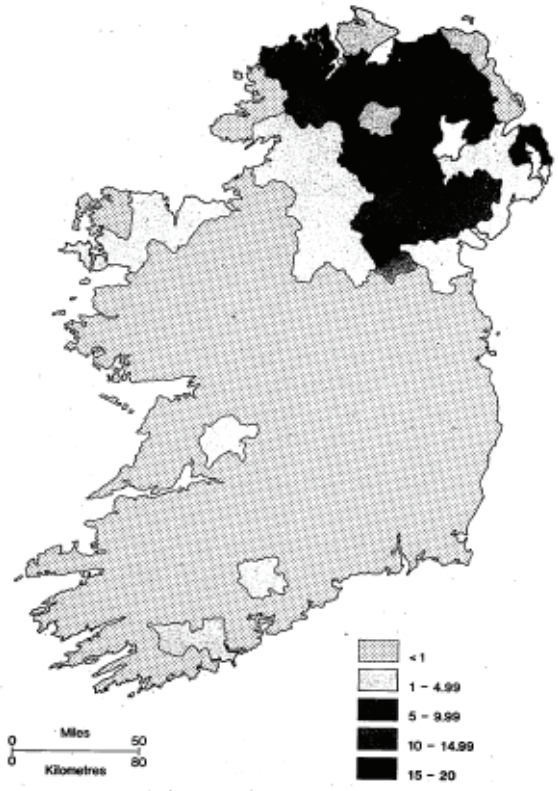
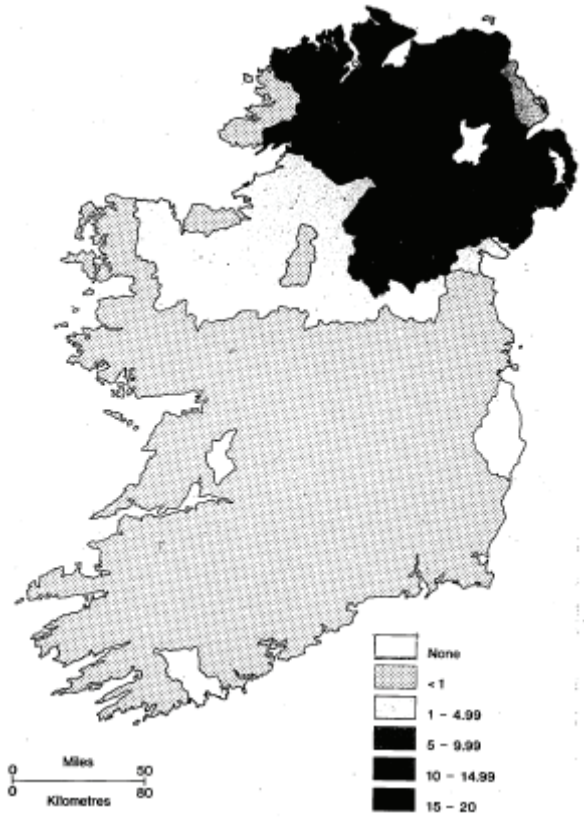


Figure 4. Flax acreage as a percentage of arable land 1865 (Poor Law Unions)



In more than two-thirds of the country less than one per cent of the arable acreage was devoted to flax and the locally important but isolated unions in Munster i.e., Scarriff in Clare, Fermoy and Dunmanway in Cork, were the legacy of eighteenth century landlord attempts to foster flax cultivation, sometimes through the introduction of Protestant weavers from Ulster.[38] On the borderlands of south-west Ulster, in Mohill Union in Leitrim, and Newport, Ballina, and Killala Unions in Mayo the linen industry had spilled over to create a periphery on which small scale flax cultivation and spinning were conjoined activities. But there, the additional forward linkage of weaving remained largely underdeveloped, the finished yarn being sold in fairs and markets to dealers from Ulster. A similar overspill was evident to the east in the Louth unions of Dundalk and Ardee, which served the formerly important spinning and weaving centre of Drogheda. Within Ulster the crop was not of uniform appearance. Throughout Inishowen and much of south-west Donegal, all of Fermanagh, south-west Cavan, east and north Down, north Armagh, south and east Antrim and mid-Tyrone the importance of flax was limited, being no greater than in the adjoining

[38] Gill, *op. cit.*, p. 84 details the promotional activities of a landlord, Cox, in Dunmanway, Co. Cork in the year 1735.

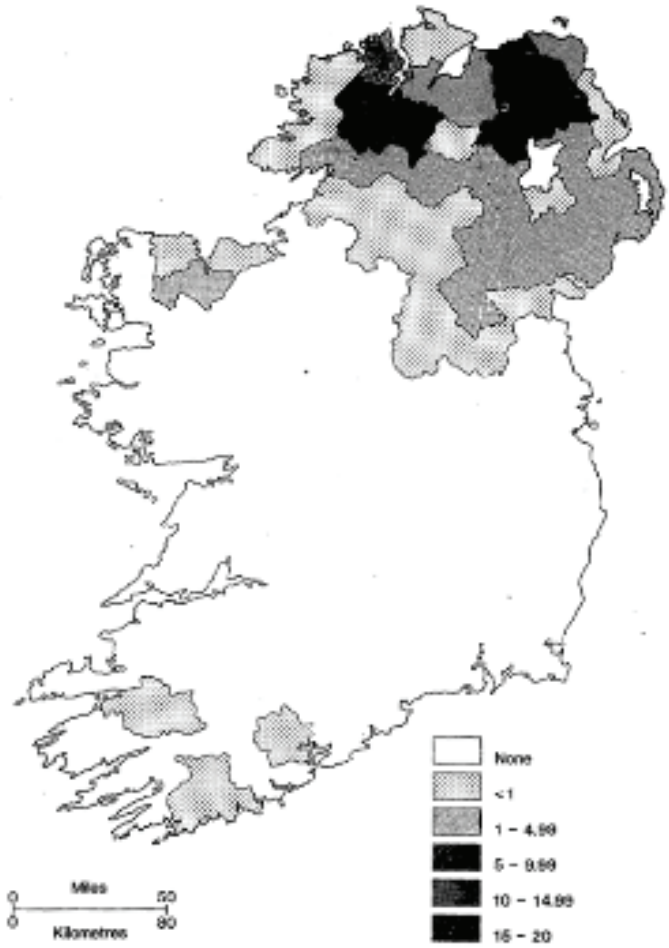
borderland areas of Connaught and Leinster. This zone of peripheral importance included Fermanagh where the linen manufacturing was negligible and the Laggan valley and Lurgan areas in the east of the province which constituted the cores of intense production of the linen fabric. It was in the economic shadow of this core zone of weaving that flax cultivation was important. Thus in the lower Bann valley of Antrim, mid-Armagh, north Monaghan and Cavan, east Tyrone and much of Derry the flax crop occupied between five and fifteen per cent of the arable land. But it was in the Lagan area of Strabane and Letterkenny Unions in east Donegal and Tyrone, and in the Cavan Union of Cootehill that flax growing was most intense, constituting almost one-fifth of the arable area. The core of specialised flax cultivation was thus to the south and west of the main manufacturing zone and in part the importance of the crop in these areas represented an attempt by the farmers of south and west Ulster to maximise their incomes in the face of the contraction of domestic manufacturing from the periphery to a factory belt centred on Belfast and its immediate hinterland.

In the mid-1860s when the acreage of flax reached its zenith there was a noticeable increase of cultivation in north Leinster and Connaught as farmers took advantage of the rising prices for the crop. But the most significant change took place in ulster where the zone of most intense cultivation was extended to include a broad swathe running through the Lower Bann valley, along the western shore of Lough Neagh and the small farm areas of mid and south Armagh and north Monaghan.[39] Here again the economic shadow effect of the manufacturing zone was readily apparent, although throughout virtually all of east Ulster there was a significant increase in the acreage under flax. Overall, therefore, the regional pattern of flax cultivation, even at a time of unprecedented demand, continued to exhibit a distance-decay aspect, with the core area being located on the perimeter of the main weaving area and a steady decline in intensity of cultivation being evident as distance increased from that core zone. The core-periphery relationship was further emphasised in the concluding years of the century when the flax acreage fell to one-sixth of what it had been forty years earlier. From Figure 5 which illustrates the extent of the crop in 1900 it is evident that throughout two-thirds of the country flax no longer featured as an optional crop. The small acreages in Munster stood as relics of a former era, testimony to the failure of previous promotional schemes.[40] But even in its traditional heartland the crop had contracted more than five per cent of the arable land and in Ballymoney Union alone did it achieve a position of more than fifteen per cent. The lower Bann valley and the Laggan area to the west of the province constituted the last cores of the once dominant staple, and within a generation the blue flowers of maturing flax would become a memory even there and the landscape

[39] J. Johnston, 'Flax and linen in the Clogher valley' in *Clogher Rec.*, 11, 2 (1983), pp 287-94.
[40] Flax supply Association, Annual report (1887), p. 25 indicates that a total of £7,495 was spent in the years 1868-77 in order to encourage flax cultivation in the south of Ireland.

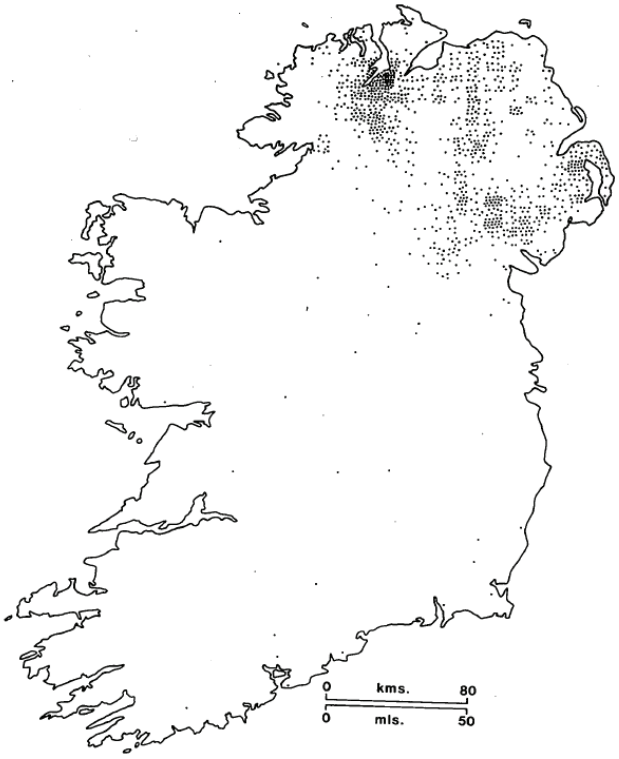
would be dotted with abandoned flax holes and ruined scutch mills. By the eve of the First World War 85 per cent of the flax used in the production of Irish linen was imported, coming mainly from Belgium, Holland and Russia. A century earlier the proportion of imported flax had stood at a mere 27 per cent of the linen industry's inputs. At the peak of its success the Irish linen industry had lost its organic link with the locally grown staple which had first stimulated textile production.[41]

Figure 5. Flax acreage as a percentage of arable land 1900 (Poor Law Unions)



[41] Flax Supply Association, *Annual report* (1907), p. 8 claims that 85 per cent of the flax used in the manufacture of Irish linen was imported from Russia, Holland and Belgium. It is estimated that three-quarters of the flax used in Ireland in 1820 was produced domestically, Warden op. cit., p. 412.

Figure 6. Flax scutching mills 1860



Flax scutching

The distribution is in part explained by its geographical relationship to the manufacturing core of the linen industry but it is also related to the provision of scutch mills, an inherent requirement for the preparatory processing of the crop. Scutching by water-driven mills had been first developed in Scotland[42] but by 1760 an Irish mill had been developed in Donegal and this prototype was later modified along Scottish lines. In 1795 the Linen Board specified a premium of £300 to encourage development of mills and by 1802 scutch mills were to be found in every parish in Co. Down and were equally popular throughout Ulster.[43] Some 600 mills were in operation by the eve of the Famine and over the next quarter of a century the number almost doubled. In 1860, at the commencement of the boom in flax cultivation, there were a total of 1,045 scutch mills operational in the country and of these, 1,017 were located in Ulster, 15 in Leinster, 8 in Munster, and 5 in Connaught.[44] The distribution of these mills has been mapped in Figure 6 and it can be seen that the locational pattern of these small water-powered operations may be directly correlated with the distribution of flax cultivation. The

[42] Durie, *op. cit.*, p. 72 indicates that there were 253 scutch mills in Scotland in 1770 and 408 in 1800.

[43] H.B. Gribbon, *The history of water power in Ulster* (Newton-Abbot, 1969), p. 105.

[44] Return of mills in Ireland constructed for scutching flax, Agricultural census of Ireland (Dublin, 1860), pp 203-19.

greatest density of mills was to be found in east Donegal where especially in the baronies of Raphoe and Kilmacrenan virtually every townland had a mill. In the Lower Bann valley of Antrim, the Clogher valley in Tyrone, the Callan and Cusher valleys in Armagh, and the Upper Bann and Lagan valleys in Down, there was likewise a proliferation of small establishments.[45] Many of these valleys had mill races every few hundred yards serving scutching, spinning, weaving and bleaching mills and they constituted one of the most impressive densities of water-powered textile-related mills in Europe. In 1875 it was recorded that within a five mile radius of Cookstown there were thirty scutch mills in operation.

> These are erected on various small streams in the neighbourhood, and are generally worked by farmers. The mills are of a very primitive kind, being a small house thatched by the straws from the flax after being scutched.[46]

Factory Inspectors decried these simple technological extensions of the agricultural process of flax cultivation and pointed out that man of them were 'located in out of the way places, difficult of access, conveyances uncertain.[47] Such mills, in their scale, locations, and density clearly articulated the nature of the local farming system and were for the most part owned by farmers.

> The flax is stacked in the farmyard, and when a portion or the whole is sold, is scutched with expedition. The farmer who has a scutch mill, not only scutches his own flax but lets out the use of it to other farmers…the farmer who sends his flax to his neighbour's mill sends the person to be employed in scutching it.[48]

The small scale and remote location of many flax mills emphasised their agricultural identity and for the most part the seasonal rhythm of scutching complemented that of farming. No conflict of time or interest was implied. As Figure 7 indicates, the majority of mills (65 per cent) worked between three and six months of the year, and only twenty mills were in operation for longer than nine months of the year. For most farmers-cum-mills owners, therefore, the scutching season fell between October and March, at a time when agricultural activity was in a lull between harvest and spring planting. Furthermore this seasonal rhythm coincided with the period when stream flow would have been greatest, thereby enabling mills to be located on minor streams which would have

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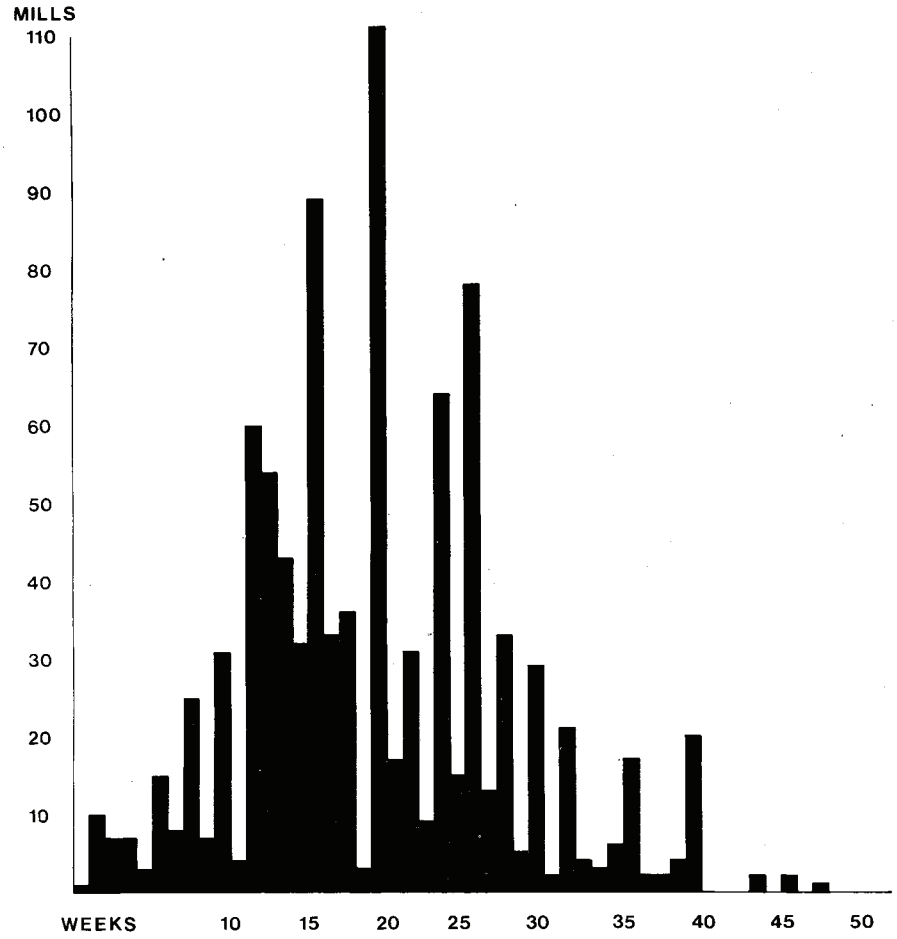
[45] W.J. Smyth, A social and economic geography of nineteenth century County Armagh, unpublished Ph.D. thesis, N.U.I., 1973.
[46] Inspector of Factories, *op. cit.*, p. 82, 1876 [C 1434] xvi.
[47] *Ibid.*, p. 67, 1877 [C 1794] xxiii.
[48] *Ibid.*, p. 69.

lacked sufficient flow to turn the mill machinery in summer.[49] The scale of the mills and their period of operation was sufficient to cater for the flax produced, and indeed there was considerable overcapacity, but the local provision of a mill, at a scale of one per townland in the zone of greatest production, was warranted by the bulky nature of the unscutched crop and the difficulty of transporting it over long distances. The scutch mills were but a fixed and larger version of the grain threshing mills that appeared in the closing decades of the nineteenth century.

Figure 7. Number of weeks worked by flax scutching mills 1860



The cost of erecting a simple scutch mill in the mid nineteenth century was approximately £200[50] and the modest investment was worthwhile only if a guaranteed supply of flax could be expected. For this reason, the bulk of the investment in scutch mills was concentrated in Ulster but the virtual absence of mills outside of the northern province proved to be

[49] W.J. Smyth, 'Locational patterns and trends in the Irish linen industry' in *Ir. Geogr.*, 8 (1975), pp 97-112.
[50] Gribbon, *op. cit.*, p. 106.

at once a cause and effect of the more speculative and less intense cultivation of flax. The acreage of flax grown in Leinster, Munster and Connaught scarcely justified a network of mills similar to that of Ulster, but the absence of mills was in itself a disincentive for cultivation. Imperfect marketing structures and transport costs to mills implied a smaller margin of profit in those regions. It was a self-reinforcing weakness which was frequently referred to by the Flax Supply Association, but the dilemma was never solved and thus the locational pattern of scutch mills must be seen as a partial explanatory factor in any analysis of the distribution of flax cultivation in Ireland.

Table 3. Number of scutch mills and acreage under flax 1865-1910

Year	*No. mills in Ulster*	*No. mills in Ireland*	*Acreage of flax*
1865	1314 (92%)	1426	251,000
1870	1409 (93%)	1518	194,000
1875	1258 (94%)	1330	101,000
1880	1140 (96%)	1182	157,000
1885	1075 (97%)	1103	108,000
1890	1045 (98%)	1059	96,000
1895	933 (98%)	952	95,000
1900	804 (98%)	815	47,000
1905	721 (98%)	733	46,000
1910	597 (99%)	601	45,000

As the flax acreage waned in the last third of the nineteenth century there was a corresponding diminution in the number of scutch mills (Table 3). However, as the data indicate, the rate of attrition in the provision of scutching facilities was significantly less than the rate of decline in the flax acreage. In the period 1865-1910 the number of mills declined by fifty-five per cent, while the flax acreage dropped by a massive eighty-two per cent. Throughout the period, therefore, there remained a growing surplus capacity in scutching facilities and while outside of Ulster the absence of mills may have been a factor in discouraging flax cultivation, such was not the case in the northern province. In that core region of cultivation the average decline was a function of ongoing structural changes in both the Irish agricultural system and within the textile manufacturing process itself. In combination these forces led to an increased dependence upon important Belgium and Russian flax. A government report on the state of the flax industry recognised the perilous state of the industry in 1911 and its words of warning proved to be a prophetic description of the demise of the staple crop.

> The crop seems to be affected by a process of gradual deterioration, only occasional and temporary improvements being experienced … It is evident that if deterioration continues it must in a few years result in the almost total extinction of the industry in Ireland, which

> would be a serious matter for the farmers of Ulster … It seems a rather serious thing to allow to go out of cultivation a crop, for the successful production of which this country has many advantages over most others, and to have to confine our entire energies to those crops which can be grown successfully in almost all countries and in the production of which we have no exceptional facilities or advantages.[51]

By the end of the Second World War the process of extinction was virtually complete.

Conclusion

On the eve of the First World War, Belfast was firmly established as the linen capital of the world and in international markets Irish linen was unrivalled in terms of quality and design. The regional craft industry of the eighteenth century had come to full fruition. In the course of the previous two centuries a locally produced staple, flax, had generated an increasingly sophisticated set of forward linkages in the form of scutching, spinning, weaving and bleaching activities but from the mid-nineteenth century onwards it was apparent that the usefulness of the domestic staple was being transcended. Paradoxically, as Irish linen manufacturing attained a position of world dominance it assumed the characteristics of an industry in which the bulk of the raw material was imported and the majority of its production was destined for export. Far from being extended successfully beyond Ulster the industry was increasingly confined to a zone within a radius of twenty-five miles of Belfast and the originating link with the agricultural sector was virtually severed. In the midst of the linen success, domestic flax had become a redundant staple. Through its success Irish flax had, in the terms of staple theory, 'become dethroned by its own creation'.

Acknowledgement. The assistance of Dr. W.H. Crawford in providing statistical data is gratefully acknowledged.

[51] Department of Agriculture and Technical Instruction for Ireland, *Report of the departmental committee on the Irish flax growing industry* (Dublin, 1911), p. 449.

CHAPTER 10

ADOPTION AND DIFFUSION PROCESSES IN THE MECHANISATION OF IRISH AGRICULTURE

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First published in *Irish Geography* (1992), 25(1), 33-53.

Introduction

The modernisation of production and the growth of output in the agricultural sector in Ireland, as in many other countries, have been associated with the adoption of many innovations which have contributed to a very significant decline in labour inputs and its replacement by mechanisation. In farming the process of mechanisation can be understood as the adoption of production methods in which human labour and draught animals are replaced to a high degree by technology which can result in greater productivity of both agricultural labour and land. It is part of a wider range of processes which result in a significant level of structural adjustment in the organisation of the total economy. Mechanisation facilitates this adjustment and enables the fewer remaining farmers to achieve higher income levels and an improved standard of living. However, farmers vary in their ability to respond to the requirements of this process for a variety of reasons including economic constraints, demographic factors and in some instances locational disadvantages. The differential impacts of these factors between fanners introduces significant temporal and spatial dimensions into the adoption and diffusion of mechanisation. While there have been many studies of the spatial structure of agricultural production in Ireland (Stamp, 1931; Gillmor, 1977, 1987; Homer *et al.*, 1984; Walsh, 1991) and of the sources of variation in growth rates (Conway, 1975; Cuddy, 1982; Boyle, 1987), there has been surprisingly little systematic analysis of the influences on the adoption and diffusion of innovations in Irish agriculture.

In the 1960s Bohlen and Breathnach (1968) investigated the levels of adoption of seventeen innovatory agricultural practices among a sample of 600 farms which were randomly selected across the 26 counties of the Republic of Ireland. Since the main focus of this sociological research project was on the most useful sources of information at each stage of the adoption process, it did not explore either the scale or the sources of variation in adoption rates between counties (Bohlen and Breathnach, 1970). The influence of demographic and farm-related factors on the adoption of twenty innovations on farms in southeast Galway was reported on in 1982 by Walsh. Studies which have considered locational influences on adoption and diffusion include Higgins' (1977) investigation of the adoption of deep ploughing techniques for land drainage in west Kerry, and Humphrey's (1981) analysis of the spread of

the Small Farm (Incentive Bonus) Scheme among western counties. Countrywide studies have been extremely limited, one of the few exceptions being Homer's (1984) study of the diffusion of credit unions between 1958 and 1982.

This study uses a unique data set extending over sixty years which is finely disaggregated for small geographical units. The data relate to tractors, the adoption of which has been shown to be related to many other agricultural innovations (Horner and Walsh, 1981: Walsh, 1982). The next section provides a brief review of the processes affecting innovation adoption and diffusion which have been identified in the literature. These general processes are brought together in a model which is suggested as appropriate for research in Ireland. The remainder of the paper uses the proposed model as a framework for discussing the spatial diffusion of tractors from the 1920s up to the present.

Innovation Adoption and Diffusion Models

Mechanisation involves several innovations. The processes which influence the adoption of innovations have attracted a considerable amount of attention from researchers in several disciplines who have identified a wide range of processes which affect the rates and patterns of adoption and diffusion (Jones, 1975; Blaikie, 1978: Brown, 1981: Rogers, 1983). Among geographers concerned with spatial diffusion processes, a number of different research traditions have developed (llbery, 1985). The earliest, associated with Hagerstrand (1952) stressed the role of learning and communication processes. The basic hypothesis in this approach is that increased awareness of new ideas will lead to favourable attitudes towards modernisation which will be conducive lo acceptance and ultimately adoption of innovations (Wilkening, 1956: Gartrell and Gartrelll, 1977: Hooks *et al*.. 1983). This implies that factors related to the effective flow of information are critical. Special significance was given to the distances between potential adopters as well as consideration of other physical barriers and individual sources of resistance which by transforming the information flows influence the morphology of the adoption surface. It was envisaged that diffusion would spread outwards from some initial adopters in a lateral manner until the entire landscape was covered (Hagerstrand, 1952. 1953). According to the Hagerstrand model, the spatial development of many diffusion patterns is characterised by the addition of new adopters around the original nuclei of introduction of the innovation. This contagious growth process was called the neighbourhood effect (Hagerstrand, 1967). This process on its own can only provide a partial explanation for empirically observed diffusion patterns.

An additional process which identifies the role of hierarchical effects in spatial diffusion has been proposed by Hudson (1969, 1972), Pederson (1970) and Berry (1972). In these papers, which are mainly concerned with diffusion of innovations through urban systems, it is envisaged that

the potential adopters can be organised into different hierarchical levels with diffusion taking place between most members of one level before proceeding to the next level. The importance of hierarchical filtering processes is also relevant in an agricultural context where a hierarchy of farms may be identified on the basis of criteria which could include farm size, enterprise specialisation, demographic attributes of the farm household, management skills and motivation, and access to credit (Yapa and Mayfield, 1978: Brown, 1981: Walsh, 1982; Shaw, 1985) These factors are particularly important in rural societies where agriculture is poorly developed and the costs of innovations are high relative to land or labour productivity levels. This is particularly true in the early stages of adoption of expensive items of machinery where the decision to adopt a tractor may also require a commitment to replacing a variety of horse drawn implements. Rates of adoption and diffusion can also be influenced by a variety of other factors including personal, psychological and sociological characteristics of the potential adopters (Jones, 1975).

The processes which contribute to neighbourhood and hierarchical effects are concerned only with the establishment of the demand surface for an innovation. These approaches are complemented by the market/infrastructure perspective which focuses on the supply of innovations to potential adopters (Brown, 1975). Through this approach attention is directed to the policies of diffusion agents. Their locations, targeting strategies, promotional activities and pricing policies may have a considerable influence on the pattern of adoption (Ilbery, l985; Unwin, 1988). While diffusion agents are concerned with increasing the demand for an innovation, there may be other factors which can distort the diffusion process. In this regard Freeman (1985) has demonstrated how early adopters can, through political processes, become pre-emptors of diffusion so that they can benefit from the excess profits that result from adoption of some innovations. Ii is the interaction of processes affecting both the demand for and supply of innovations which produces the temporal and spatial patterns of adoption and diffusion.

The foregoing discussion can be summarised in the following model. For the purpose of illustration it is assumed that the potential adopters (farmers) can be classified into a three-level hierarchy consisting of large, medium and small farms which may be defined in terms of size, or some other index of economic potential. In Figure 1(i) there are 60 farms, of which 12 are considered to be large, 20 are medium-sized and the remainder (28) arc small. It is also assumed that the spatial distributions of the three categories arc neither uniform nor random. The entire region is partitioned into three subregions (A. B. C.) with large farms predominating in A, medium-sized in B and small farms in C.

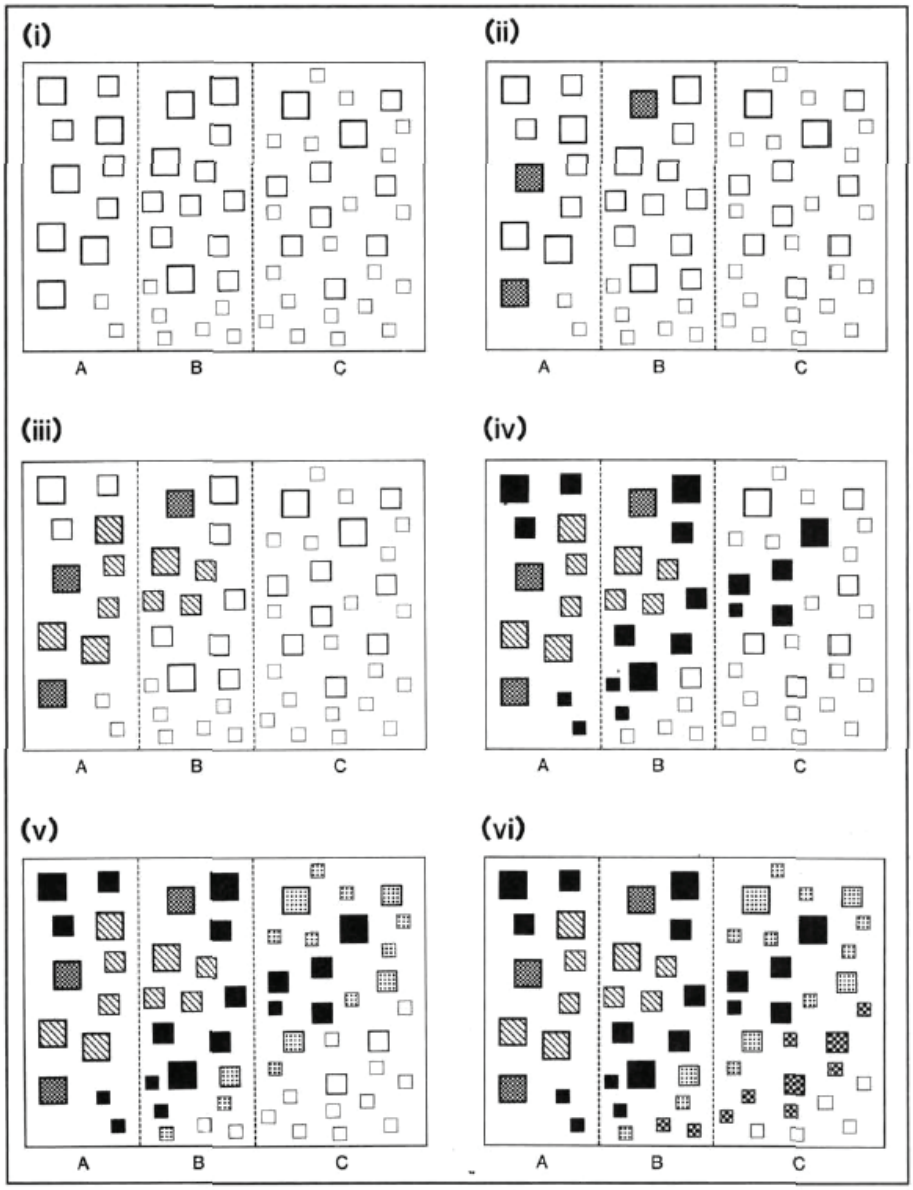
In the initial stages the innovation is most likely to be adopted on some of the largest farms. They are most likely to have the financial resources to purchase the innovation and they are also likely to benefit most from

adoption. At the very early stages the innovation is likely to be available from only a very limited number of outlets (Brown, 1975) and information flows are likely to be restricted to what may be derived from the mass media and more formal channels of a personal kind such as agricultural advisors, and commercial representatives (Jones, 1975). At this stage, while there are likely to be some clusters of adopters where the largest farms are concentrated. There are also likely to be some individual pioneers who may be located some considerable distance from the clusters (Figure l (ii)). Those at the top of the farmer hierarchy are likely to be pan of geographically extensive social networks so their propensity to adopt innovations is more likely to be influenced by their hierarchical position rather than their location (Smyth, 1975). The small number of outlets at this stage are likely to be restricted lo locations in or near the largest cities, in order to take advantage of their superior accessibility. This will be especially the case if the innovation has to be imported. After awareness has been created and evidence is accumulated (either formally or informally) to demonstrate the benefits of adoption the innovation spreads rapidly through the highest level in the hierarchy of potential adopters and begins to filler down to the next level. In Figure l (iii) the overall level of adoption is 20% but it has already reached almost 60% among the largest farms. These pioneers correspond with the "early adopters" identified by Rogers (1958). By this stage a strong neighbourhood effect is becoming evident as the increasing density of adopters facilitates more informal information exchanges between farmers in the same locality. The increasing demand for the innovation will be encouraged by a growing number of suppliers or diffusion agents (Brown and Cox, 1971: Brown, 1975) who are likely to form a distribution network that attempts to maximise sales potential. While the response of entrepreneurs at locations that meet the threshold level of sales potential may exhibit a strong random component (Brown, 1981) it is likely to reinforce the neighbourhood effect especially if there are pronounced regional differences in the distribution of potential adopters at each hierarchical level. Apart from the role of suppliers, the rate of adoption can also be influenced by government policies towards agriculture which may have unequal regional impacts.

The diffusion processes continue to operate until almost everybody has adopted. In Figure l (iv) while half of all the farms have adopted, the diffusion is complete amongst the large farms and there is over 70% adoption on the medium-size farms. The medium-size farms which have not adopted are located in sub region C where they are furthest away from the initial source of the innovation. Adoption has commenced on some of the smallest farms, but mainly among those located adjacent to the earliest adopters in sub regions A and B. At this stage some additional factors may begin to influence the diffusion process. These include the availability of some low cost second-hand items from the earliest adopters who are already upgrading their technology, and also improvements in the income position of many small farmers who, having

been marginalised rather than modernised, have taken on another occupation. In Figure l (v), adoption occurs on most of the remaining medium-size farms and there is a three-fold increase in diffusion among small farms. There is a strong neighbourhood effect in the diffusion at this level due to a combination of the communication and diffusion agency factors. The final stage may be quite slow as it involves adoption by those identified as "laggards" by Rogers (1958), who are mostly imitative in their behaviour (Jones, 1975) and also severely constrained by structural and situations] factors in their ability to adopt the innovation.

Figure 1. Hierarchical and Neighbourhood Innovation Diffusion Model



The temporal dimension implied by this model of diffusion conforms to a logistic growth path (Casetti, 1969). While the timing of the commencement of adoption at any location is influenced by the interaction of processes affecting both the supply and demand for an innovation, the pace of diffusion over time is likely to be influenced by other factors. These include the historical legacy in relation to the structure and distribution of the farm hierarchy, trends in output and incomes which may in turn be influenced by a range of government policies, as well as refinements and improvements to the innovation itself which may make it more attractive to potential adopters.

The Adoption and Diffusion of Tractors in Ireland

This section traces the introduction of tractors into Ireland and their subsequent diffusion throughout the island. The main data sources are the agricultural census enumerations taken in the Republic of Ireland by the Central Statistics Office and by the Ministry of Agriculture in Northern Ireland. These are supplemented by information on suppliers gleaned from the catalogues of the Annual Spring Agricultural Show in Dublin, as well as from interviews with individuals involved in the agricultural machinery trade.

The introduction to Ireland of tractors and other forms of mechanisation came relatively late via a pattern of international diffusion from the United States to Britain. The origins of the tractor can be traced back to the earliest self-propelled steam engines which were developed around I860 for use on the wheatlands of north Dakota and Minnesota. The weight and cumbersome design of these machines greatly restricted their use to operations such as grain threshing. It was not until 1892 that the first practical self-propelled gasoline tractor was built by John Froelich of Iowa, where in 1905 the first business concerned exclusively with the manufacture of tractors was established by C.W. Hart and C.H. Parr (Rasmussen, 1982). The technology was not transferred across the Atlantic until the early years of this century, so that by 1910 the number of tractors in Britain was probably less than fifty (Cawood, 1980). The threat of food scarcity during the First World War demonstrated the need for Britain to increase its level of domestic agricultural production. A tillage order of 1917 required farmers to substantially increase the amount of ploughed land. In a situation of limited availability of manpower, the only solution was to encourage the adoption of tractors for towing ploughs. At this stage, however, there were only two British firms manufacturing tractors: Saundersons in Bedford and the Austin Motor Company in Birmingham. Since their combined output was not nearly sufficient to supply the expanding market, there developed a high level of dependence on American imports. The British government in 1917 arranged to have 6000 Fords on tractors imported from North America, which enabled Ford to become firmly established in the UK market. They also attempted through demonstrations and competitions

to provide information and instruction on the proper use of tractors for ploughing.

A number of importers and distributors quickly turned their attention to Ireland. It has been estimated that in March 1917 there were only 70 tractors in the whole of Ireland (Martin, 1984). A series of demonstrations, which commenced at Cullybackey near Ballymena in Antrim, was organised throughout Northern Ireland by Harry Ferguson who had developed a revolutionary type of plough (Martin, 1984). The effectiveness of demonstrations as a means of creating awareness and encouraging adoption is evident from the fact that the total number of tractors in Ireland had increased to about 300 by the autumn of 1917 (Martin, 1984). Immediately after the First World War, firms from London, Bedford, Dursley, and Birmingham began to appoint agents in Ireland (all in Belfast and Dublin) for the distribution of tractors and tractor ploughs as well as lubricants. The agents used important public events such as the Annual Spring Agricultural Show organised in Dublin by the Royal Dublin Society to exhibit the new machines and implements. The catalogues for these events in 1919 and 1920 show that no less than eight different models of tractors were on display, most of which were American imports into Britain. The emphasis in some of the early advertisements was on the potential economic gains from adopting the new technology: for example the advert for the Saunderson "Universal" tractor proclaimed in large lettering that "Time,! Money,!! Labour,!!! today's most perplexing problems" could be solved by buying one of" their tractors.

Table 1. Number of tractors in the Republic of Ireland, 1928-1988 and Northern Ireland, 1944-1990

Republic of Ireland		Northern Ireland	
Year	Tractors	Year	Tractors
1928	804		
1939	2,067		
1947	5,865	1944	6,789
1950	13,569		
1955	29,744	1954	20,019
1960	43,697	1959	28,930
1965	60,167	1966	35,143
1970	84,349	1972	33,420
1975	114,218	1975	36,898
1980	145,100	1980	47,600
1985	148,100	1984	46,340
1988	147,900	1990	43,700

Source: Central Statistics Office. Dublin, and Ministry of Agriculture for Northern Ireland. Belfast.

The adverts also emphasised the simplicity of the new technology which was described as "absolutely foolproof". However, within a few years most of the tractors exhibited in Dublin in 1920 were no longer available as their American and British manufacturers were put out of business by Henry Ford whose company had been working since 1915 on a model that would dominate the tractor market. A conveyor bell system of production was introduced into Ford's specially designed new plant at Cork in 1917 so that in July 1919 the company could commence producing the "Fordson" on a mass scale, al first solely for the British government. By 1925 the "Fordson" was exhibited al the Spring Show in Dublin by London-based firms. The advertisements for this machine which marked the arrival of the modern tractor (constructed as a unit, totally enclosed, light, speedy and easily manoeuvred) emphasised its economy and labour saving characteristics. The message was simple and direct: "it has been proven that one Fordson tractor does as much work in a day as six horses. Six horses eat not only an immense quantity of provender in the year but the attention they require eats up a great deal of time. Horses simply eat money all the time they stand idle. The Fordson eats nothing and requires no attention when it is not working. Get a Fordson for your farm. Cut out waste and bank the money your horses eat".

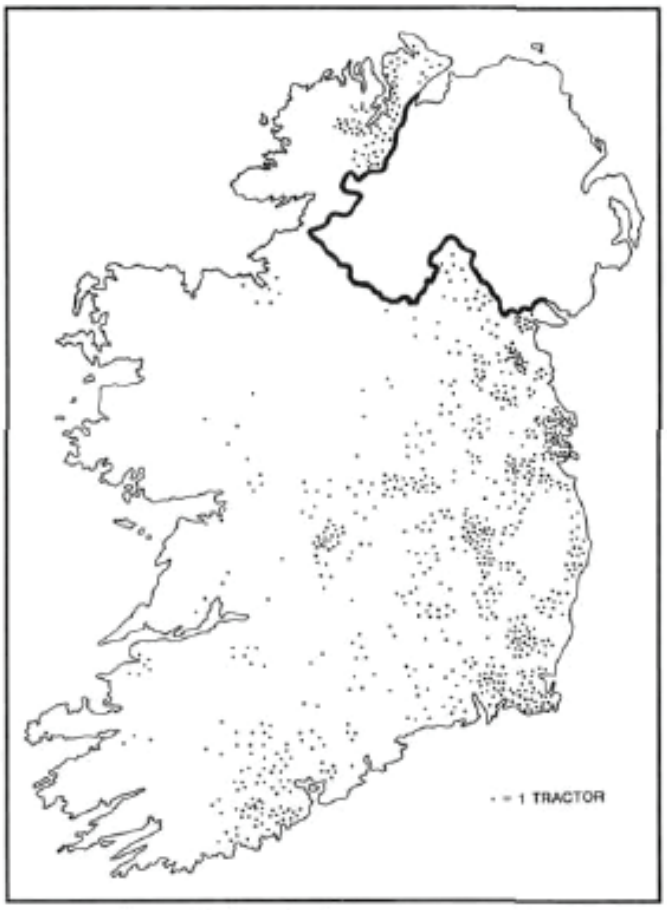
The 1920s: Early adoption at key locations

The emphasis in the early Fordson advertisements on the substitution of tractors for horses and labour on the farms was well placed. In 1926 just over half of the labour force in the Republic of Ireland was involved in agricultural occupations which included farmers, farmers' relatives assisting, and agricultural labourers. Around the same lime there were approximately 320,000 horses used for agriculture, the maintenance of which would have required at least ten percent of the land used for crops and pasture. While there were probably some tractors imported into Ireland from as early as 1910, it was not until 1928 that the first official enumeration was made by the Central Statistics Office which revealed that there were just over 800 tractors in use on farms. Since then there has been a steady growth in the numbers up to the 1980s with almost three fifths of the total increase concentrated in the period since 1965 (Table 1). In Northern Ireland adoption occurred more quickly, though it is more difficult to trace as there does not appear to be any census data for the period prior to 1944.

The spatial patterns created by the adoption and diffusion of tractors and other items of machinery can be traced in considerable detail from the data compiled for over 2000 District Electoral Divisions and 160 Rural Districts in the Republic by the Central Statistics Office. By 1928 there was already a well-defined geographical pattern (Figure 2). The largest concentrations were in the southeast with 108 enumerated in Wexford alone, and 110 in an arc extending from south Kildare westwards through Mountmellick and Tullamore districts to Borrisokane district in north

Tipperary. The next largest concentration was 92 in county Cork, mostly to the west and north of the city. More localised concentrations were evident around Dublin, Ardee and Dundalk in Louth, and three districts in northeast Donegal. Two-fifths of the tractors were in counties Dublin, Kildare, Wexford and Cork which jointly accounted for about one-fifth of the crops and pasture land. The level of concentration in Donegal was over twice what might have been expected on the basis of its share of crops and pastureland. The level of adoption declined as one moved away from these centres. There were 49 districts without any tractors and another 56 where there were fewer than five. Apart from the Donegal concentration, early adoption in the western counties was mostly confined to districts where the topography is generally fiat, as in east Galway and parts of north Kerry. While the overall pattern demonstrates the existence of a number of key nodes of early adoption it also shows that the pioneers throughout much of the country were widely dispersed, oftentimes at considerable distances from the next adopters. For example, even at this early stage there was some adoption in remote locations such as Ventry in the Dingle peninsula which is over 160 kms from Cork and 350 kms from Dublin.

Figure 2. Distribution of tractors, 1928



A number of explanatory factors can be suggested for this pattern. These include the distributions of tillage, hired agricultural labourers and farm size. Since the early tractors were designed primarily to speed up operations such as ploughing, the distributions of crops such as oats, potatoes, turnips and barley which accounted for almost 88% of the ploughed land is worth noting. Stamp (1931) showed that in 1929 these crops were concentrated mostly in south Leinster (especially Wexford), the lowlying parts of Cork: Louth, Monaghan and east Cavan in the northeast: the lowlands and coastal strips in Donegal: and the well-drained limestone region extending from north Clare through cast Galway into Mayo. Of particular significance was the location of commercial crops such as barley in Wexford, the valleys of south Leinster, and county Louth; wheat which was particularly important in Dublin, Wexford and south Cork: and potatoes in parts of Louth, Monaghan and Donegal where the seed crop was highly concentrated. An additional factor in the case of northeast Donegal was its proximity to Derry city which was probably an important centre of supply for farmers throughout the agriculturally fertile lowlands in the Foyle basin. The numbers of hired agricultural labourers were greatest in the areas around Dublin, south Kildare, north Wexford, east Waterford and Cork city, (Meenan, 1970). Their role in the agricultural labour force was particularly low throughout most of the west and northwest (with the exception of east Donegal) where there was a greater involvement of fanners' relatives. This contrast was an important influence on the pattern of early adoption because the labour saving benefits of mechanisation could be best realised on farms where there were hired labourers. The farm size factor which influences the hierarchical effect has consistently displayed a marked gradient from the southeast towards the west and northwest. (Homer *et al*., 1984). Of particular importance in the early stages of adoption and diffusion of an expensive and revolutionary innovation was the location of large farms, especially those involved in the cultivation of commercial cereals, Jones Hughes (1982) has shown that, for a variety of physical and historical reasons most of the larger farms in the mid-nineteenth century were heavily concentrated in the east and south. Despite the subsequent Land Acts it is likely that many survived into the early decades of this century. While Gillmor (1991) has shown for the Republic of Ireland that in 1931 the mean area of crops and pasture per holding was greatest in counties Kildare, Meath and Wicklow. Freeman (1950) established that in the most fertile parts of Northern Ireland there were local concentrations of farms in excess of 40 ha. The quality of land was another important factor which influenced the distribution of commercial tillage crops. Furthermore, the lighter well-drained soils were much better able to sustain without damage the very heavy early tractors. From this perspective parts of the east and south were again the most favoured (Gardiner and Radford, 1980), while in Northern Ireland the best soils are in parts of counties Down, Antrim and Derry (Symons, l963; Cruickshank, 1982). Apart from these structural factors, adoption was also likely to occur at an early stage

amongst tillage farmers since they are generally regarded as the most progressive. A final factor which contributed to the evolution of the spatial pattern was the location of major general merchant stores which had already established strong connections with the farming community. Most prominent amongst these were Perry's in Athy and McGee's in Ardee. These types of stores, along with garages which were already selling motor cars were important diffusion agents in the early years.

1928 - 1939: Intensification and limited expansion

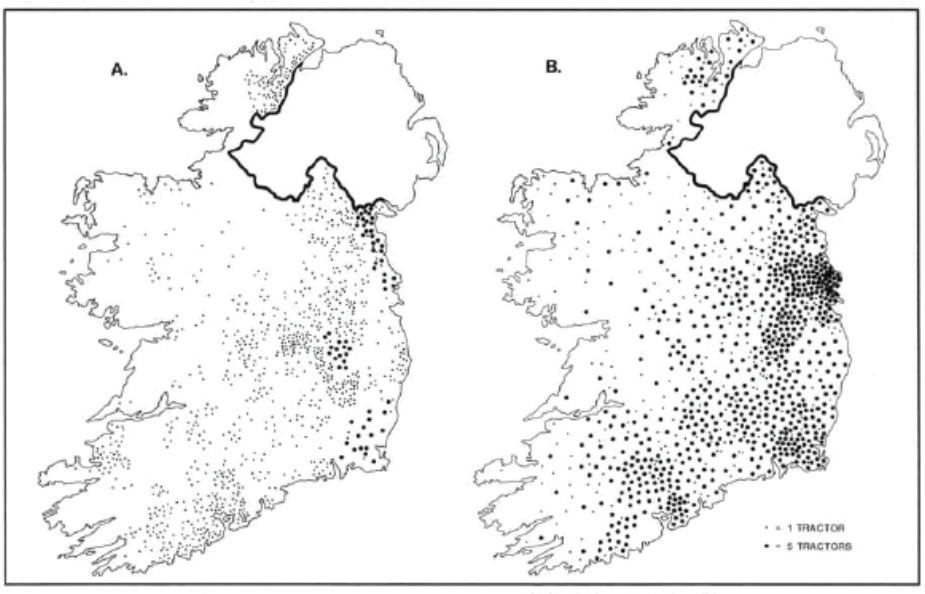
The 1930s was a difficult period for agriculture in the Republic of Ireland with the estimated value of total output in 1934-5 almost 37% less than the estimate for 1929-30 (Meenan, 1970). Even after a recovery in prices towards the end of the decade, the total output estimate for 1938-9 was still 15% less than for 1929-30. This overall situation, which resulted from a trade dispute with Britain and an emphasis by government on a protectionist agricultural policy, was not conducive to a rapid growth in mechanisation. However, of some importance for the geography of mechanisation was the encouragement and assistance given to farmers with land capable of growing wheat or sugar beet. The area under both of these commercial crops expanded from about 10.500 to almost 120.200 ha between 1931 and 1939. Most of this expansion occurred m parts of the eastern and southern counties.

While the general economic situation in the 1930s was not favourable towards investment in machinery, there were two important advances in tractor design which greatly enhanced their capabilities. These were the introduction of pneumatic tyres and hydraulic implement controls. The pneumatic lyre greatly increased the scope of tractor usage by enabling them to move easily and speedily and to act as road haulage vehicles. Their increased speed also meant that they could be used more effectively for operations such as hay mowing and tossing. This broadening in their range of functions also expanded the potential market. The invention of the Ferguson hydraulic three-point linkage mounting system revolutionised the way in which tractors could be used for operations such as ploughing and harrowing. This invention altered the role of the tractor from being essentially a towing machine to the forerunner of the modern highly versatile machine that it is today. By reducing the risk of overturning, which was a fundamental weakness in the early designs, it greatly improved the safely of the driver. These technical improvements were quickly incorporated into the Standard Fordson which was first produced in Cork in 1929. By the late 1930s at least four different tractor models were exhibited at the RDS Spring Show by Dublin-based firms who were also agents for British distributors. In addition a growing number of firms had begun to exhibit tractor drawn ploughs, harrows, mowers, binders and potato diggers. All of the exhibitors were Dublin-based, apart from the Pierce Agricultural Machinery Company of Wexford who in 1940 exhibited a two-furrow tractor plough, and a

Carlow-based firm that had commenced selling all-steel chassis tractor trailers in the late 1930s.

At the next enumeration in 1939 the total had only increased to 2076. Between 1928 and 1939 there occurred an intensification in the areas of early adoption, as well as expansion into surrounding areas where some new adoption centres emerged (Figure 3(a)). The number in county Louth quadrupled from 35 to 145 while a trebling in numbers occurred around Athy and in the hinterland of Cork city (Table 2). In the midland counties of Laois and Offaly the total also trebled with a spectacular increase from 11 to 61 in Mountmellick district. Around Dublin there was considerable expansion in north Kildare, and parts of Meath, while in the southeast important new centres of adoption were established in Carlow and Kilkenny. Elsewhere the districts around towns such as Tralee, Listowel, Waterford, Birr, Abbeyleix, Cavan, and Monaghan were emerging as centres of adoption. Slow progress was experienced in the hinterlands of Limerick and Galway cities, presumably mainly due to the small amounts of tillage and the small scale of farming in these areas. The total in counties Mayo, Roscommon, Leitrim, Longford and Cavan increased from 12 to 83. Nevertheless, there still remained 23 districts, mostly in the northwest, where no tractors had been purchased. Finally, it is useful to contrast the pattern of expansion in Donegal in the 1930s with that in Cork. In Donegal the doubling in the number of tractors did not lead to any extension into new districts (primarily due to the very severe physical and structural constraints in the remainder of the county) whereas in Cork there was diffusion into almost all districts and considerable progress in the districts located on the fringe of the early adoption zone.

Figure 3. Increase in number of tractors (a) 1928-1939, (b) 1939-1947



The 1940s: Stagnation and relaunch

On the eve of World War II there were still approximately 530,000 males engaged in farm work in the Republic of Ireland. In many parts of the state there was also considerable involvement of female members of farm families in work related to farmyard based enterprises (Arensherg and Kimball. 1940). The total number of agricultural horses at this time was about 326,000. During the war years there was very little increase in mechanisation due to difficulties of importing new tractors and spare parts. Apart from a limited number of Fordsons the only new tractors available at this time were some American manufactured Allis-Chalmers models imported by McGee's of Ardee (Neil-Watson, 1991). The situation in Northern Ireland was probably not quite as severe as a result of its political status within the UK which provided a high level of market support and protection for its farmers (Sheehy *et al.*, 1981). The first enumeration of agricultural machinery items in Northern Ireland in 1944 found that there was approximately 6800 tractors. The distribution between counties reveals a density variation from 11.7 per 1000 ha crops and pasture land in county Down to 2.2 in Fermanagh. The degree of localisation in the hinterland of Belfast is evident from the fact that approximately one-third of the tractors were in Down which contained 21CA of the total crops and pasture land. While county Tyrone had an equivalent share of crops and pasture land (most of which was located in the western half of the county) its number of tractors was only about half the total in Down (Table 2). In county Derry the number of tractors was slightly in excess (about 5%) of what might have been expected on the basis of land quality alone. It is very likely that Derry city was a centre Redistribution to suppliers and farmers throughout the fertile Foyle river basin.

In the aftermath of the war, Government policy towards agriculture in the Republic changed from being primarily concerned with supplying the home market to a policy which emphasised improvement and intensification of production for export markets. Indeed, a study on Ireland's potential contribution to the European Recovery Programme emphasised increased agricultural output which would necessitate, among other things, greater mechanisation (Government of Ireland, 1948). The geography of agricultural production had not changed very much by 1946 as indicated by Freeman's (1947, 1949) map of farm types which identified Wexford, parts of the Midlands, the northeast and north Donegal as the principal areas with considerable tillage. Meenan's (1970) maps of the distribution of manpower on farms in 1946 also demonstrate continuing high levels of dependence on hired labourers in the hinterlands of Dublin, Cork and Waterford as well as in south Kildare. The 1946 census of population enumerated 113,800 agricultural labourers and 203,460 farmers' relatives assisting on farms. Significant increases in prices of milk, wheat and sugar beet (the benefits of which accrued mostly to farmers in the east and south) resulted in a rapid growth in the value of total agricultural output so that the estimate for 1947 was twice

that for 1938-9. The increasing returns to farmers were matched by vigorous marketing campaigns by the two main suppliers of tractors - the Ford and Ferguson companies. Ford had an advantage in the early years based on its readymade distribution system through their car dealer network which was established across the entire country. Their advertising campaign continued to emphasise the prospect of labour saving and greater incomes from mechanised farming. For example, the message in their advertisement in the catalogue for the 1950 Dublin Spring Show was "Ford Tractor Less Work More Income per Acre". The first of the famous Ferguson line of tractors was manufactured in Coventry in 1946 (from 1953 these became known as Massey Ferguson tractors following an involvement of the Toronto based Massey Harris harvesting machinery firm with Ferguson). The company in 1946-47 established a network of thirty dealers throughout the Republic of Ireland to sell a variety of models designed to suit the requirements of different users, and also a very wide range of implements and accessories. The adverts for the Ferguson model also emphasised the prospect of greater incomes e.g. one supplier in the southwest used the phrase "It will pay too to farm with Ferguson". Undoubtedly, there was a high level of competition between the Ford and Massey Ferguson dealers which would have helped to keep down prices in an expanding market.

The 1947 agricultural census in the Republic of Ireland enumerated approximately 5900 tractors which represented an increase of 3800 over 1939. The largest increases were in counties Kildare, Wexford, Meath, Dublin and east Cork (Figure 3(b)). There were also significant increases in the hinterlands of towns such as Carlow, Kilkenny, Mullingar, Cashel and Mallow. There remained many districts in western counties where very little increase occurred. Slow progress in adoption and diffusion in western regions may also have been influenced by the prevailing rural social system which resulted in sons replacing fathers on farms and the new families replacing themselves. This system along with informal methods of co-operation in farm work survived until the late 1940s (Hannan and Breen, 1987) and acted as a powerful restraining force on innovation adoption (Hannan, 1972).

The 1950s: Take-off, end of first wave of diffusion

In the late 1940s and early 1950s there were a number of technical improvements which made the new technology a much more attractive option for farmers. These included improvements in relation to the power take-off systems, which facilitated an expansion in the range of implements that could be used with tractors, as well as the introduction of diesel engines that provided a more economical and reliable source of power than the spark ignition engines which had been in use up to then. There followed a sharp increase in the adoption curve for the Republic (Figure 4). By 1949 the total number of tractors had increased to over 10,100. Over the next three years there was a further increase of 9,000, and by 1955 the total had reached approximately 30.000. The expanding

market was catered for mostly by the Ford and Ferguson companies. The light and versatile Ferguson 20 model, which was fitted with a diesel engine about 1953, was extremely popular among Irish farmers, with one dealer in Cork alone achieving sales of over 1000 Fergusons between 1950 and 1955.

Table 2. Changes in numbers of tractors for selected periods

County	-1928	1928 -1939	1939 -1947	1947 -1953	1953 -1960	1960 -1965	1965 -1970	1970 -1980
Carlow	25	44	102	465	672	253	371	500
Dublin	53	25	264	1008	104	382	54	-78
Kildare	70	126	312	732	789	362	375	879
Kilkenny	32	25	230	855	1230	506	639	1576
Laois	24	92	93	797	904	405	564	1178
Longford	4	4	46	153	237	242	515	1632
Louth	35	110	85	562	575	256	264	201
Meath	54	71	424	733	1035	418	983	1636
Offaly	41	51	104	162	866	337	431	1574
Westmeath	15	18	131	272	370	270	515	1942
Wexford	108	87	378	1375	1937	683	908	1452
Wicklow	36	34	96	482	720	477	361	710
Clare	11	4	26	209	373	607	1311	4227
Cork	92	195	534	1851	3648	2704	3285	6301
Kerry	10	43	23	525	778	787	1459	3941
Limerick	7	32	123	355	701	1123	1757	3155
Tipperary	41	72	305	883	1502	1106	1618	3228
Waterford	18	28	106	468	693	356	436	1012
Galway	16	22	65	586	887	625	1432	5245
Leitrim	0	1	13	139	260	381	833	2140
Mayo	1	22	48	328	488	449	933	5211
Roscommon	2	12	51	276	401	393	961	3613
Sligo	11	2	20	194	259	294	666	2017
Cavan	5	32	51	403	581	933	1544	2665
Donegal	71	78	118	896	1032	1127	1095	3175
Monaghan	22	33	73	711	857	994	872	1596
Republic of Ireland	804	1263	3798	15933	21899	16470	24182	60728

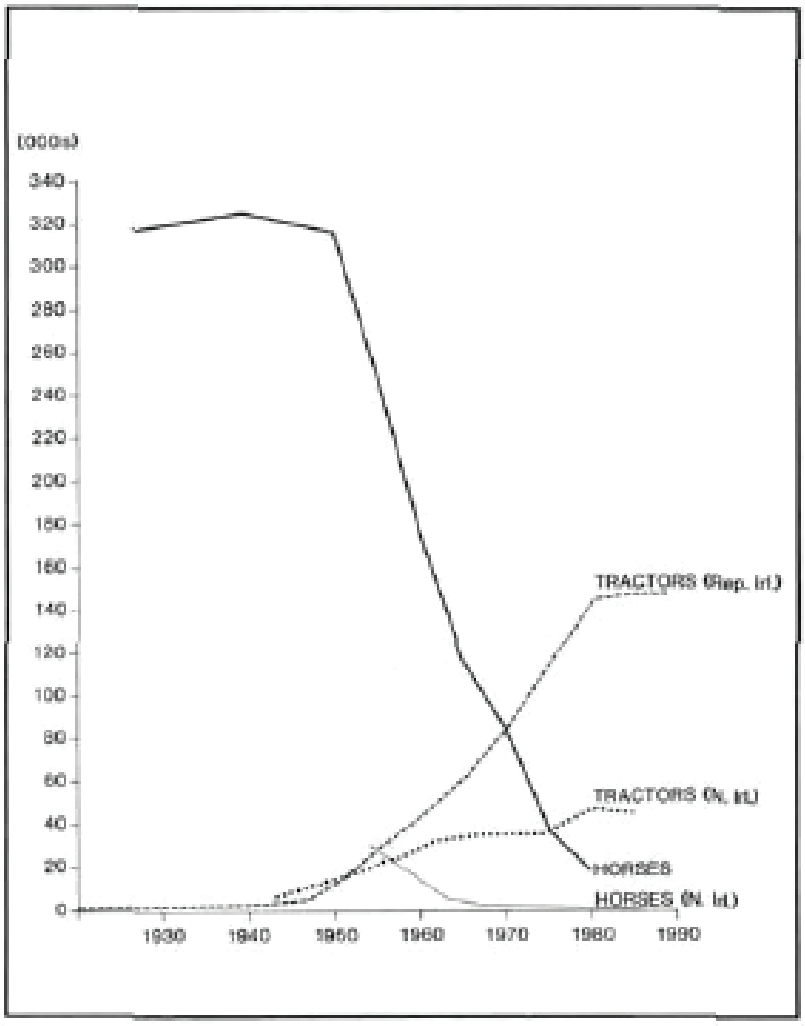
County	-1944	1944 -1954	1954 -1959	1959 -1966	1966 -1972	1972 -1980
Antrim	1480	3137	2321	1213	-480	2479
Armagh	704	1674	1038	479	-219	2144
Down	2226	3181	1412	1002	-696	2735
Fermanagh	265	740	885	1121	159	1790
Derry	991	2259	1005	905	-352	1842
Tyrone	1123	2239	2250	1493	-135	3190
Northern Ireland	6789	13230	8911	6213	-1723	14180

In order to map the distribution of tractors from the early 1950s it is necessary to switch from dot to choropleth mapping techniques. While a number of ratios are possible, the one chosen relates the number of tractors to the total number of holdings greater than 2 ha. Smaller holdings are omitted since the level of adoption on these is likely to be extremely small. Due to the fact that on a number of large holdings there

may be more than one tractor, the ratio may slightly overestimate the level of ownership in districts where there are a significant number of such holdings. Tractors have had to be related to holdings rather than farms since the agricultural census enumerations are based on the former. The discrepancy between holdings and farms was small in the 1950s but it becomes greater in later years and it is also greater in districts where the average size of holding is small (for distribution maps of holdings and farms by size see Horner *et al.*, 1984: 1987). Hence the choropleth maps presented here probably underestimate the true levels of adoption or ownership of tractors in small-holding districts.

In order to facilitate comparisons between maps a common set of class intervals have been used for the maps covering the period up to 1980.

Figure 4. Trend in numbers of agricultural horses and tractors: Republic of Ireland and Northern Ireland



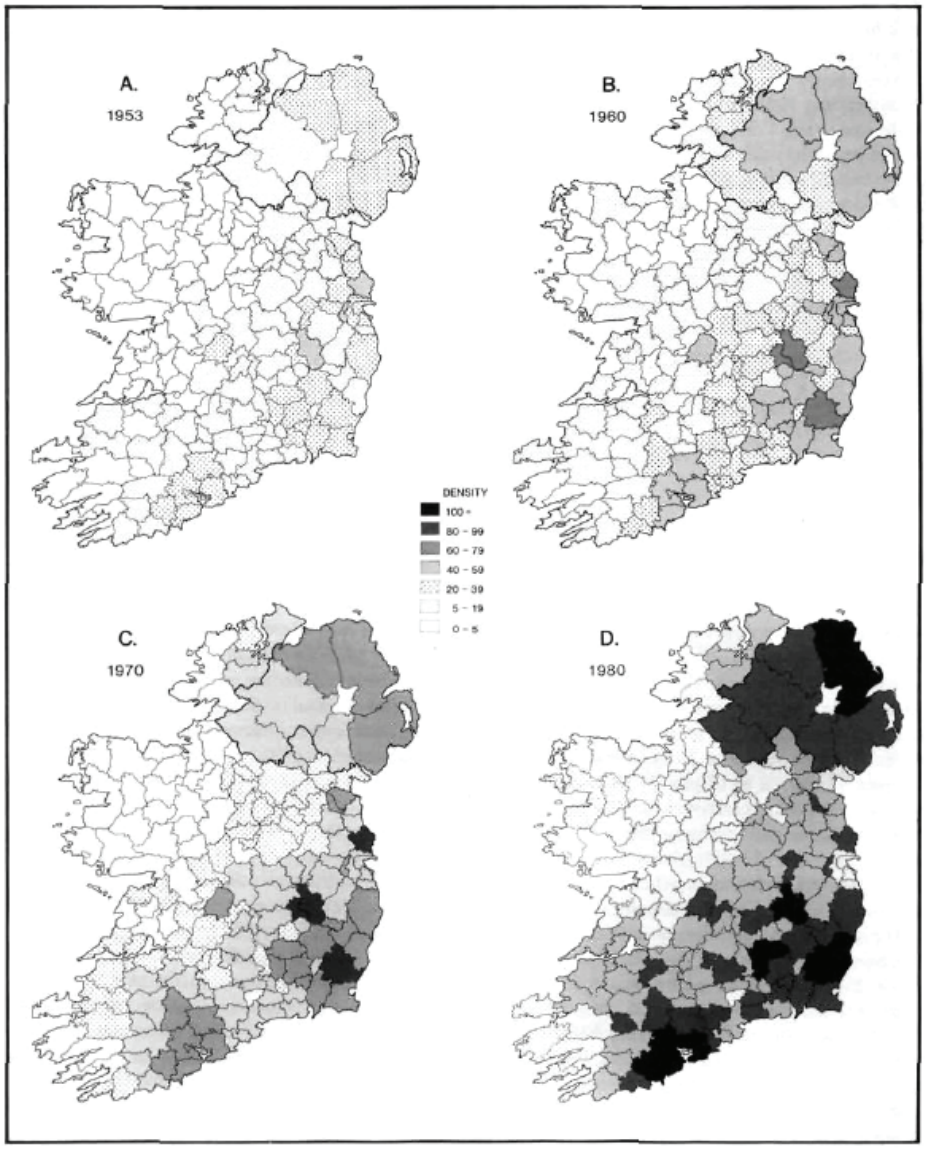
The distribution of tractors in 1953 is shown on Figure 5(a). The density distribution was greatest at 48 tractors per 100 holdings in north Dublin and south Kildare and almost 40 in Enniscorthy district. Density values in the range of 20-29 occurred in the districts around Cork city and further east in many of the districts adjacent to the core areas. While the force of the first "diffusion wave" up to the late 1950s (Hagerstrand, 1952) was felt across most of Leinster and Munster there was still relatively little change throughout most of the western counties apart from northeast Donegal and north Kerry (Table 2). Nevertheless, close examination of the data at district level reveals that some important small centres of adoption and diffusion were emerging in the more remote districts in the southwest, and throughout much of Clare, east Galway, Sligo, south Leitrim and the southern and western parts of Donegal. Significantly, by this time there were some tractors in every district.

In Northern Ireland there were just over 20,000 tractors which represented a density of 30 per 100 holdings greater than 2 ha which is greatly in excess of the value of 9 for the Republic. At county level the densities varied from approximately 40 in Down, Antrim and Derry to about 23 in Tyrone and Armagh, and only 13 in Fermanagh. Thus, when the data are considered for the island as a whole, it is evident that roughly similar levels of mechanisation had been achieved in those parts extending in an arc from the hinterland of Derry eastwards towards Belfast, southwards along an east coast zone which extended inland to Kildare and Kilkenny, and from there southwestwards to the hinterland of Cork city.

By the mid-1950s the Massey Ferguson dealer network based on a strategic selection of nodes was well able to stimulate and cater for the growing demand. In order to increase awareness and encourage adoption field demonstrations of new models and new implements were held regularly across the country, and dealers were motivated to maximise their sales through a system of bonus payments. The largest dealer was in Cork city, to whom just over 600 tractors were supplied between 1954-57. While the average number of sales per dealer over this period was 210 there was a high level of variation with dealers in north Cork, mid-Tipperary, and in counties Louth. Cavan and Donegal each achieving sales of between 330 and 380 tractors, while the dealers in Leitrim. Roscommon, Longford and Westmeath had sales of fewer than 100. Apart from the two major suppliers other firms such as UK-based David Brown International and the Czechoslovakian Zetor manufacturers established subsidiary companies in Dublin, which in turn developed their own distribution networks. These were less extensive with much of the David Brown sales concentrated along the Border counties, while the early Zetor sales were mostly in counties Wexford, Waterford, Cork, Clare and Mayo. One of the First distributors of International tractors outside Dublin was a firm in Kilkenny (Neill-Watson, 1991).

The mid to late 1950s was a period of considerable year to year fluctuations in agricultural output, especially in relation to tillage, which undermined farmers' confidence and slowed down the pace of mechanisation in the Republic of Ireland. During this period there was a trend towards larger and more powerful tractors which could be used to perform an increasing range of tasks, including baling of hay and straw, and harvesting of silage and grain. By 1960 there were 1652 pick-up balers, 690 forage harvesters and 4254 combine harvesters in use. Over 11,300 (26% of the total) tractors had a power rating in excess of 35 horsepower (HP).

Figure 5. Number of tractors per too holdings (a) 1953 (b) 1960 (c) 1970 and (d) 1980



Note: data for Northern Ireland are extrapolated from Table 3.

The 1960s: Intensification, expansion, hierarchical filtering

The first direct evidence for the existence of a hierarchical effect in the diffusion is contained in the Report published by the C.S.O. on the 1960 Agricultural Census which includes a set of cross-tabulations based on a 10% sample of the returns. These show that 44% of the tractors were on holdings of at least 40 ha which amounted to only 11% of the total holdings larger than 2 ha. The number of tractors per 100 holdings ranged from 117 for holdings over 120 ha to 49 for those between 40 and 60 ha and 10 for those between 12 and 20 ha (Figure 6). Already approximately 4300 holdings each had more than one tractor. The incidence of multiple ownership declined sharply according to size of holding from 56% for holdings over 120 ha to 19% for holdings between 60 and 80 ha. and under 7% for 20-40 ha holdings.

The importance of the hierarchical effect in shaping the density distribution of the 43,700 tractors enumerated in 1960 is evident from Figure 5(b). When account is taken of the number of holdings with more than one tractor the overall density per 100 holdings in 1960 was 13.5. At district level it is not possible to take account of multiple ownership, hence the ratios for tractors per 100 holdings slightly overstate the number of holdings with tractors. The density varied from over 60 in three districts (reaching a maximum of 67 in Athy) to less than 5 in 23 districts, and as low as 1 in Oughterard and Clifden in west Gal way and Castletown in southwest Cork. By comparison with 1954 the number of districts with densities greater than 40 increased from 2 to 25. The role of towns as locations for suppliers in shaping the spatial pattern of diffusion is evident from the increases around Ballina, Sligo and Donegal in the northwest. The phase of mechanisation between 1946 and 1961 was marked by a reduction of 54,000 (48%) in the number of agricultural labourers and almost 80,000 (39%) in the number of relatives assisting on farms. Between 1950 and 1960 the number of horses used for agriculture declined by 141.3(H) (45%). Nevertheless the total number was still over four times the total tractors.

The rate of expansion in tractor numbers in Northern Ireland in the late 1950s was almost identical to that of the Republic (47% increase between 1954-59 compared with 45%). The highest density per 100 holdings had moved from Down to Antrim where it was 57 (Table 3). The above average growth rates in Tyrone (67%) and Fermanagh (88%) in the southwest are the result of both intensification and spread effects.

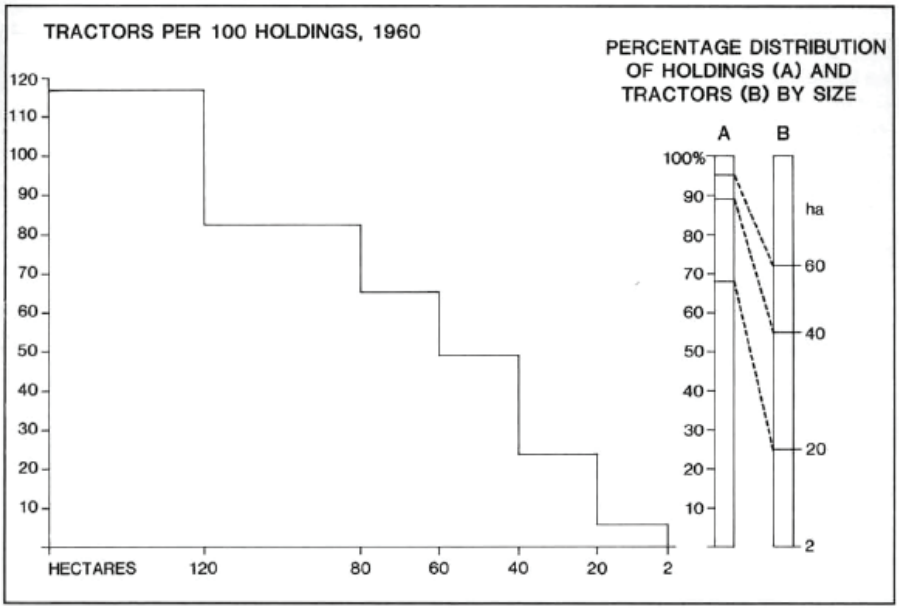
From the end of the 1950s, government policy in the Republic of Ireland towards agriculture has been firmly committed to increasing productivity (Kelleher, 1983). This is just one component of an overall strategy to modernise the economy, which formed the basis of a series of economic plans throughout the 1960s. In order to achieve the objective of increasing agricultural output the state has financed educational, advisory and research services as well as providing price supports for dairying, pig

rearing and some cereals (Government of Ireland, 1964). Consequently, following decades of near stagnation the volume of gross agricultural output finally began to increase around 1960.

Table 3. Tractors per 100 holdings (>2 ha) Northern Ireland

	1944	1954	1959	1966	1972	1980
Antrim	10.5	38.7	56.9	74.6	75.9	108.6
Armagh	6.2	23.2	34.9	45.1	46.7	81.5
Down	14.8	40.8	50.3	63.9	62.5	94.5
Fermanagh	3.0	12.8	24.4	44.6	50.4	83.1
Derry	10.3	39.4	50.1	65.4	66.5	99.9
Tyrone	6.6	22.3	38.5	54.5	58.0	89.8
N. Ireland	8.9	30.1	43.6	59.0	60.9	93.6

Figure 6. Tractors per 100 holdings according to size, 1960



Matthews (1981) estimated that between 1958 and 1963 gross agricultural output increased at a rate of 3.5% per annum. The expansion in output was important in encouraging further mechanisation which in turn facilitated to some extent the intensification process. Another factor in intensification was greater use of artificial fertilisers and lime to improve crop yields.

This was matched by an increase in the number of fertiliser distributors from just over 11,000 in 1960 to 29,100 in 1970. The resultant heavier crops of hay were also more difficult to mow with horse drawn mowers, which in turn encouraged greater adoption of tractor mowers initially

amongst agricultural contractors but later by individual farmers. Thus the number of tractor-mounted mowers increased from under 16,900 in 1960 to over 56,700 in 1970 (Table 4). There was also a rapid growth in the numbers of balers and forage harvesters. Some changes also occurred in relation to the availability of tractors and new implements. Increasingly the main dealers became more specialised agricultural machinery outlets which carried not only a range of implements but also a stock of spare parts and had a skilled workforce of both salesmen and repair mechanics. Not surprisingly, against this background the number of number of tractors increased steadily from 43,700 in 1960 to just over 60,000 in 1965 and over 84,000 in 1970. An important point in the transition from working horses to tractors was reached towards the end of 1970 when the total number of tractors equalled the number of horses used for agriculture in the Republic. This transition point had been reached about 16 years previously in the less diverse and more strongly government-supported agricultural sector in Northern Ireland (Figure 4).

Table 4. Numbers of agricultural machines (000s).

Republic of Ireland 1960-1988						
	1960	1965	1970	1975	1980	1988
Tractors	43.7	60.2	84.3	114.2	145.1	147.9
Mowers	16.9	n.a.	56.7	71.7	83.3	83.8
Fertiliser Distributors	11.1	19.9	29.1	n.a.	60.4	n.a.
Pick-up Balers	1.6	n.a.	8.3	14.2	21.4	22.7
Forage harvesters	0.7	3.3	7.0	8.3	11.1	13.1
Combine harvesters	4.2	5.8	6.3	4.9	5.3	4.9
Northern Ireland 1959-1984						
	1959	1966	1969	1972	1980	1984
Tractors	28.9	35.1	33.1	33.4	47.6	46.3
Mowers	16.9	23.0	22.0	21.2	24.7	20.5
Fertiliser Distributors	8.5	12.3	13.0	14.3	19.7	19.5
Pick-up Balers	1.5	4.7	5.5	6.2	8.4	8.5
Forage Harvesters	0.4	2.5	3.3	4.3	6.8	6.7
Combine Harvesters	0.4	1.8	1.7	1.7	2.0	1.5

When related to the total number of holdings (greater than 2 ha), the overall density in 1970 was almost 33 per 100 holdings. By this stage the density had just exceeded 80 in north Dublin, Enniscorthy and around Athy (Figure 5(c)). There was an extensive area in the southeast and in the hinterland of Cork city where densities exceeded 60. It was in these areas that farmers benefitted most from government policies towards agriculture (Conway, 1975). There was also considerable expansion in the western cattle and sheep grazing region (Gillmor, 1967) so that the number of districts with densities smaller than 10 declined from 60 to 10 over the decade. One of the most striking features of the 1970 distribution is the extent to which the pattern corresponds to the one

established almost fifty years previously when tractors were first introduced to Ireland.

The experience in Northern Ireland in the 1960s was somewhat different to that in the Republic. The level of increase up to the mid-1960s (21.5% between 1959-66) was only about half that in the Republic. This was followed by an even greater contrast - as the number in '.he Republic grew by 40% between 1965-70, those in the North increased only marginally (1.8%) between 1966-69 before declining by 6.5% (27(H)) over the next three years. The pattern of decline was widespread, especially in counties Down and Antrim: the only county where the number of tractors continued to increase was Fermanagh where farming was least mechanised. The Economics and Statistics Division of the Ministry of Agriculture attributed the decrease to the continuing decline in the number of farm businesses and the trend towards larger and more powerful tractors. By 1972 one-sixth of all tractors had a power rating in excess of 50HP - an identical proportion was recorded for the Republic in 1975 (Walsh and Homer. 1981). At this stage almost 30% of farms had at least two tractors.

The 1970s: Widespread adoption, second wave of diffusion

The most significant influence on agricultural production in the 1970s was probably the system of guaranteed prices for most commodities under the European Community Common Agricultural Policy. This contributed to further intensification and greater levels of factor substitution in production (Boyle, 1981). Increased volumes of output and higher prices resulted in a significant improvement in farmers' incomes up to 1978. This resulted in the second wave of diffusion (Table 2) with mechanisation now occurring on farms of all sizes, though there continued to be a pronounced hierarchical effect in the proportion of farmers investing in machinery. The proportions in 1978 ranged from 27% on farms with between 6 and 12 ha to 83% on farms with more than 40 ha (Power, 1980).

The proportions with tractors varied from 97% for farms in excess of 80 ha to 66% for those between 12 and 20 ha and 43%- for 6-12 hectare farms. The proportions for the latter two sizes of farms were 42% and 22% in 1973. The increasing number of small and medium-size farms purchasing tractors led to a very high level of dependence on second-hand items as only 5% of first-time buyers purchased new models. The domestic supply of second-hand tractors from large farms where replacement and upgrading were occurring was augmented by imports mainly from the U.K. The acceleration in adoption on small farms in the 1970s was due to a combination of factors including the availability of relatively low-cost second-hand items, improvements in small farmers' incomes due to C.A.P. prices and some off-farm occupation for a growing number of small fanners (Higgins, 1983). While an increasing number of farmers purchased their own tractors, there was also a high

incidence of hiring machinery services from agricultural contractors for specialised operations requiring expensive equipment such as silage making, baling of hay and straw, and combine harvesting of cereals.

Throughout the decade the total number of tractors in the Republic increased at an average annual rate of about 60,000 to a level of just over 145,000 in 1980. Over the same period the number of horses used for agriculture continued to decline so that by 1980 there were fewer than 19,000. Over half of these were concentrated in counties Mayo, Galway, Clare, Kerry and Cork. The amount of labour employed in farming operations also continued to decline with the number of assisting relatives declining by 81% between 1961 and 1981 to 24,200 while over the same period the number of agricultural labourers declined by 70% to less than 18,000. Increased mechanisation and modernisation have also contributed to increased marginalisalion (Kelleher and O'Mahony, 1984) and a reduction of about one-third in the number of farmers.

Table 5. Distribution of tractor sizes by region, 1980

	Tractor sizes in HP			
	<35	35-50	51-79	80+
Region	as % of total			
Northwest	35.8	47.8	14.5	1.9
West	34.6	50.7	13.5	1.2
Midland & East	19.0	41.3	32.3	7.4
Southwest	18.0	48.0	30.1	4.0
Southeast	14.4	41.6	37.2	6.7
Republic of Ireland	24.3	46.1	25.5	4.1
Northern Ireland	21.5	44.6*	28.6*	5.3

The 1980 density distribution indicates that there were over 100 tractors per 100 holdings in north Wexford, south Kildare, north Kilkenny and in the districts around Cork city (Figure 5(d)). On many of the larger tillage farms in these areas there were three or more tractors. There were 36 districts with densities in excess of 80 compared with only 4 ten years previously. At this stage there were considerable gains throughout most of the western districts as more of the remaining small farms became mechanised. The number of places with densities less than 20 declined from 38 to only 4 which were located in the western small farm fringe (Gillmor, 1967) in parts of west Galway, northwest Mayo and southwest Donegal. Apart from increasing numbers there has been a continuation of the trend towards more powerful and more sophisticated machines (Table 5). The newest and most innovatory items are concentrated mainly in parts of the east and south while older, smaller and less versatile tractors are to be found mostly on farms in western districts (Horner, Walsh and Williams. 1984).

In Northern Ireland also, after 1972 there was a substantial increase in the number of tractors to 47,6000. Since the total number of full-lime and part-time farm businesses was approximately 30,300 it is likely that about half of this total had at least two tractors. The trend towards larger tractors continued with 34% over 55HPin 1980 compared with one-sixth over 50HP in 1972.

The 1980s: Stagnation and saturation

Since about 1978 a number of factors have combined to slow down the pace of intensification (Harte. 1992) and seriously depress real farm incomes (Sheehy, 1988). These changes have curtailed any further expansion in mechanisation. Sample surveys taken on an annual basis by the C.S.O. have confirmed a situation of stagnation in regard to the numbers of several items of farm machinery so that between 1980 and 1988 the number of tractors increased by only about 3,000, with very little variability across regions in levels of increase. A more detailed analysis of the geography of change in mechanisation in the 1980s must await publication of the results of the 1991 agricultural census. Reports from the agricultural machinery traders' association claim that there was a decline in the annual number of tractors purchased from approximately 8,000 around 1980 to 2,200 in the final years of the decade. The levelling off in the number of tractors may be related to an increasing reliance on agricultural contractors to perform tasks such as silage making which require considerable amounts of large and very expensive machinery. It is probably also an indication that market saturation has been reached. One indication that the transition from draught animals to tractors is now virtually complete is that there are fewer than 2,000 agricultural horses left on Irish farms. While there may still be about 190,000 agricultural holdings, the number of household heads described as farmers in 1987 was estimated to be only 135,000 (Department of Agriculture and Food. 1991). Additional purchases in the future will be mostly to replace older stock and/or to provide additional and more sophisticated machines for specialised tasks. For many farmers now the decision is not so much whether to purchase a tractor but rather which make and model. There are now about twenty different makes of tractors comprising some 380 different models available in the Republic of Ireland (Neill-Watson, 1991). The limited data available for Northern Ireland in the 1980s (Table 1) suggests that not only has market saturation been reached but that the total number of tractors is declining as farms are rationalised, operations become more specialised and greater reliance is placed on agricultural contractors.

Conclusion

A number of conclusions can be drawn from the empirical evidence presented in this paper. These can be discussed in relation to the geography of the transformation of agricultural production, and also in relation to the more general literature on innovation diffusion.

The pattern of adjustment in agriculture has been characterised by a widening division between on the one hand a relatively small, commercially oriented and highly capital intensive modernising sector, and on the other hand a large proportion of farms which are both economically and socially marginalised (Walsh, 1992). While a number of processes have been identified as contributing to a dualistic structure in the post 1960s period it is evident from the maps that the influence of mechanisation on the spatial differentiation of agricultural production can be traced back to the 1920s. A number of factors have been identified as possible influences on the spatial patterns: the distributions of tilled land for commercial crops, hired agricultural labour, and large holdings especially in the early years. Also important was access to suppliers which were mainly distributed in accordance with the principle of maximising sales. In addition, adoption took place earlier and more quickly in some districts along the border with Northern Ireland which suggests that some of the items were brought in from there (possibly as second-hand machines since mechanisation had commenced earlier there).

The model outlined at the beginning emphasised the importance of hierarchical and neighbourhood effects as influences on the demand for an innovation, and the role of diffusion agents in facilitating supply to potential adopters. It also noted the importance of government policies and strategies which may favour more strongly some categories of potential adopters. The data presented provide clear support for the hierarchical hypothesis and strongly suggest the existence of a neighbourhood effect. The interaction of the two effects produced the spatial pattern of adoption and diffusion.

A number of additional factors appear to have influenced the empirical patterns, which may be of relevance to further studies of innovation adoption and diffusion. These include the role of major events in influencing temporal trends (e.g. food scarcity in the UK during the First World War, the economic recovery after the Second World War, accession to the EC); the importance of field demonstrations, and public exhibitions at large meetings; the messages contained in sales advertisements and the role of bonuses as a motivation for salespersons; improvements to the design of the innovation which enhance its range of applications; upgrading by early adopters resulting in a supply of relatively cheap second-hand items for late adopters: government and EC policies which discriminate in favour of some potential adopters at different phases in the diffusion process: and lastly sectoral policies which may indirectly improve the capability of potential adopters to acquire the innovation (e.g. rural-based industrialisation and services which provide off-farm employment opportunities and increase the household income on many small farms).

The interaction of temporal and spatial influences has been emphasised throughout. This approach goes beyond the more restrictive analyses which characterised many of the earlier geographical studies of innovation diffusion (e.g. the studies of the diffusion of tractors in the United States by Casetti and Semple (1969) and Cliff and Ord (1975)). While some limited evidence has been provided on the marketing strategies of the main suppliers, further research is required on this topic. This should involve detailed analysis of company records, and where possible interviews with some of the key individuals involved following the take-off in adoption in the 1950s. The analysis presented here relates specifically to the adoption and diffusion of mechanisation, which represents a fundamental and expensive alteration in work practices for the farmers concerned. As the twentieth century draws to a close, production technologies are being replaced by information technologies which are likely to have far reaching implications for the future of farming and farmers. In the early stages of the diffusion of innovations related to the new technologies, most of the adopters are again likely to be the more advantaged farmers, many of whom are already involved in specialist networks (e.g. cereals growers). Since a strong hierarchical effect is likely to be evident in the diffusion the historical experience in relation to mechanisation suggests that there may be a case for providing some assistance to medium-size commercial farmers so that they do not become technologically disadvantaged and economically marginalised as happened to many small farmers in an era of unregulated diffusion of production technologies.

Acknowledgements Special thanks are extended to James Keenan for expertly producing the maps and diagrams for this paper. The assistance of John Neill-Watson in relation to agricultural machinery dealer networks, and Ford New Holland is also gratefully acknowledged.

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CHAPTER 11

WOMEN'S EMPLOYMENT AND PERIPHERALISATION: THE CASE OF IRELAND'S BRANCH PLANT ECONOMY

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First published in *Geoforum* (1993), 24(1), 19-29.

Introduction

Although there has been some controversy over its leading to a situation whereby national economic interpretation (Jenkins, 1984), the idea of a 'new' international division of labour (NIDL), distinctively different from the 'old' division between largely self- contained industrial economies and primary-producing peripheral economies, as classically identified by Marx (1961), had secured widespread acceptance in the literature on economic development by the end of the 1970s. While the diffusion of manufacturing production to low-cost underdeveloped countries has tended to be emphasised in the literature on the NIDL (Frobel et al., 1980), in fact the phenomenon involved much more than this and described a general process of international re-structuring by transnational firms, whereby increasingly the individual operations in particular locations of these firms became integral components of international production systems. This process has affected both developed and underdeveloped economies, leading to a situation whereby national economic systems became increasingly truncated (Hayter, 1982), while international production systems became increasingly integrated.

Among the complex of factors which contributed to the replacement of integrated national production systems by international integration were the desire to achieve economies of scale; the desire to exploit international variations in resource endowments and costs by locating segments of overall production systems in those locations most suited to those segments; and the desire to derive maximum advantage from international variations in taxation levels through the manipulation of intracorporate transfer prices (Bradbury, 1985; Breathnach, 1989b). The ability to exploit these various possibilities was, in turn, greatly facilitated by appropriate developments in corporate organisation, production technology, transport and communications (Dicken, 1986).

In the 1980s, attention was increasingly focused on new forms of industrial restructuring, associated with a purported transition from the post-war 'Fordist' regime of accumulation to a new, post-Fordist regime of 'flexible' accumulation (Gertler, 1988; Elson, 1991). Growing flexibilisation has been observed in a wide range of areas, including forms of corporate organisation, production technology, functions of workers, and the hiring and firing of labour. This, in turn, is thought to be having an increasing impact on the locational patterns of manufacturing

industry, arising from the growing trend towards the use of subcontracting and 'just-in-time' systems, and the replacement of human labour by new technology.

This paper outlines the growing incorporation of the Republic of Ireland into the NIDL in the 1960s and 1970s, emphasising Ireland's role as a labour reservoir for transnational firms seeking a base for serving European markets. The particularly significant role of women workers in this process of branch plant industrialisation is detailed. This paper concludes with some observations on the outlook for women's employment in Irish-based industry arising from the impact of more recent forms of restructuring, allied to broader changes in the economic environment.

Women and the NIDL

Perhaps no aspect of the NIDL has been publicised as much as the role of women workers in transnational branch plants located in underdeveloped countries (Elson and Pearson, 1981; Mitter. 1986; Pearson, 1986; Fuentes and Ehreneich, 1987). Employed mainly in the textiles, clothing and electronics industries, women - mostly young - typically account for around 85% of the workforce in the export processing zones in which many of these branch plants are located. Roughly 1 million people were employed in the 59 such zones which were operating in the Third World in 1980 (Takeo, 1986; Dicken, 1986).

The specific targeting of (especially young) women workers despite simultaneous high unemployment among the male workforce is conventionally attributed to a range of factors which make such workers particularly attractive to transnational firms. These include a keen eye for detailed work, manual dexterity, higher boredom thresholds than male workers, lower rates of pay for 'women's' work, and docile behavioural traits. Such characteristics are, in the main, derived from existing social structures emphasising female subordination and gender-specific social inculcation of particular skills. It is ironic that this informal inculcation of particular skills reduces greatly the formal training requirements of the types of work in question, thereby allowing such work to be designated 'unskilled' and therefore poorly paid.

Branch plants have a strong preference for recruiting young women with no previous formal work experience, particularly in an industrial environment. As Konig (1975, p.35) [quoted in Pearson (1984)] puts it, such women are "virgins in terms of industrial employment that need not be retrained or un-trained". A key element in this context is that young, inexperienced women tend to bring naive and docile attitudes with them into the workplace, thereby rendering them particularly amenable to patriarchal and authoritarian command structures. Any danger that these will be gradually replaced over time by greater cynicism or militancy is largely obviated by the fact that most of the women in question generally

leave the workplace at an early age due to marriage, pregnancy or ill-health (the latter being a particularly common occurrence in Third World branch plants).

The NIDL in Western Europe

Apart from the relocation of production activities from industrial core regions to the Third World, much attention has also been paid to the role of women workers in the developing spatial division of labour within these core regions themselves (Women And Geography Study Group, 1984; Massey, 1984). In the European Community (EC), there has been a marked relative shift in manufacturing activity from core to peripheral regions over the last 20 years (Keeble et al.. 1983; Knox. 1984). Much of this has involved the relocation of production activity in search of reserves of cheaper labour (Hudson, 1983), a strategy increasingly preferred to the alternative of attracting migrant peripheral labour to the core regions of the Community (Paine, 1979). In addition, there is much evidence that inward investment from outside the EC, particularly from the U.S.A. and Japan, has also been opting for peripheral locations from which to serve the EC market (Dicken, 1986).

Firms relocating to the EC periphery have been showing a strong preference for rural and small-town locations. While both men and women workers may be targeted in this context, a preference for women is frequently apparent, given the possibility of exploiting, on the factory floor, the traditionally subordinate position of women in such areas (Harris, 1983). In addition, the normally low participation rate of women in the labour force in rural areas means that their potential as a latent labour force is that much greater.

The same applies to women in declining industrial regions where male-dominant coalmining and heavy engineering had been the leading sectors. Such regions typically have had low female participation rates, thereby creating a potential labour reserve which is increasingly being drawn upon as women are forced into paid employment due to massive levels of redundancy among male workers. In these cases, the skilled work previously carried out by the menfolk is rapidly being replaced by 'unskilled' work done by women with little previous experience of industrial employment and frequently imbued with subordinate attitudes, given the 'macho' male culture which tends to be rampant in such regions. In some older industrial regions - especially where there is an existing tradition of female participation (such as textile regions) - there may be a preparedness to take on older women in the new factories, especially married women returning to work having reared their families (Pearson, 1986; Wickham and Murray, 1987).

Ireland and the NIDL

Since the late 1950s, the Republic of Ireland (henceforth 'Ireland') has been pursuing an industrial policy which has been heavily dependent on

the attraction of foreign investment. Tax breaks, capital grants and ready-built advance factories have been the principal formal incentives provided. There has been a gradual build-up in the stock of foreign firms in Ireland, with a marked acceleration immediately following accession to the EC in 1973, which allowed Ireland to be used as a low-cost base with duty-free access to the very large EC market. This has been particularly attractive to U.S. investors, while there has also been a significant amount of investment since 1973 of Japanese origin (Breathnach, 1989a). The other main sources of overseas investment have been West Germany and the United Kingdom.

While there was a major slowdown in the inflow of foreign investment in the early 1980s, it has continued to grow, albeit gradually. With the previously heavily protected indigenous industrial sector suffering on-going contraction in both the 1970s and 1980s, employment in foreign manufacturing firms reached 43% of the total by 1989 (Industrial Development Authority Annual Report, 1989). More significantly, foreign firms now account for over two-thirds of manufacturing output and some 80% of non-food manufactured exports. This reflects the fact that foreign investment is mainly concentrated in expanding, high-technology sectors with above-average capital intensity, such as electronics, engineering and pharmaceuticals.

The types of plant located in Ireland by foreign firms point clearly to a subordinate, peripheral position within the NIDL (Telesis Consultancy Group, 1982; Breathnach, 1988, 1989b). These plants are mainly involved in export-oriented limited-skill assembly and testing operations with little associated research and development activity, and very restricted marketing and management functions. Material and service linkages with the Irish economy are weak, while linkages with overseas affiliates by contrast are quite strong, a situation which facilitates the manipulation of inter-affiliate transfer prices in order to concentrate profits in Ireland, where tax rates are effectively close to zero. This, in turn, helps to explain the high profitability of foreign firms in Ireland and the resultant high level of annual profit outflows: in 1989, these amounted to 10% of total GDP (Central Bank Quarterly Report, Spring 1990).

Women's Employment and Foreign Investment in Ireland

Apart from the formal incentives to foreign investment offered by the Irish government (low taxes, grants and factories), Ireland's status as a labour reserve has also clearly acted as a significant attraction for overseas firms. High rates of fertility have produced annual additions to the labour force which the Irish economy has historically been unable to absorb, with the result that high levels of net emigration have been a recurring feature of the Irish demographic experience (Breathnach and Jackson, 1991). There has therefore been a virtually permanent labour surplus in Ireland, where wage costs are considerably below those obtaining in the core regions of the international capitalist economy.

Table 1. Manufacturing employment change, l961-1986

	1961-71	*1971-81*	*1981-86*
All manufacturing			
% change, total	+21.0	+11.5	-9.6
% change, males	+24.3	+17.4	-12.3
% change, females	+14.2	-2.0	-2.3
Textiles, etc *			
% change, total	-0.2	-28.7	-19.9
% change, males	+3.6	-22.5	-31.0
% change, females	-2.9	-33.5	-10.1
Metals and engineering			
% change, total	+54.9	+81.0	+6.7
% change, males	+49.3	+67.3	+1.5
% change, females	+81.9	+135.2	+21.3
All excluding textiles etc.			
% change, total	+30.6	+25.2	-7.5
% change, males	+29.2	+24.9	-10.1
% change, females	+36.0	+26.4	+1.4

* Textiles etc. = textiles, clothing, footwear.

Source: Census of Population.

Ireland's labour reserve status is further augmented by traditionally low rates of female participation in the labour force. This is related to the dominant position, until recently, of agriculture in the national economy, allied to the powerful role played by a highly-conservative and male-dominated Catholic Church in Irish society. This latter role is nowhere more clearly expressed than in the Irish constitution, enacted in 1937, which enshrined women's place as being in the home, and frowned on married women working elsewhere (O'dowd, 1987). This was reinforced by legislation which restricted women's right to work, such as compulsory retirement upon marriage for women in the public service.

The female population in Ireland, therefore, includes a substantial latent reserve labour force which, as has been demonstrated by parallel situations elsewhere, presents significant recruitment possibilities to incoming industries, particularly as more liberal attitudes to women working, and accompanying legislative change, developed from the 1960s on. In 1961, when Ireland's policy of promoting inward investment was getting under way, only 26.4% of those in employment were women. The proportion in manufacturing employment was significantly higher, at 32.3%, reflecting the fact that, at this stage, Irish manufacturing industry was principally concentrated in the major urban areas, especially Dublin (where female participation in the paid labour force is traditionally higher), and that the single largest industrial sector, in employment terms, was textiles and clothing, whose workforce (as elsewhere) is predominantly female.

Manufacturing Employment Change in Ireland 1961-1986

During the period 1961-1971, total manufacturing employment grew by 2l% (Table 1), the bulk of this growth being due to incoming foreign investment (Gillmor, 1985). While male employment grew at a faster rate than female employment in this period, this was due entirely to stagnation in the textiles and clothing sector, in which the majority of female manufacturing workers were to be found. Excluding this sector, female employment grew significantly faster than male employment (36.0% as against 29.2%). Of particular significance was the very rapid rate of growth of female employment (81.9% as against 54.9% for males) - albeit from a very small base - in the metals and engineering sector (including electrical engineering), which has been the leading sector of foreign investment in Ireland.

The trends established in the 1960s were further reinforced in the 1970s. Heavy contraction in the textiles and clothing sector mainly affected women, so that aggregate female employment in manufacturing in the period actually declined slightly, despite an overall increase in employment in manufacturing of 11.5%. Almost all of this increase was attributable to foreign firms (Telesis Consultancy Group, 1982). Excluding the textiles and clothing sector, however, female manufacturing employment grew at a slightly faster rate than for males. Again, the metals and engineering sector stands out in this regard, with female employment in this sector expanding by a massive 135.2%, almost exactly double the rate for its male counterpart.

The 1980s have seen an overall decrease in manufacturing employment in Ireland, amounting to 9.6% in the period 1981-1986. To a certain extent this has been due to international recession in the early part of the decade, but the fact that output has continued to grow strongly through the decade suggests that other factors, particularly labour-saving technology and subcontracting of service functions (leading to a re-categorisation of some workers from 'industry' to 'services' in official statistics), have been primarily responsible. The employment performance of females in the 1980s has been much stronger than that for males. Excluding textiles and clothing (which continued to contract rapidly), female manufacturing employment actually grew in 1981-1986, albeit slightly (1.4%), whereas that for males fell sharply (10.1%). In the metals and engineering sector, where there was an overall growth in employment, the number of female employees increased by 21.3% as against only 1.5% for males.

Most of the employment loss in the 1980s occurred in indigenous (largely 'traditional') industry, whereas there was only a slight decline in the foreign (largely 'modern') sector. Given the fact that almost half of the employment in foreign firms in Ireland is in the metals and engineering sector, as against only a fifth in the case of indigenous industry (Industrial Development Authority Annual Report, 1986), one can

surmise – in the absence of aggregate data on the gender division in foreign and indigenous firms – that foreign firms have been primarily responsible for the superior manufacturing employment performance of women (apart from textiles and clothing) in Ireland since 1960, and that these firms have therefore been much more oriented to the recruitment of women workers than have indigenous firms.

This conclusion is further supported by data on the spatial distribution of female manufacturing employment. Growth in female employment since 1961 has occurred exclusively outside the main urban centres. If one defines the latter as comprising Dublin City and County, Cork, Limerick and Waterford County Boroughs, and County Louth (which attracted a disproportionate share of manufacturing employment in the protectionist period prior to 1961), one finds that female manufacturing employment in these areas combined declined by 35.5% between 1961 and 1986 (due mainly to contraction of the textiles and clothing sector) while it increased by 139% in the remainder of the country. As a result the proportion of total female employment located in the urban centres declined from 74.3 to 43.8%

The growth of female employment outside the main urban centres parallels the spatial pattern of growth in employment in foreign investment, which has shown a strong preference for rural and small-town locations (Breathnach, 1985). Of Ireland's nine planning regions, the three containing the highest proportions of manufacturing employment in foreign firms are all located in the traditionally less developed western part of the country (Gillmor, 1982). These are also the three regions with the highest proportions of females in manufacturing (excluding textiles and clothing). American firms have played a particularly important role in shaping this pattern (Table 2). One may conclude, therefore, that access to female labour from a rural/small-town background has been a locational determinant of considerable significance to foreign firms investing in Ireland.

Women's Employment in the Irish Electronics Industry

As Massey (1984, p. 140) has noted. "Electronics is a labour-intensive industry - it is undisputed that the search for labour is one of the dominant determinants of its location." Given Ireland's labour-reserve status, therefore, one would expect that the electronics sector would be prominent among foreign firms which have located in the country, and this is indeed the case. In fact, electronics is the single most important element of foreign investment in Ireland, accounting for a sixth of all employment in foreign firms in 1987, over 10% of total GDP, and about 20% of total exports. Foreign electronics firms account for 85%, of all electronics employment in Ireland (Cogan, 1987). Production consists mainly of assembly and testing of intermediate (integrated circuits) and final products (especially computers). U.S. firms account for about 80% of employment in the foreign-owned electronics sector.

Table 2. Regional distribution of foreign and female manufacturing employment, 1981

Planning region	*Females as % of manufacturing employment **	*Foreign firms as % of manufacturing employment*	*U.S. firms as % of manufacturing employment*
Northwest	31.5	47.2	22.6
West	29.1	48.3	36.7
Midwest	24.6	51.6	27.7
Midlands	23.6	36.0	18.9
East	22.9	30.1	8.7
Donegal	21.1	15.6	1.4
Northeast	19.6	37.0	19.7
Southeast	18.0	25.4	9.2
Southwest	16.2	36.8	13.6
IRELAND	21.8	34.4	14.4

* Excluding textiles, clothing and footwear.

Sources: Census of Population (1981) and Gillmor (1982).

Two extensive studies of firms in the Irish electronics sector provide detailed insights into the gender dimension of employment in the sector. Wickham and Murray (1987) carried out surveys in both 1981 and 1983-1984 covering 90% of firms in the sector. Jackson (1987) conducted a survey of larger foreign-owned electronics firms representing an estimated 84% of all employment in such firms. The following findings are largely derived from these studies.

Women accounted for 53% of all employment in the sector in 1983 - almost twice the participation rate of women in manufacturing employment as a whole. This high proportion of women is directly related to the high proportion (55%) of the workforce who were classified as assembly workers/operatives (Table 3). Of these workers, three-quarters were women, the proportion being higher for firms specialising in mass production of components and consumer products. Due to the low proportions of women in other work categories, (apart from clerical work), over three-quarters of all women in the electronics sector were assembly workers.

Table 3. Occupational structure of the Irish electronics industry, 1983

	Occupational category as % of total employment	*Women as % of occupational category*
Managers	6.1	3.0
Professionals *	7.3	15.5
Administrators	5.4	52.0
Clerical	7.5	74.9
Supervisors	5.5	20.2
Technicians	8.0	5.9
Craft workers	2.0	0.7
Operatives	55.4	74.0
Others	2.8	40.4
Total	100.0	53.4

* Mainly engineers and technologists.

Source: Wickham (1986).

While the proportion of workers engaged in assembly work (55%) is high by the standards of developed countries (a third in both the U.S. and the U.K. in 1980-1981), it is low by comparison with Third World export processing zones, where, typically, upwards of 90% of the workforce are assembly workers. This indicates that Irish-based electronics firms occupy an intermediate position in the industry's international division of labour. Thus, whereas developed core countries are oriented more towards management, marketing and technological development functions, and Third World countries specialise in component manufacture and assembly of simpler consumer products for re-export back to the country of origin, in Ireland there is a greater relative emphasis on testing and assembly of more complex electronic control systems, with products being sold on directly to European markets. Therefore, Irish-based electronics firms tend to employ higher proportions of technical, professional and sales staff than their Third World counterparts.

However, very few of these more highly-skilled workers are women. In 1983, only 3% of managers, 15.5% of professionals and 5.9% of technicians in the electronics sector were women (compared with 74% of assembly workers) (Table 3). Thus is created a "rigidly hierarchical social system of production" (Massey, 1984, p. 140), whereby most of the executive, technical, scientific and skilled manual work is done by men, while the basic assembly work is mainly done by women. This apparent gender segmentation, however, does not necessarily reflect deliberate policy on the part of the firms in question; rather does it more likely reflect biases in the Irish educational and social systems which discourage women from seeking careers in these occupations. Thus, Catholic Church control of schools and widespread sex segregation in education have combined to steer female students away from technical and business subjects (Beale, 1986; O'dowd, 1987). As Massey (1984, p. 141) has

observed: 'who does what job [in the electronics industry] is part and parcel of the reproduction of social structures in society as a whole'.

Overt employment discrimination on gender grounds is illegal under Irish law. However, an appropriate supply of preferred female labour can be generated through more indirect means. Thus, the wage levels payable to electronics assembly workers are very low relative to the typical wages of male industrial workers, who therefore are deterred from taking on this work. At the same time, wages in the electronics sector are high compared to the average for female industrial (and unskilled service) workers, thereby stimulating a ready supply of women workers.

The relatively low wage rates received by women assembly workers in Irish electronics firms is further reinforced by very limited promotion outlets. Recruitment to more sophisticated job categories is usually done from outside the factory rather than from lower grades (and, as indicated already, involves mainly men). However, the evidence suggests that promotions which *do* occur from assembly work favour male workers, thereby reinforcing the notion that such work is essentially the preserve of women only.

Women Workers and Trade Unions

The fact that the great majority of assembly workers in Irish electronics firms are members of a trade union has had little impact on the status of the workers concerned. Trade union membership bears little relationship to trade union consciousness (Murray and Wickham, 1985). An important factor in this respect is that many foreign branch plants in Ireland have concluded exclusive deals - usually with the principal general workers union, SIPTU (previously the ITGWU) - in advance of setting up in Ireland. This means that trade union membership is a *fait accompli* for incoming assembly workers, and is something that is taken for granted, especially as union dues are normally deducted by management direct from wages and then passed on to the union. The tendency for wage rates and other conditions of employment in Ireland to be negotiated centrally at national level also inhibits the development of trade union identification among workers at local level.

For women workers specifically, interest in trade union affairs is further inhibited by the fact that union officials tend to be almost exclusively male (even where the vast majority of the workers whom they represent are women) and frequently unconsciously accept the notion that women workers per se should not be paid as much as men, on the grounds that their income is essentially supplementary, whereas it is the role of male workers to earn the basic 'family' income. The low involvement of women in trade union activism - even where most of the workers are themselves women - may be attributed, if only in part, to obstacles placed in the way of such involvement, such as sexist behaviour and attitudes on the part of male trade union committee members and difficulty in

attending after-hours meetings due to domestic duty commitments which still tend to fall disproportionately on women despite having jobs outside the home (Harris, l983).

Table 4. Employment structure of foreign-owned manufacturing plants in Limerick City

	Women		*Men*		
Work category	As % of all workers	As % of category	As % of all women	As % of category	As % of all men
Assembly/operative	66.5	69.4	83.7	30.6	45.4
Technical/professional	12.9	16.8	3.9	83.2	24.0
Clerical/managerial	15.6	43.4	12.2	56.6	19.7
Maintenance	5.0	1.9	0.2	98.1	10.9
Total	100.0	55.2	100.0	44.8	100.0
Total employment: 3134					

However, the main problem in this respect is that most women assembly workers show very little interest in any case in organising themselves in defence of their interests. As elsewhere, this may be related to the youth of electronics assembly workers, most of whom are recruited as a matter of policy direct from school or the state industrial training agency. Many of these may have little long-term commitment to their job, either because they hope to find something better or because they expect to retire on marriage - a practice which is still quite common (though declining) in Ireland. However, even the significant numbers of (mainly married) older women assembly workers show little inclination to militancy, either because of preoccupation with household duties, or because in many cases they are the sole or principal household income earners and do not wish to jeopardise their position, particularly as the range of employment choice open to working mothers tends to be spatially restricted by household encumbrances (Women And Geography Study Group, 1984).

Women's Employment in Foreign Firms in Ireland: the Local Impact

Given the high proportion of manufacturing employment accounted for by foreign firms, particularly in the western regions. the distinctive gender structure of their workforces can have a significant impact on local labour markets. Flanagan (1986) conducted a study of the workforce structures of large foreign-owned branch plants in Limerick. Ireland's third largest city (1986 population, including suburbs: 74,000), located in the southwest of the country. Of eight such plants employing I00+ workers, six co-operated in the study. Between them, these employed a total of 3134 people (average 522): this represented 43% of all employment in manufacturing plants in the Limerick urban area in 1986.

Of the six firms, three were in electronics, two in electrical engineering, and one in precision mechanical engineering. Only the latter had a majority of male workers. Women represented 55% of the aggregate employment in the six firms, which is remarkably similar to the national figure for electronics workers reported above. Women workers in the six firms accounted for over half of all female workers in manufacturing plants in the Limerick urban area, thereby conferring on these firms a dominant role in the market for women industrial workers in the region.

Table 4 provides a detailed breakdown of the aggregate workforce in the six firms according to broad work categories. This shows that two-thirds of all workers in the six plants were assembly workers, most of whom were women. Given the low representation of women in the other work categories, this meant that over four-fifths of all women workers in the plants were in assembly. Women were particularly poorly represented in the technical/professional and maintenance (mainly skilled craft workers) grades. The available data did not allow a numerical distinction to be made between clerical and managerial workers, but the evidence from the Wickham and Murray and Jackson studies (above) suggests that women were more likely to be concentrated in the clerical end of this category.

These data, therefore, indicate, first of all, how the type of jobs available in the six factories is largely restricted to unskilled assembly work, and, secondly, how particularly circumscribed the labour market for women workers is in the plants. Given the dominant position of these plants in the local Limerick economy, this has major implications for the focal labour market. In particular, a shortage of local outlets for growing numbers of technical/professional graduates will inevitably lead to emigration of these graduates from the region. The possibility that the Limerick situation is replicated around the country is strongly indicated by the rapid recent growth in emigration by technically-qualified people from the country altogether (Breathnach and Jackson, 1991).

Analysis of the employment data for the six firms throws some interesting light on the phenomenon of gender segmentation, even within the unskilled work category. As already noted, the one firm engaged in mechanical engineering had a predominantly male workforce (including 80% of assembly workers), while the others – engaged in electronics/electrical engineering – were predominantly female. In addition, gender segmentation was evident in the internal production operations of two of the latter firms. One electrical engineering firm had two categories of production worker-machine operators (almost 90% male) and assembly workers (exclusively female). One can see clearly here the operation of conventional perceptions of what kinds of work are appropriate to men and women, even though the training and previous experience requirements of both kinds of work were broadly similar.

Finally, the six firms under study were asked to rate the importance of a range of possible factors (including availability of female labour) involved in choosing to locate in the Limerick area. The largest of the firms (952 employees, of whom 63% were women) stated that the availability of female labour was of no importance, whereas availability of management and office personnel (5.5% of workers) was given as a very important locational factor. The second largest firm (59% female) actually queried the inclusion of availability of female labour in the list. The firm with the highest proportion of women workers (48.4%) listed all but four of the factors presented as being 'very important', thereby allocating no special importance to the female labour factor. A fourth firm, in which 51.5% of the workforce was female, marked all of the listed factors as being important except the availability of female labour, which was stated to be of no importance. Of the remaining firms, one was primarily a male employer; the other – the smallest of the six – did attribute importance to the female labour factor, but did not give it priority. Overall, one suspects a certain element of disingenuousness and perhaps sensitivity to the issue of female employment in the responses to this question.

Conclusion

Ireland has, over the last 30 years, developed as a base for supplying the European market with goods produced in branch plants of transnational firms. The reasons for locating in Ireland are complex, but access to relatively cheap, unskilled and female labour has clearly been of considerable importance. The emphasis on low-skill assembly work in branch plants located in Ireland, and the associated lack of higher-order functions, confers on Ireland a truncated and inferior form of development and therefore a dependent and subordinate position within the NIDL which emerged in the 1960s and 1970s. This position, however, is defined within a West European context: Ireland is not in the business of competing for the types of mobile investment which have in the past chosen to locate in parts of Southeast Asia and Latin America. Rather is Ireland's an intermediate 'semi-peripheral' status within the NIDL.

There is some evidence that foreign firms located in Ireland tend to upgrade their operations over time (Wickham and Murray, 1987); there is also evidence that the proportion of women entering higher-grade work is growing, albeit slowly and from a very low base. What is particularly worrying is that the repetitive assembly work in which women workers have hitherto been concentrated is precisely the kind of work most liable to automation with the development of micro-electronic technology. This process of replacement of unskilled and mainly female labour by new technology has been widely reported elsewhere (Elson and Pearson, 1989; Pearson, 1989; Elson, 1991), and could have profound repercussions on the spatial division of labour in manufacturing industry.

This replacement process is also clearly in operation in the case of Ireland, where growth in the number of assembly workers in the electronics industry in the 1980s has been sluggish, while output has been expanding rapidly. Indeed, employment growth in the industry is now largely dependent on the continuous introduction of new firms. Whether this will continue in the context of growing competition from lower-cost locations in Southern and Eastern Europe, as the thrust towards European unity gathers pace, remains to be seen. As new European peripheries are created, the Industrial Development Authority is hopeful of raising Ireland's position in the pecking order of the European spatial division of labour, through upgrading the technical status of the functions being carried out there by foreign firms. Should this strategy prove successful, women workers will have to transcend traditional patterns of training and recruitment if they are to secure reasonable prospects of future employment growth in the manufacturing sector.

Acknowledgement Gratitude is expressed to Peter Murray for his comments on an earlier version of this paper.

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CHAPTER 12

HYPOTHESIZED FOETAL AND EARLY LIFE INFLUENCES ON ADULT HEART DISEASE MORTALITY: AN ECOLOGICAL ANALYSIS OF DATA FOR THE REPUBLIC OF IRELAND

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First published in *Social Science and Medicine* (1998), 46(6), 683-693.

Introduction

Spatial disparities in the prevalence of heart disease are frequently explained in terms of adult lifestyle factors (e.g. diet, smoking, alcohol consumption, stress, exercise, etc.). However, in recent years a number of researchers have suggested an alternative mode of explanation: namely, that the risk of heart disease in adult life may be influenced either by factors related to living conditions shortly after birth or by foetal development before birth. These propositions may be referred to collectively (if loosely) as the "perinatal" hypothesis. Much of the early research on the perinatal hypothesis was prompted by observed ecological correlations between adult heart disease mortality and infant mortality within the same age cohort several decades previously. However, correlations of this type have so far been reported for a limited number of countries, raising the question as to what extent they are replicable in other geographical contexts. This paper reports the results of an ecological analysis of adult heart disease and infant mortality in the Republic of Ireland.

The first part of the paper traces the origins and evolution of the perinatal hypothesis and identifies some of the major issues which have arisen in the literature. The middle sections of the paper report the results of an empirical study using data on infant mortality and deaths from ischaemic and other forms of heart disease in the Republic of Ireland. The final part of the paper discusses the extent to which these findings provide support, or otherwise, for the perinatal hypothesis.

The perinatal hypothesis

The origins of the perinatal hypothesis may be traced to a series of ecological studies by Forsdahl in the 1970s (e.g. Forsdahl, 1977, 1978). Forsdahl observed that mortality from arteriosclerotic heart disease in Norway varied considerably from county to county, but that these variations did not correspond to contemporary variations in living conditions. Using infant mortality as an indicator of living conditions, Forsdahl (1977) found that: (1) there were considerable variations in infant mortality rates in Norway at the beginning of the century, but that these variations had more or less disappeared by the 1960s; (2) there was a strong correlation between the patterns of mortality from

arteriosclerotic heart disease amongst people aged 40-69 in 1964-1967 and 1969-1972 and infant mortality from 1896 to 1925; i.e. people were dying in greater numbers as adults in the same areas as people from the same age cohort had died 50 years previously as infants.

Forsdahl interpreted the equalization of the infant mortality rates as evidence of a reduction in the spatial inequalities in living conditions. This in turn implied that the areas which initially had the highest levels of infant mortality must have experienced more rapid improvements in living conditions. This led him to hypothesize that people who experienced poverty in childhood and adolescence were more susceptible to heart disease in later life than people raised in the areas which were originally the most prosperous. He further suggested that "the prerequisite is a later exposure to affluence and its consequence in the form of our present way of life. Where this latter condition is not fulfilled as in the underdeveloped countries the mortality rates from arteriosclerotic heart disease remain low" (Forsdahl, 1977, p. 95).

In a subsequent study, Forsdahl (1978) reported a strong correlation between infant mortality in the early parts of the century and mean serum cholesterol levels, but not with blood pressure, amongst adults in the mid-1970s in municipalities in Finnmark. This led him to suggest that people brought up in poverty may have a reduced tolerance to certain types of fat.

Forsdahl's study may be criticized on at least two counts (Elford *et al.*, 1992):

1. Although Forsdahl showed links between adult mortality and infant mortality 50 years previously, he did not provide any direct evidence that prosperity in later life is a factor. Later prosperity is assumed (on the basis of declining infant mortality rates) rather than measured directly. Also, the areas identified as having experienced the greatest increases in prosperity are (by definition) those which were poorest to begin with adult mortality could just as easily be a function of childhood poverty as of later prosperity.

2. Forsdahl did not take sufficient account of possible confounding factors. He acknowledged, for example, that cigarette smoking may have been more widespread in the high mortality areas, but he then ignored smoking (and other later lifestyle factors) when proposing his theory to explain adult mortality. If smoking happened to be more widespread in the areas which previously had the highest infant mortality rates, significant ecological correlations between adult heart disease and infant mortality could arise without there necessarily being any direct causal link between heart disease and conditions around the time of birth.

Taking these points together, one can identify at least three sets of possible explanations (plus hybrids) for Forsdahl's empirical observations:

1. Adult heart disease may be a function of initial poverty followed by later prosperity (as hypothesized by Forsdahl); or

2. Adult heart disease may be a function of lifestyle factors (such as smoking) in adult life, which simply happen to be found in the areas which previously had high rates of infant mortality; this is consistent with the "orthodox" view; or

3. Adult heart disease is a function of factors around the time of birth, irrespective of whether or not this is followed by later prosperity the "perinatal" hypothesis.

Ecological correlations between adult heart disease and infant mortality in earlier decades have been reported in other studies. Williams *et al.* (1979), for example, in one of the earlier UK studies, found that ischaemic heart disease mortality in English and Welsh counties in 1968-1973 was ecologically correlated with infant mortality in the period 1885-1948. However, they also found that the pattern of infant mortality had changed very little over time. In other words, there was no evidence to suggest that adult mortality in England and Wales was necessarily associated with rapid prosperity (as hypothesized by Forsdahl).

Buck and Simpson (1982) found that infant mortality in 1917 in 17 US registration states was correlated with adult arteriosclerotic heart disease mortality (and also respiratory cancer mortality amongst men) in 1961 and 1971. However, they did not find a correlation between infant mortality in 1927 and adult mortality in either 1961 or 1971. Buck and Simpson suggested that adult heart disease may in some way be triggered by the immunological responses to diarrhoea and enteritis, which were common sources of infant deaths in 1917, but less common in 1927. This might explain the absence of an ecological correlation with infant mortality in 1927.

Much of the more recent work on the perinatal hypothesis is associated with Professor David Barker and his associates in the MRC Environmental Epidemiology Unit in Southampton. Barker and his associates have produced a series of thought-provoking studies, at both ecological and individual levels of analysis, many of which are reprinted in Barker (1992).

For example, Barker and Osmond (1986) reported ecological correlations between infant mortality 1921-1925 and a number of major causes of death 1968-1978 for 212 local authority areas in England and Wales. Heart disease recorded a high correlation, but the correlations for

bronchitis and stomach cancer were even higher. These correlations are consistent with the perinatal hypothesis, but they do not necessarily contradict lifestyle hypotheses related to the regionally persistent nature of social deprivation in England and Wales; i.e. the areas which were the most socially deprived, and which had the highest rates of infant mortality in the past, still tend to be the most socially deprived at present and might therefore be expected to be characterized by the lifestyle factors (such as smoking or diet) believed to contribute to heart disease. However, Barker (1994a) argued against this possibility and noted that deaths from lung cancer, which he suggested may be taken as an indicator of tobacco consumption, and dietary fat consumption each have a different geographical distribution from past infant mortality.

Barker and Osmond (1987), in a more detailed study, compared three neighbouring towns in Lancashire (Burnley, Nelson and Colne). The three towns are very similar today in terms of social composition, and most other aspects, i.e. they are all cotton weaving towns. However, Burnley has one of the highest death rates in England, whereas Nelson is close to the national average. Colne is intermediate. These death rates directly parallel the infant mortality rates in the early decades of the century. These differences were attributed, at the time, to differences in development. Burnley and Colne were older towns, and the women working in the mills were usually second or third-generation mill workers. Nelson was newer, and many of the women working there were recent immigrants from nearby rural districts where the women were described as "sturdier and healthier" than those in Burnley. However, whatever the reasons were for the differences in infant mortality at the turn of the century, these differences would seem to be reflected by present-day heart disease mortality rates lending support to the perinatal hypothesis.

Ecological correlations between adult heart disease rates and infant mortality several decades previously could be misleading because of population movements. However, Osmond *et al.* (1990) analysed data coded from almost 2 million death certificates which recorded the place of birth in England and Wales between 1969 and 1972. It was found that about half of the deceased had migrated to a different part of the country during their lives, but it was also found that the increased risk of coronary heart disease and stroke of people born in the northern counties and industrial areas persisted even if they moved to low-risk parts of the country. Conversely, people born in and around London retained a lower risk from these diseases, even if they moved to areas of higher risk.

The most persuasive evidence provided by Barker and his colleagues in support of the perinatal hypothesis is provided by a series of longitudinal studies using archival birth records in places such as Hertfordshire (Barker *et al.*, 1989; Osmond *et al.*, 1993), Preston (Phillips *et al.*, 1994) and Sheffield (Barker *et al.*, 1995). These studies match information on

features such as birth weight, ponderal index, and weight at 12 months of babies born in the early decades of the century with their later medical histories, resulting in a series of statistically significant associations, reinforced by plausible biomedical explanations (e.g. Barker, 1994a,b, 1995). The net effect of this work has been to push the hypothesized critical period further and further back from childhood, to infancy, to the early foetal period, and possibly even to the period before conception (during which, it is hypothesized, maternal nutrition levels may influence subsequent early foetal development).

The thinking of the Environmental Epidemiology Unit in Southampton has clearly moved far beyond Forsdahl's early observations and hypotheses. However, this thinking is largely (although not entirely) informed by empirical studies based in the UK. It is possible that the relationships which have been identified may be peculiar to the UK at a particular stage in its epidemiological history. There is therefore a need to establish to what extent the empirical regularities observed in the UK can be replicated in other geographical contexts. The remainder of this paper reports the preliminary findings of an empirical evaluation of the perinatal hypothesis in a different geographical context namely, the Republic of Ireland.

The data

The author is unaware of any archival birth records which could form the basis of a longitudinal study in Ireland, so the present study is confined to an analysis of ecological data. The data used in this study were extracted from the *Report on Vital Statistics*, and its forerunners, published annually by the Central Statistics Office in Dublin. (The *Report on Vital Statistics* was published under several different titles in the period 1916-1990. It was published in the earliest part of the study period as *The Annual Report of the Registrar General*). Publication of these reports normally occurs within a few years, but publication has recently fallen behind schedule with the result that no data were available at the time of writing for any year after 1990.

The *Report on Vital Statistics* provides data on births and deaths disaggregated by Counties and County Boroughs (Fig. 1). The present territory of the Republic of Ireland is divided for administrative and statistical purposes into 27 Counties and five County Boroughs. [Strictly speaking there are only 26 Counties, but one (Tipperary) is divided into two Ridings, each of which has similar powers to a County, for local government purposes.] The larger urban areas (i.e. Dublin, Cork, Limerick, Waterford and Galway) are incorporated as County Boroughs and have broadly similar administrative powers to Counties. The administrative areas of the Counties and County Boroughs are non-overlapping, so the County Boroughs may in effect be thought of as "urban counties". Most counties have a population between 50 000 and

125 000, although Dublin C.B. and Dublin County with populations of 478 389 and 546 915, respectively, are notable exceptions.

Figure 1. Counties and County Boroughs, 1990.

The *Report on Vital Statistics* provides information on the number of deaths from Principal Groups of Causes, disaggregated by county of normal residence, sex and 10 year age groups. This study analyses deaths from "Ischaemic and Other Forms of Heart Disease" (ICD 393-398, 410-417 and 420-429) amongst people aged 55-64. Although the number of deaths are higher in the older age groups, it was felt desirable to confine the study to deaths which could be regarded as "premature". Deaths in the 65-74 age group, or above, were therefore omitted from the study. Deaths below the age of 55 were also omitted to limit the size of the target cohort.

There were a total of 902 male and 300 female deaths from Ischaemic and Other Forms of Heart Disease amongst people aged 55-64 in 1990. Although this is a substantial number in total, it was felt that the numbers in some counties might be too small to provide a reliable indication of

underlying risk because of stochastic variations. It was therefore decided to aggregate deaths amongst 55-64-year-olds over a 10 year period from 1981 to 1990. This gave a total of 10,596 male and 3,824 female deaths, ranging from 95 male and 37 female deaths in Leitrim to 1,829 male and 806 female deaths in Dublin C.B.

The total numbers of deaths were expressed as rates using the population aged 55-64, as recorded in the 1986 Census of Population. Age-specific rates were estimated using both empirical Bayes and conventional maximum likelihood techniques. However, the differences between the two sets of estimates were found to be minimal, so the present paper reports only the findings based on the maximum likelihood estimates.

People in the 55-64 age cohort in 1990 were born between 1925 and 1935; those aged 55-64 in 1981 were born between 1916 and 1926. The date of birth of those dying between 1981 and 1990 therefore ranged from 1916 to 1935. Data on infant deaths (i.e. deaths under the age of 12 months) were extracted from the Reports for 1916-1935. There was a total of 87,368 infant deaths. The numbers of deaths in each area were aggregated and expressed as a rate using the aggregated number of live births over the same time period. As before, little difference was found between empirical Bayes and maximum likelihood estimates, so only the findings based on the maximum likelihood estimates are reported here.

The boundaries between Counties remained virtually unchanged from 1916 to 1990, but the number of County Boroughs in the study area increased from one in 1916, to four in 1923, to five in 1986. Also, the boundaries between some County Boroughs and the surrounding County areas were redefined (as, for example, in Dublin in 1930) to take account of urban expansion. Given that the mortality rates between the County Boroughs and the adjoining rural areas are often strikingly different, it was decided to retain the County-County Borough distinction, although to do this it was necessary to ignore the effects of minor boundary changes. The study is therefore based on 27 Counties and the four County Boroughs which have been in existence since 1923. Galway County and Galway County Borough are regarded for the purposes of this study as a single area (which, in fact, they were until 1986). The numbers of births and deaths in Cork, Limerick and Waterford County Boroughs before 1923 are not recorded, so the births and deaths in these cities for the period 1916-1922 are allocated between the County and County Borough areas in the same ratio as was recorded for the period 1923-1935. It is believed that the errors arising from this expediency are minimal.

Study design and limitations

The objectives of the present study are necessarily limited in scope. The study is intended as an exploratory investigation of whether the Irish data are broadly consistent with the perinatal hypothesis: it is not intended as

a rigorous test of detailed causal hypotheses. If adult heart disease is a function of conditions in early life or (as argued by Barker) foetal development, then one would expect to find a significant ecological correlation between adult heart disease and infant mortality in the same age cohort several decades previously. The presence of a significant correlation would not "prove" the perinatal hypothesis to be correct, but it could be regarded as providing supporting evidence. Conversely, the absence of a significant correlation would not necessarily prove the perinatal hypothesis is false, but it would point to "inconsistencies" which need to be explained if the perinatal hypothesis is not to be rejected.

Some of these inconsistencies may be generated by the methods used. There are a number of well-documented methodological problems associated with ecological correlations, such as the modifiable areal units problem (Openshaw, 1983) and the problem of ecological inference (Robinson, 1950). There are also a number of less-documented problems, such as "data closure" (Chayes, 1971) and "correlated components" (Pearson, 1897). None of these problems invalidate the use of ecological correlations, especially when used as an exploratory tool, but they must be taken into account when interpreting the results.

In this instance, we wish to make inferences about causal processes affecting individuals. In addition to the usual problems of making inferences about individuals from aggregate data, the fact that the two death rates necessarily refer to different individuals requires us to give some thought to how the death rates should be interpreted. The implicit assumption in many of the studies referred to above is that infant mortality may be regarded as a surrogate measure of living conditions (e.g. Forsdahl, 1977, 1978), although Buck and Simpson (1982) suggested that raised infant mortality may be an indicator of diarrhoea or enteritis. Infant mortality was initially regarded in the present study as an indicator of unspecified social conditions: however, this interpretation (as will be explained later) turned out to be more problematic than was originally envisaged.

Heart disease mortality should also be regarded as a surrogate measure: in this instance, as a surrogate for heart disease morbidity (which is what we would ideally like to explain). It is possible that heart disease survival rates may be higher in some areas, giving a misleading impression of relative heart disease morbidity. However, although this must be regarded as a possibility, the author is unaware of any evidence to suggest that Irish mortality rates do not provide a reasonable indicator of morbidity.

The adult and infant mortality rates should ideally refer to the same cohort. Everyone dying aged 55-64 between 1981 and 1990 would have been born between 1916 and 1935, but people born in some years will have had a greater "opportunity" of dying at the "right" age between

1981 and 1990 than those born in other years. For example, those born in 1916 would be the correct age for at least part of 1981, but would have been too old by 1982. Those born in 1926, in contrast, could have died at the right age in any year between 1981 and 1990. Given that the patterns of infant mortality remained relatively stable in the period from 1916 to 1935 (see below), this is not believed to be a major problem.

A more serious problem is that an unknown percentage of the people dying in each area would have been born in a different area. If the risk of heart disease is influenced by factors at the beginning of life (as hypothesized), then the adult mortality rates in some areas may be inflated by the in-migration of high-risk people or the out-migration of low-risk people, whereas the mortality rates in other areas will be deflated by flows in the opposite direction. The extent to which adult mortality rates are inflated or deflated will depend upon the extent of these flows. This issue will be addressed again in the final section.

Finally, as in all correlation studies, one must be alert to the possibility that the observed correlation between two variables could be influenced by a third, unidentified, variable. If this third variable is positively correlated with the two variables being observed, the net effect may be to induce a significant positive correlation between the observed variables even if they are causally unrelated. If the third variable is positively correlated with one of the observed variables but negatively correlated with the other, the net effect will be to deflate the observed correlation between the variables. The most likely situation, in the present context, is that the pattern of adult heart disease mortality could be influenced by lifestyle factors or conditions in adult life which have a similar spatial distribution to the social conditions which pertained in childhood. This would cause the observed ecological correlation between heart disease mortality and infant mortality several decades previously to be inflated. Although a far from perfect solution, this study attempts to control for social conditions in adult life using infant mortality in the 1980s as an indicator of unspecified living conditions, following Buck and Simpson (1982).

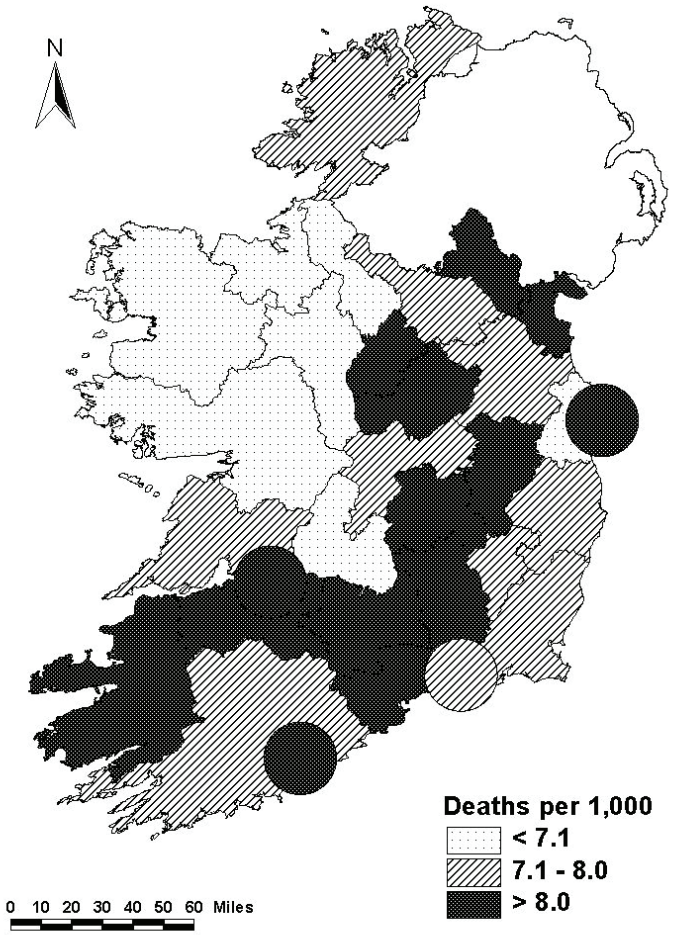
Empirical results

There were 10,596 male and 3,824 female deaths from Ischaemic and Other Forms of Heart Disease between the ages of 55 and 64 in the Republic of Ireland between 1981 and 1990, giving an estimated mean annual age specific death rate of 7.69 deaths per thousand for males and 2.65 deaths per thousand for females. The age-specific death rates per county ranged from a low of 6.27 per thousand to a high of 9.49 per thousand for males, and from a low of 1.98 per thousand to a high of 3.44 per thousand for females. There was a downward trend in deaths from heart disease during the study period: the national age-specific death rate for males fell from 7.98 in 1981 to 6.63 in 1990, whereas that for females fell from 2.90 in 1981 to 2.14 in 1990. (These rates were

calculated using population estimates for 1981 and 1990, based on information from the 1981 and 1991 censuses.)

The distribution of ischaemic heart disease mortality for males in the 1980s is shown in Fig. 2. There is a striking cluster of low mortality counties in the north-west of the country. The areas of highest mortality do not form any obvious pattern. Three of the four County Boroughs, represented by the circles, display above average death rates, but they are by no means the highest in the country.

Figure 2 Age-specific death rates from ischaemic heart disease for males, 1981-1990.

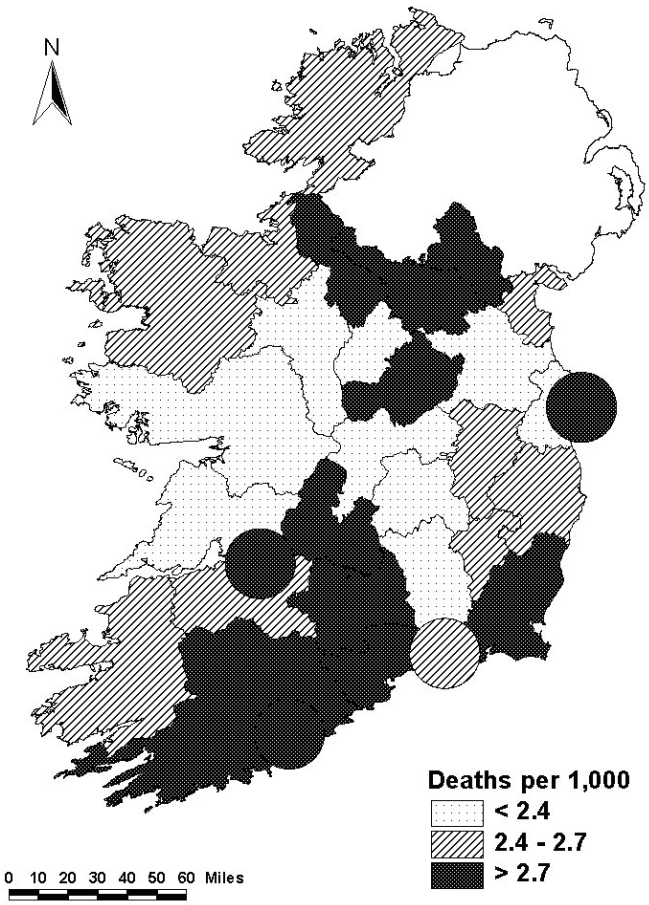


The distribution of ischaemic heart disease for females in the 1980s (Fig. 3) shows some similarities, to the extent that there is a cluster of low mortality counties in the west and clusters of high or moderately high mortality in the south and the north. However, the low mortality cluster for females is located further south and extends more into the midlands. Three of the four County Boroughs again have above-average rates of

mortality. The partial similarity between the two distributions is reflected by a positive, but non-significant, ecological correlation (r=0.25).

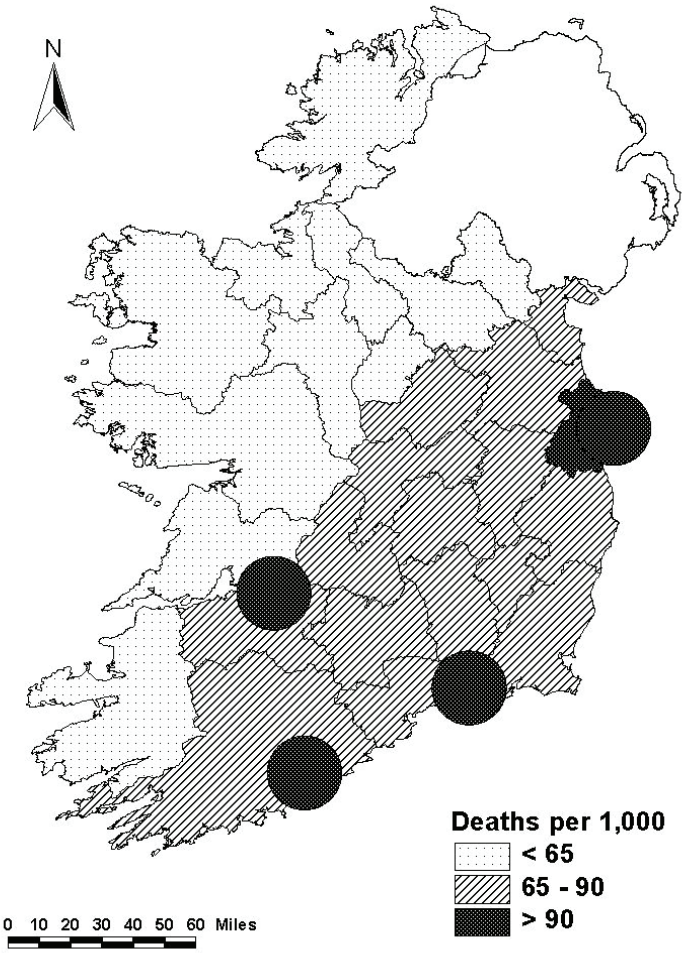
There was a total of 49,401 male and 37,967 female infant deaths between 1916 and 1935, giving mean annual infant mortality rates of 79.70 per thousand live births for males and 64.66 per thousand live births for females. Infant mortality rates fell slightly during the study period, from 86.8 per thousand in 1916 to 78.2 per thousand in 1935 for males and from 75.5 per thousand in 1916 to 58.2 per thousand in 1935 for females. However, the spatial distribution of infant mortality remained stable throughout the study period for both sexes (Table 1). It would therefore appear reasonable to regard rates based on all infant deaths between 1916 and 1935 as a reliable indicator of the spatial distribution of infant mortality at the time of birth for all those dying between 1981 and 1990.

Figure 3. Age-specific death rates from ischaemic heart disease for females, 1981-1990.



The infant mortality rates for males born between 1916 and 1935 display a very striking spatial distribution (Fig. 4). The distribution exhibits a high degree of spatial order, yet it is almost a mirror image of what one might have expected from a knowledge of the literature on social inequalities in Ireland. Conventional wisdom is that living conditions in Ireland have always been poorer in rural areas; and also, within rural areas, they have always been much worse in the north and west of the country than in the south and east. One would therefore expect infant mortality to have been highest in the north-west of the country and lowest in the urban areas, but the map for male infant mortality between 1916 and 1935 indicates that the opposite was actually the case. Further, the distribution exhibits a very strong positive skew, in which the major urban areas record rates approximately twice as high as those prevailing throughout most of the north and west.

Figure 4. Infant mortality rates for males, 1916-1935.



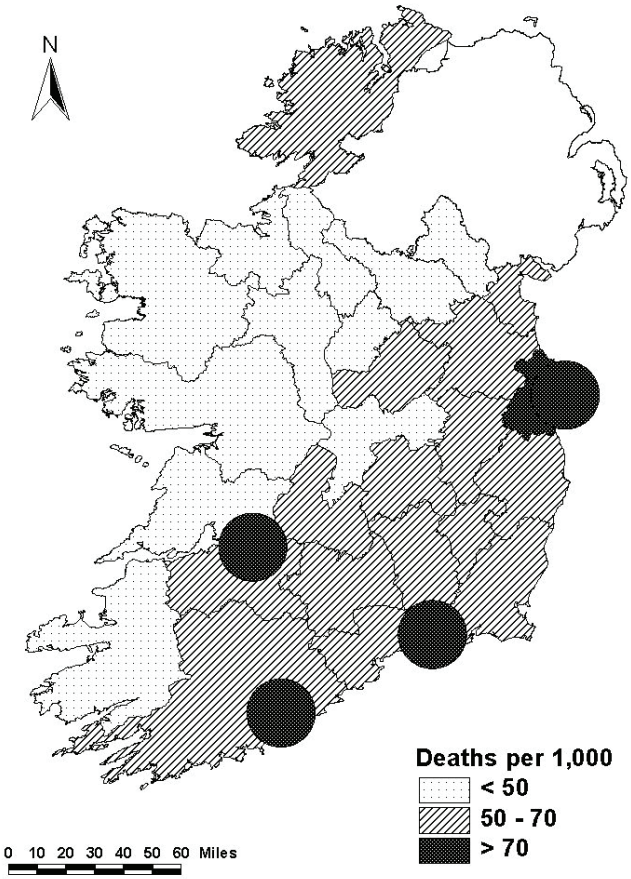
The pattern of infant mortality for females is, as one might expect, very similar (Fig. 5). The ecological correlation between male and female infant mortality between 1916 and 1935 is positive and highly significant (r=0.98).

If the perinatal hypothesis is correct, one would expect a significant positive ecological correlation between the heart disease rates and infant mortality, as reported in the UK, US and Norwegian studies.

Table 1. Ecological correlations between infant mortality rates for different time periods (males top right, females bottom left)

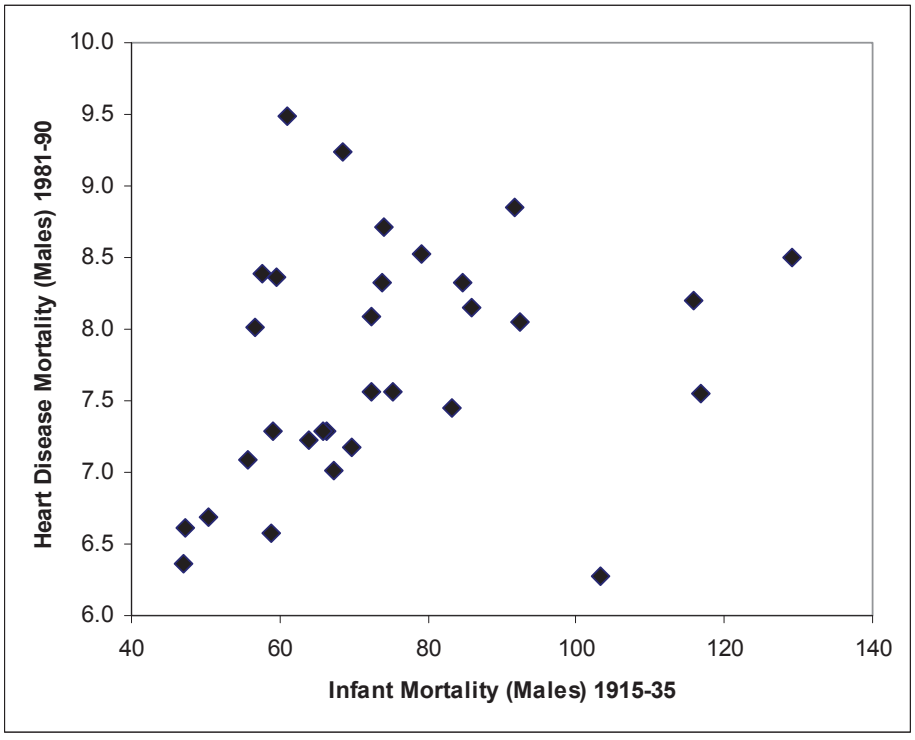
	1916-1920	*1921-1925*	*1926-1930*	*1931-1935*
1916-1920		0.9453	0.9072	0.8272
1921-1925	0.9361		0.9213	0.8533
1926-1930	0.9299	0.9216		0.8992
1931-1935	0.8799	0.8689	0.9447	

Figure 5. Infant mortality rates for females, 1916-1935.



The Pearson product moment correlations between ischaemic heart disease and infant mortality are found to be 0.26 and 0.29 for males and females respectively. These correlations are positive and sufficiently large to suggest that there may be a relationship of some sort, but they are not sufficiently large to be regarded as statistically significant at the 0.05 significance level. (Correlations were also calculated after excluding Dublin C.B. and Dublin County, which have much larger populations than the other areas. The correlation coefficients were larger, but still remained non-significant.) The scattergrams reveal a wide scatter of points, although there are some indications of a weak linear trend (Figs 6 and 7).

Figure 6. Scattergram of ischaemic heart disease rates 1981-1990 against infant mortality 1916-1935 for males.

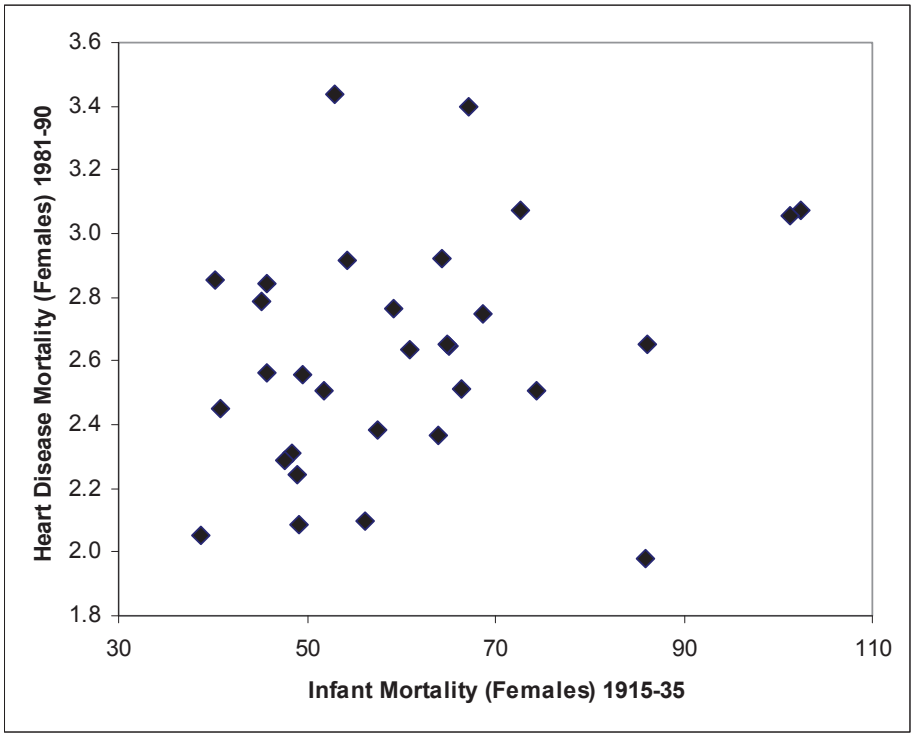


Both scattergrams also indicate a strong positive skew in the infant mortality rates. Normalizing both variables using logarithmic transformations made little difference to the Pearson product moment coefficients. However, Spearman and Kendall rank order correlations were found to be significant at the 0.05 significance level for males (r_s=0.39, tau=0.30), although not for females (r_s=0.30, tau=0.21).

The effects of possible confounding variables were tested using infant mortality rates for the 1980s as an indicator of modern living conditions. The partial correlations between the heart disease rates and infant mortality, controlling for infant mortality in the 1980s, were virtually

identical to the zero-order correlations for both males (r=0.26) and females (r=0.31), suggesting that the observed relationships, although weak, are not spurious.

Fig. 7. Scattergram of ischaemic heart disease rates 19811990 against infant mortality 1916-1935 for females.



Discussion

Three aspects of the empirical findings require further comment: (1) the striking differences in heart disease mortality between males and females; (2) the apparent anomalies in the pattern of infant mortality in Ireland between 1916 and 1935; (3) the weak ecological correlations between infant mortality 1916-1935 and adult heart disease in the 1980s.

Mortality rates from Ischaemic and Other Forms of Heart Disease are almost three times higher amongst males aged 55-64 than amongst females of the same age. This might appear to cast some doubts upon the perinatal hypothesis: it is easy to explain how such disparities might be generated by differences in adult lifestyles (e.g. smoking, alcohol consumption, occupation), but it is less obvious how they could be generated by factors before or soon after birth. However, the observed disparities are not as damaging to the perinatal hypothesis as they might first appear. Males and females are genetically different. There is evidence to suggest, for example, that females are "genetically stronger": male infant mortality rates are noticeably higher than female infant mortality rates, yet the "lifestyles" of male and female infants are unlikely to be

dissimilar. Males and females also develop in different ways. Boys are more likely to be born "short", because they are more vulnerable to undernutrition in late gestation because of their more rapid "growth trajectory", whereas girls are more likely to be born "thin". Barker (1994a) suggests that "thin" babies were undernourished in mid-gestation, and are subsequently likely to suffer elevated blood pressure and a disturbed glucose-insulin metabolism, whereas "short" babies were undernourished in late gestation, and are subsequently likely to suffer from raised blood pressure, and disturbed cholesterol metabolism and blood clotting. Both groups are vulnerable to coronary heart disease in later life, but for different reasons. Barker suggests that this "provides a framework within which the lower rates of cardiovascular disease in women than in men can be explored" (Barker, 1994a,bp. 49).

The second striking finding of this study is the spatial distribution of infant mortality in Ireland between 1916 and 1935 contradicts all the traditional assumptions about the geography of social disadvantage in Ireland. There are only three possible explanations for this apparent anomaly: (1) the true pattern of social deprivation in Ireland may be different from that traditionally believed; (2) the infant mortality rates for the period 1916-1935 are in some way spurious; or (3) infant mortality rates are not in fact related to social conditions, as generally believed; or that the relationship, for some unknown reason, is different in Ireland.

The first possibility is that, contrary to popular belief, social conditions may have been much worse in the urban areas than in rural areas. There is little doubt that the living conditions of the Dublin working classes in the early decades of the twentieth century were extremely poor (Daly, 1984). Indeed, Aalen (1992) claimed that housing conditions in Dublin in the period under review were possibly the worst in Europe. The finding that infant mortality rates were high in Dublin and the other major cities (which experienced similar conditions) is therefore not in itself a major source of surprise. However, there is strong documentary evidence to suggest that living conditions were equally poor, if not worse, in the rural west and north-west of the country, as reflected by very high rates of poverty driven out-migration dating back to the middle parts of the nineteenth century. Although it is possible that the extent of rural poverty may have been overstated by contemporary observers, and the extent of urban poverty correspondingly understated, it is difficult to believe that so many government reports and contemporary social observers could have misinterpreted the situation to the extent that would be necessary to account for infant mortality rates which in the study period were twice as high in urban areas as in the most deprived rural areas.

Further, whatever doubts may or may not surround the extent of relative deprivation between urban and rural areas, no-one would seriously argue that the counties in the south and east of the country were more deprived

than those in the west and north-west. Counties in the south and east persistently score higher on a broad spectrum of social indicators (e.g. land quality, farm size), yet they recorded higher infant mortality rates than those in the north and west. It is possible that there may have been a hidden underclass of farm labourers working on the large prosperous farms in the south and east, in contrast to the more self-reliant cottiers who struggled to eke out a living in the west and north-west, but it is again difficult to believe that contemporary social observers could have misjudged the situation to the extent that would be required to explain the spatial distribution of infant mortality rates.

The second possibility is that the observed infant mortality rates are not a true indicator of the infant mortality. For example, some infant deaths may have been incorrectly attributed to the urban areas in which most of the hospitals are located, rather than to the area in which the mother was normally resident. This would tend to artificially inflate the observed mortality rates in the urban areas. However, if this was the case, one would also expect the number of live births (which serves as the denominator when calculating the infant mortality rates) to be distorted to a similar degree; i.e. the two distortions should therefore, to a large extent, cancel one another out. Another possibility is that the number of deaths in rural areas may have been under-reported because of non-registration or non-certification. There is evidence to suggest that problems of this type were significant, and more common in the west and north-west, even in quite recent times (e.g. Dean, 1969; Dean and McLoughlin, 1980; Dean and Mulvihill, 1972), although probably not to the extent that would be required to explain the observed differences in infant mortality rates. Besides, one would again expect any undercounting of the number of deaths to be more or less counterbalanced by a corresponding under-reporting in the number of births.

If one accepts that the observed infant mortality rates provide a reasonable indication of the spatial variations in the actual incidence of infant deaths, and if one also accepts that the widely held perceptions about the geography of social disadvantage in Ireland are not totally unfounded, then one is left only with the third possibility, namely that the variations in infant mortality rates in Ireland between 1916 and 1935 did not reflect spatial variations in living conditions.

This interpretation, if generalizable to other contexts, raises questions about the interpretation that should be placed on studies using infant mortality as an indicator of non-specific living conditions, including Forsdahl's seminal studies in Norway. Forsdahl argued that the rates of adult heart disease in Norway were highest in the areas that had experienced the fastest rates of economic growth, but he did not directly measure living conditions; rather, he assumed an equalization in living conditions based upon an observed equalization in infant mortality rates. However, the apparent lack of an association between infant mortality

and living conditions in Ireland suggests that infant mortality need not necessarily be a reliable indicator of living conditions.

This study also points to a second set of reasons for questioning Forsdahl's interpretation. Forsdahl reported much lower ecological correlations in Norway between arteriosclerotic heart disease and contemporary infant mortality rates than between heart disease and infant mortality rates several decades earlier. Similar results were found in Ireland: the correlations between ischaemic heart disease and infant mortality in Ireland between 1981 and 1990 are considerably lower than those with infant mortality between 1916 and 1935. Forsdahl inferred that the weaker association between heart disease and contemporary infant mortality indicated that we should look towards living conditions in early life, rather than at present, for an explanation of the causes of heart disease. However, closer examination of the Irish data suggests that the reduced ecological correlations may be a statistical artefact rather than necessarily reflecting changes in living conditions. The number of infant deaths in Ireland is now less than 10% of what it was in the earlier part of the century; consequently, estimates of infant mortality rates are now much more susceptible to stochastic variations because of the smaller absolute numbers of deaths; i.e. it is now more difficult to isolate the "signal" indicating variations in the underlying risk of infant mortality from the stochastic noise. Correlations based on these "noisy" estimates of infant mortality will inevitably produce smaller coefficients, irrespective of whether or not there has been change in the pattern of underlying risk.

Norwegian counties, in terms of mean population, are only slightly larger than Irish counties: they would therefore be expected to be subject to similar stochastic effects; in which case the smaller ecological correlation coefficients reported by Forsdahl would not necessarily indicate an equalization in infant mortality or (by inference) living standards. In contrast, UK counties, and more especially English counties, have a much larger mean population; consequently, UK infant mortality rates would provide more reliable estimates of the underlying risk. This may partly explain why the observed patterns of infant mortality in England and Wales have tended to be more stable over time than those in either Norway or Ireland.

The third aspect of the present study requiring further comment is the weak ecological correlations found between heart disease mortality and. infant mortality. The correlations are positive and sufficiently large to suggest that there may be a relationship; but they are not large enough (with the exception of the non-parametric correlations for males) to be regarded as statistically significant. It might be argued that the areas used in this study form a statistical population (i.e. a complete set of areas) rather than a sample, and that the concept of "statistical significance" is not really applicable, in which case there is nothing special about the

value which must be obtained for a correlation to be regarded as "significant". However, irrespective of whether one accepts this argument or not, the fact remains that the correlations are too small to provide convincing evidence in support of the perinatal hypothesis.

This does not necessarily mean we need to reject the perinatal hypothesis. There are several reasons why the correlations could be low, even if the perinatal hypothesis is correct. For example, many people no longer live in the county of their birth; consequently, the prevalence of heart disease amongst the current inhabitants of a given county may provide only an approximate guide to the prevalence of heart disease amongst the people who were born and raised in that county. The 1991 Census reported that 20.4% of those enumerated did not normally reside in the county in which they were born (Central Statistics Office, 1996). The percentage is slightly higher amongst those aged 55-64, but more than three-quarters of those who died between 1981 and 1990 probably lived in the county of their birth. This is a much larger percentage than reported by Osmond *et al.* (1990) for England and Wales, but it must be remembered that Ireland has traditionally been characterized by much higher levels of outmigration.

Net migration flows within the Republic are generally from rural areas, especially those in the north and west, towards Dublin and adjoining counties (Walsh, 1991). Dublin would be expected, on the basis of its past infant mortality rates, to have very high rates for heart disease. However, many of Dublin's poorest (who might be assumed under the perinatal hypothesis to have a higher risk) have been obliged to emigrate, whereas those who have remained have been supplemented by generally well-educated (and presumably low-risk) immigrants from other parts of the country. Both movements would have the effect of lowering the heart disease mortality rates relative to what would be expected under the perinatal hypothesis. Conversely, heart disease rates in low infant mortality counties in the north and west may have been inflated by the loss of some of their better educated (and presumably low-risk) inhabitants to Dublin. The net effect of these movements is that the ecological correlations between heart disease and past infant mortality probably understate the strength of the relationships between infant mortality rates by county and subsequent heart disease rates amongst the males and females actually born in those counties, including those who subsequently migrated to other counties.

On the other hand, it must also be accepted that the observed ecological correlations could have been inflated by the effects of confounding variables. Attempts to control for possible confounding factors using contemporary infant mortality as an indicator of unspecified living conditions made little difference to the observed correlations, but (as noted above) it is questionable whether contemporary infant mortality rates can actually be regarded as a reliable indicator of living conditions

(let alone other factors believed to be related to living conditions). However, given that neither adult heart disease mortality rates for the period 1981-1990 nor infant mortality rates for the period 1916-1935 appear to be positively correlated with living conditions (as generally perceived), either past or present, there is little reason to believe that the observed ecological correlations are in fact inflated.

Summary

The evidence provided in support of hypothesized foetal or early life influences on adult heart disease by the ecological correlations between heart disease mortality 1981-1990 and infant mortality 1916-1935 in Ireland is ambiguous. The ecological correlations suggest that there may be an association, but they are not sufficiently strong to be regarded as statistically significant. Conversely, given the likely effects of migration, they are not sufficiently weak to suggest the hypotheses should be rejected, especially given the very convincing evidence accumulated by Barker and his associates from longitudinal studies of individuals (e.g. Barker, 1992, 1994a).

The ambiguous nature of the Irish results contrasts with the strong ecological correlations reported elsewhere, especially in England and Wales. One possible explanation for these differences is that heart disease may be a function of both perinatal factors and present-day adult lifestyle factors. In the UK, the geographies of these two sets of factors are similar and therefore their effects are mutually reinforcing, resulting in strong ecological correlations between heart disease and both past infant mortality and present-day living conditions. In Ireland, these two sets of factors would appear to have different geographies, therefore their effects are contradictory, resulting in much weaker ecological correlations between heart disease and either past infant mortality or present-day living conditions.

The totally unexpected pattern of infant mortality identified in this study for the period 1916-1935 requires further investigation. If, as suggested above, infant mortality in Ireland was not associated with adverse living conditions, then it would be useful to establish why the spatial disparities reported above were so pronounced. This in turn might provide further insights into whether heart disease in adult life is associated with specific factors linked with infant mortality or to other more general social conditions which affect people around the time of birth.

Acknowledgements – The author would like to thank the staff of the Central Statistics Office in Ardee Road, Dublin, and in Cork for their assistance in locating the data. The author would also like to thank the anonymous referees of this paper for their many detailed and useful comments. .

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CHAPTER 13

CHANGING LIFE IN THE TOWNS OF NORTH KILDARE

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First published in *Irish Geography* (2000), 33(1), 74-89.

Introduction

There has been a long history of studies focussing on the growth of major urban centres and their effects on smaller communities both within the cities themselves and in the surrounding areas. As noted by Frankenberg (1966: 155), "all communities are societies, but not all societies are communities ... community implies having something in common". Some authors have suggested that urban growth has led to the loss of local communities (e.g. Wirth, 1938), with workplace or interest group associations replacing those based on the local home place. Others such as Fischer (1981), have argued that, while there are some changes, local communities based on the homogeneous nature of the residents persist in many places. A third group have asserted that communities remain but they are not necessarily as limited geographically in the past, these they term 'communities liberated'.

This group (e.g. Wellman and Berkovitz, 1988) suggest that these liberated communities are still in existence but that they are not as fixed within limited territories, with members still having local linkages but also other links to the wider metropolitan area. They also suggest that more local ties may be stimulated by outside influences, particularly threats to the community from authorities or those who live outside the area and who are socially different. As noted by Davies and Herbert (1993), the sources of 'localism' may be related to the revival of grassroots community organisations and it has been suggested that this may also lead to the development of a higher level of democratic organisation in the community.

The Irish context

Early in the twentieth century it was recognised both that the outward expansion of Dublin was virtually inevitable and also that this would have a major impact on surrounding areas. As a way to ensure that this development was undertaken in a structured manner proposals were made on a number of occasions for a unitary planning authority, for example in 1926, it was proposed that the coastal area from Malahide to Killiney should be placed under the control of the city authorities (Dublin Commission, 1926). Later, various plans were produced advocating that growth should be focussed in satellite towns, within the metropolitan region, but physically separated from the current built-up area (Abercrombie *et al.*, 1941, Wright, 967). Wright identified two zones of metropolitan influence, an inner one in which Dublin was a dominant

influence (including all of county Dublin plus small parts of Kildare, Meath and Wicklow) and an outer zone of weaker influence, which included much of the rest of these counties. The criteria by which the degree of influence was judged included the degree of access available to the city, the frequency of shopping visits, employment in the city and focus for shopping. Two of the towns in the present study (Maynooth and Celbridge) were included within the inner zone of influence, while the third (Kilcock) was within the outer zone. Wright (1967: 33) also considered that, in addition to the development of satellite towns, a "policy encouraging rebuilding and of limited, compact expansion should be applied to [inland) towns" (including Maynooth and Celbridge). He envisaged an increase of 50 percent in the populations of these towns in the twenty years following the report. Wright considered that it was important that growth of housing should be paralleled by growth of employment and services in the settlements to avoid serious traffic problems caused by commuting which he considered would be by private rather than by public transport.

The Wright report was never implemented in any detail but the "push to the periphery received the imprimatur of Miles Wright" (Horner, 1992). Since the planning framework which would have ensured that this movement was undertaken in a controlled manner was not put in place, development tended to be attached to the fringes of existing settlements, where services were readily available. Despite Wright's (1967) statement that "at present [North Kildare] is not seriously threatened by urban development" (13.50), as early as 1972 Aalen noted that:

> ... increases will occur because there is no firm regional control on the westward expansion of Dublin … Although north-east Kildare is designated an area of special development control in the county plan, it will be difficult for the county council to resist development pressures, in the absence of a regional or national directive (p.27).

In 1985 the Eastern Regional Development Organisation (ERDO) produced a plan for the development of the Dublin region up to 2011 (ERDO, 1985) which envisaged considerable population growth in the region, caused by both in-migration and by natural increase. It recommended that this growth should continue the spread from the inner city towards the suburbs and beyond into counties Kildare, Meath and Wicklow. Despite revised (lower) population estimates in the 1988 up-date of the ERDO plan (ERDO, 1988), the towns of north-east Kildare were still expected to experience an increase in population. It was envisaged that this growth would be facilitated by their proximity to National roads and rail lines. The potential and actual expansion of settlement along main roads had already been noted by Aalen in 1972, when he stated that "metropolitan spread is occurring .... by the conversion of traditional settlements along major highways into suburbs"

(p. 16). In 1988 Horner charted the gradual increase in commuting possibilities by public transport over the preceding 30 years, noting that in 1986 commuting by public transport was possible within 45-50 km from Dublin and from the main towns up to 80 km distant. This increase had been facilitated by, amongst other changes, the opening of commuter rail services (including on the line serving Maynooth). Since then, road improvements have also taken place on a large scale, such as the M50 and West Link Bridge, the M4 and improvements to many of the National roads connecting Dublin city to the surrounding area, further increasing the possibilities for commuting to work in Dublin.

The potential growth identified by these reports has become reality in many of the areas on the periphery of Dublin and three towns (Maynooth, Celbridge and Kilcock) have all increased in size during the recent past. The changes resulting from this growth and the effects on lives of the residents of the towns are now examined.

Data collection methodology

The principal data sources for this study were questionnaire surveys of the residents of the towns of Maynooth, Celbridge and Kilcock in 1995, 1997 and 1998 respectively. The questions were formulated to provide both general information about the towns and also information on topical local issues. The latter was developed in co-operation with local community groups. This meant that, while most questions were common to all of the questionnaires, some were asked in only one or two localities. A two-stage sampling technique was employed. First the built-up area in each town was divided into a series of zones, each containing approximately the same number of houses. A systematic sample was then taken of households within each zone, except in the case of Kilcock where, because of its small size, all households were surveyed.

In the surveys of Maynooth and Celbridge the surveyors were able to gain responses from more than 75 percent of the target total. In Kilcock the questionnaire was completed by more than 50 percent of all households in the town. To assess the likelihood that those answering the questionnaire were representative of the residents, comparisons were made with the figures for age distribution in the most recent census of population (1991 for Maynooth and 1996 for Celbridge and Kilcock). In each of the towns the figures were comparable. The largest discrepancy was in the 65 years and older age group in Kilcock which was somewhat under-represented, possibly reflecting a greater reluctance of older people to open the door after dark. Students in Maynooth were screened out of this analysis. The majority saw themselves as only temporary residents and thus had limited engagement with the towns. The surveys of retail and service provision were undertaken in 1999.

The main data source for comparative purposes was the work undertaken by Aalen el al. in 1970 when they produced *County Kildare: A geographical*

background for planning, which provided a comprehensive study of the physical, social and economic background of the county and made recommendations for its future development. In Volume II of the report were provided detailed studies of the towns of Kildare and these have been used in the present paper to provide comparisons with the recent surveys.

Overall Population Change

In the 1970 report it was predicted that by 1981 all three towns would have shown a considerable increase from their 1966 populations of 1254 (Maynooth), 1514 (Celbridge) and 815 (Kilcock). The reasons advanced for this growth (apart from natural increase) were:

a) the possibility of large scale residential development in Celbridge (proposals for the building of up to 1400 houses were then under active consideration);
b) outline planning permission had been granted for 120 private houses in Maynooth and plans existed for 30 local authority houses. A further reason identified for growth was the planned expansion of St Patrick's College – an increase from 600 to 2000 students was anticipated;
c) in Kilcock, residential development was predicted to be of importance from the late 1970s onward, although 30 new local authority houses and some private sites were being developed at the time of the report.

Each town experienced a level of growth towards the upper end of the predicted range (Table I). Between 1961 and 1981 Maynooth grew by 248 percent, Celbridge 210 percent and Kilcock 104 percent. Growth has been maintained since then and is predicted to continue at least until 2006, the latest date for which Kildare County Council has made predictions (KCC 1996).

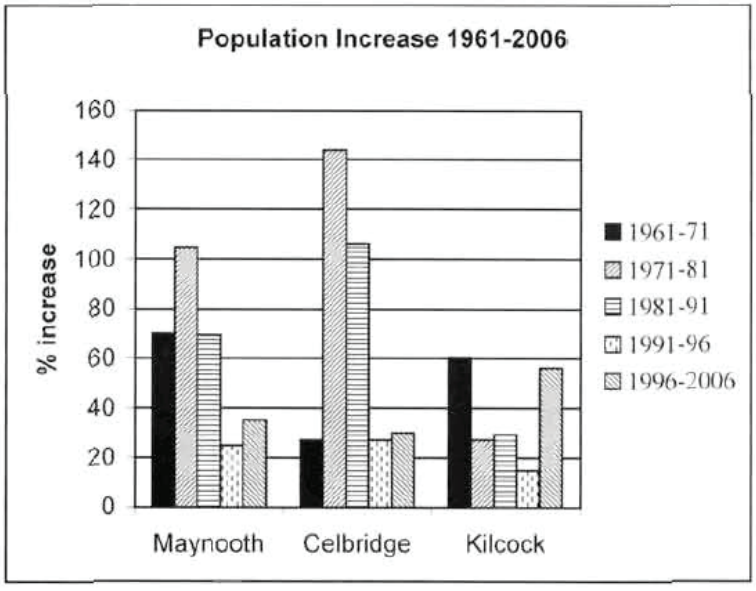
Table 1: Population change in the three towns.

	Maynooth	*Celbridge*	*Kilcock*
Actual 1961	1153	1371	739
Actual 1966	1254	1514	815
Predicted 1971	2500-3500	1700-1900	900-1050
Actual 1971	1961	1744	1185
Predicted 1981	3500-5000	2000-5000	1200-1600
Actual 1981	4015	4253	1508
Actual 1991	6807	8763	1950
Actual 1996	8512	11143	2238
Predicted 2006	11,500	14,500	3500

As may be seen in Figure 1, the percentage growth rate was largest in Maynooth during the period 1961-1971, but after that time Celbridge grew at the fastest rate, making it reasonable to suggest that proximity to Dublin was an influential factor in this growth, as predicted in 1970.

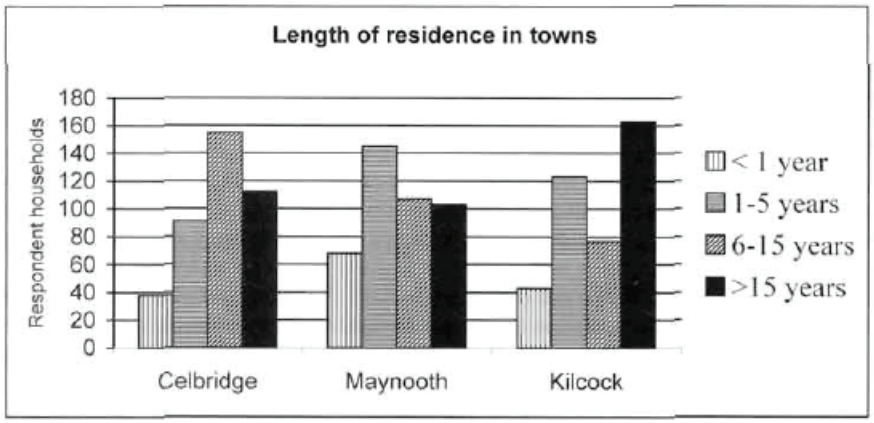
The recent surveys provided further evidence for this as less than ten percent of those surveyed in Maynooth and fifteen percent in Celbridge reported that they had always lived in the town. The level of in-migration was rather lower in Kilcock, with 31.7 percent recording long-term residence there. Kilcock is 30 km from Dublin while Maynooth (24 km) and Celbridge (20 km) are closer. Certainly in 1970, this lower in-migration rate was predicted as Kilcock was outside the zone of development of Dublin and was "unlikely to experience 'mushroom' growth at this stage" (Aalen *et al*, 1970: 73). Horner (1988) also made this distinction, noting a relationship between population growth in the Dublin region and the improvement of public transport within the region facilitating commuting. The phasing of the in-migration also appears related to distance from Dublin, with Celbridge experiencing the earliest evidence of major movements to the town, as the largest proportion of the surveyed population had moved to the town between six and fifteen years before the survey, while in Maynooth the peak was between one and five years. There was also a fairly large number who had been resident less than one year in November 1995. The largest group in Kilcock was the long term residents, most of whom were not in-migrants but those who had always lived in the town (Figure 2).

Figure 1: Population increase 1961-2006.



Another facet of recent population change is a reversal of the male-female ratio. In 1966 there was an excess of males over females in Kildare, even in the urban areas. This latter occurrence was unusual in Ireland where urban areas usually had an excess of females over males, explicable in terms of the opportunities for female employment in service industries. In Celbridge the ratio was as low as 845 females per 1000 males compared with 878 per 1000 in Kilcock and 938 women per thousand men in Maynooth. By 1996, there had been a dramatic turn around with more females than males in all three towns. The structure was less unbalanced than was the case in 1966. Celbridge still had the lowest proportion of females (1005:1000) and Maynooth the highest (1038: 1000), with the ratio in Kilcock being 1024:1000. The increase in employment in service industries both within the towns and within the Greater Dublin area would presumably be influential in this change. Evidence for changing employment is shown both by the results of the 1996 census and by the surveys of both Celbridge and Maynooth (see section on employment below).

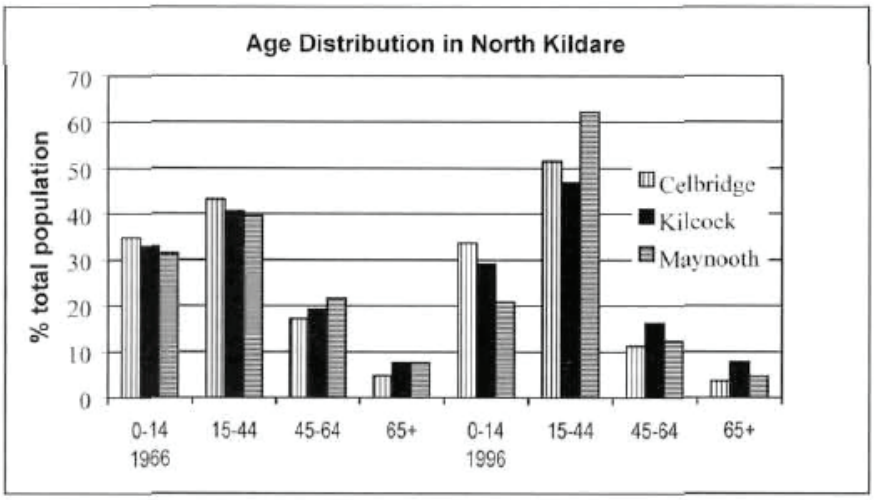
Figure 2: Length of residence in the three towns.



Between 1966 and 1996 the age structure of the towns became younger with an increase in the relative proportion of the population in the 15-44 years age group and a decrease in the 45-64 age group in all three north Kildare towns (Figure 3). This is undoubtedly due to the greater employment opportunities in the district and in Greater Dublin which has both kept this age-group within the towns and encouraged in-migration. Kilcock, the town furthest from Dublin recorded the smallest increase in the proportion of its population in the 15-44 age group, providing support for the suggestion that distance from Dublin influenced migration patterns. It had the lowest level of in-migration and was the only one of the three towns to show an increase in the proportion of the population over 65 years, growing slightly from 7.48 to 7.73 percent. It must be noted that the very high proportion in the 15-44 years age group in Maynooth is influenced by the number of students

resident in the town, but even when this group is removed from the total population, it is still higher than in the other two towns.

Figure 3: Age structure in the three towns 1966 and 1996.



Attitudes to change

Altitudes towards further growth of the three towns were not explored in the 1970 study, but questions were asked about this in two of those undertaken more recently in Maynooth and in Kilcock. At the time of the Maynooth study the Kildare Draft Development plan (KCC, 1995), and recently been made available for inspection by the public. It was proposed that there should be 280 acres (c. 113 ha) of land rezoned for housing development. If all of this land was developed for housing this could lead to a population of over 21,000 by 2006. When the Kilcock study was undertaken, the final version of the Development Plan was on display (KCC, 1999), which recommended a growth from the 1996 population of approximately 2300 to 3500 by 2006.

In Maynooth, only 30.3 percent were in favour of unrestricted growth and 44.2 percent were opposed to this, while 17 percent felt that amenity development should keep pace with any future growth. In Kilcock, however, 59 percent of respondents considered that the proposed increase in population was acceptable and only 26.5 percent rejected the idea. A reason for this difference may be that the growth of Kilcock over the previous period had been less rapid than that of Maynooth and the former town had relatively few facilities/amenities. There would perhaps be a perception that increased population would be advantageous in negotiation with the authorities for improvements and also would encourage commercial firms, such as supermarkets to locate in the town. In Maynooth, growth had been much greater and a proportion of residents stated that they felt amenities must be developed in parallel with housing. It may be suggested that those who were against any

further growth may also have felt that there was currently pressure on the facilities available in the town. Some previous studies of communities facing considerable growth have identified a relationship between length of residence and attitude to growth, with long term residents being more likely to support growth than those who had moved more recently to the area (e.g. Connell, 1974), but no evidence was found in the present surveys. Indeed, in the case of Maynooth, the residents who had lived in the town for the shortest time were the most likely to favour further development.

Employment

Local employment

In all three towns at least 70 percent of people within the economically active group were employed locally in the 1960s (Aalen *et al.*, 1970, Table 2). Even in the 1960s, the majority of those who worked outside their home town travelled to or towards Dublin. The proportion who travelled to Dublin was greatest in Celbridge (the town closest to Dublin), with eighteen percent doing this, in comparison with Maynooth (seven to thirteen percent) and Kilcock (fourteen percent). In the latter town it was noted that a further eleven percent travelled eastwards to Lucan, Leixlip and Maynooth. No detailed surveys were carried out in the other two towns, but it would be reasonable to suppose that this Dublin-directed movement was replicated.

Table 2: Location of employment in towns in north Kildare (percent).

	1968		*1990s*			
	Local	Dublin	Local	Central Dublin	Other Dublin	All Dublin
Maynooth	74-78	7-13	19.0	16.0	25.0	41.0
Celbridge	70	18	15.0	21.8	39.4	61.2
Kilcock	70	14	17.6	28.0	N/A	N/A

Sources: Aalen, 1970b, Waddington, 1996 (Maynooth), 1998 (Celbridge) and 1999a (Kilcock)

By the 1990s, the proportion working locally had declined steeply, with only nineteen percent of those surveyed in Maynooth, fifteen percent in Celbridge and 17.6 percent in Kilcock working in their respective towns. This partly reflects some changes in employment opportunities (for example, the closure of a bakery in Kilcock and textile factories in Celbridge) but also an increasing focus on Dublin as 41 percent of respondents in Maynooth and 61.2 percent in Celbridge worked somewhere in county Dublin, while 28 percent of those in Kilcock (144 people) worked in the inner city of Dublin.

Female employment

The proportion of women in the labour force has increased in all three towns since 1968. At that time, Celbridge had the highest participation rate (33 percent), with Maynooth having 30.2 percent and Kilcock only 23.5 percent. The 1970 report suggested that participation rose with proximity to Dublin, a conclusion supported by these figures. By 1996, Maynooth now had the highest proportion of female members of the labour force (41.5 percent compared with 40.0 percent in Celbridge). The proportion of women in paid employment showed the largest percentage increase in Kilcock - rising to 37.9 percent, but was still lower than the other two towns, suggesting that the distance effect from Dublin was still influential.

Types of employment

The types of employment showed some changes during the period. Noteworthy was the decline in importance of manufacturing in all of the towns. This was particularly marked in Celbridge which had the largest amount of workers in this group (38 percent in 1966 and 19 percent in 1996). In this town and surrounding area there were a number of manufacturing industries in 1966 which had closed by 1996, including textiles and meat processing, while the newer industries, for example electronics, did not employ large numbers of local residents. Maynooth experienced a decrease from 18.4 to 17.7 percent in industrial workers, reflecting the relatively low level of employment available locally in this category at any time - there was only one fairly large industrial employer in Maynooth during the period – an animal feed mill. In all three towns there has been an increase in those involved in the professional sector, with an increase of 10 percentage points in both Celbridge and Maynooth. In Maynooth by 1996 this had become the largest employment sector, employing 25.4 percent of the workforce, while it was second most important in Celbridge and third most important in Kilcock. Maynooth's relatively high percentage in 1966 (15 percent) was almost certainly related to the presence of the National Seminary and Pontifical University. Of particular interest was the increase in proportion of female workers in this group, rising from 40.7 percent to 61.6 percent in Maynooth and from 37.0 to 66.6 percent in Celbridge but by only 6.2 percent to 66.2 percent in Kilcock. These increases reflect both the overall increase in female participation in the work force and also the growth of jobs in this sector over the time period in the Greater Dublin area in general. The apparently anomalous finding in Kilcock is related partly to the very small number of persons involved in 1966 - with only 30 people in total in this sector of whom 18 were female. Many of these women were religious sisters as there was a convent in the town. The total number in 19% was much larger for both male and female workers in this sector.

Transport to work

While levels of commuting to Dublin have clearly increased in all three towns since 1968, there have been important changes in both the provision and usage of public transport for work purposes. Each town in 1968 had at least two bus services which enabled people to reach work in central Dublin before 09.00 (Table 3), and none had a rail service. Despite this, Aalen *et al.* (1970: 73) suggested that up to 60 percent of city centre commuters from Kilcock travelled by public transport. No detailed surveys of transport use were carried out in the other two towns, but it would be reasonable to suppose that figures were comparable. Somewhat earlier studies elsewhere also noted this availability and usage of public transport as being an important factor for the development of commuter settlements, for example Johnson (1956) and Connell (1974) around Belfast and London respectively. In 1988 Horner suggested that the gradual extension of the commuting hinterland of Dublin was particularly related to improvements in public transport, including the opening in 1981 of the suburban rail passenger services in Maynooth. The station in Celbridge did not open for such services until 1994 and that in Kilcock shortly before the date of the survey in 1998. Both Homer (1988) and Duffy (1987) noted that the impact of private transport availability was also an important factor influencing the growth of commuting from the wider surroundings of the city.

Table 3: Number of public transport connections reaching central Dublin before 09.00.

	*1966**		*1990s***	
	Bus	Rail	Bus	Rail
Maynooth	4	0	7	3
Cellbridge	2	0	6	3
Kilcock	2	0	1	1

Sources: *Aalen *et al*, (1970); ** Dublin Bus, Bus Éireann, and Iarnród Éireann timetables (1996-98)

In the 1990s the possibilities of reaching city centre destinations before 09.00 by public transport had increased in both Maynooth and Celbridge, while Kilcock had lost one bus service but had gained a train service. Bus commuting from Kilcock was reduced shortly after the questionnaire survey was completed when some services were withdrawn by Bus Éireann. Despite the improvement in rail services in all three settlements and of buses in Celbridge and Maynooth, usage of public transport for work purposes decreased in the period between the two studies, to fourteen percent in Maynooth, sixteen percent in Celbridge and 20.6 percent in Kilcock. In both Kilcock and Celbridge the convenience of private transport was the most important influence on this decision - selected by more than 30 percent in both towns. In all cases timing and frequency of services were also seen as important deterrents to the use of public transport. The location of the station for Celbridge, approximately

2km from the town, and the Dublin terminus at Heuston station (2.5km from the city centre), without onward suburban rail connections would be likely to influence the perception of limited convenience of public transport. In the Kilcock survey, those not using public transport (particularly the railway) were asked to state whether they would consider using it if services were improved. Almost 75 percent stated that this was at least possible, but 56 percent indicated that this would only be the case if a regular hourly service to Dublin was provided during the whole day - providing further support for the finding that flexibility of travel time was a major influence in usage of private rather than public transport.

Life in the towns of north Kildare

Reasons for choosing to live in north Kildare

In each of the three 1990s surveys, respondents were asked to identify at least one reason why they chose to live in their town. In all three towns access to other places for purposes of work or study was the most selected reason why they had moved to their new town (Table 4). An earlier study of villages in Ireland (Gillmor, 1988) found this to be the second most selected reason for moving to the new location (28.8 percent) after availability of housing (38.3 percent of responses). Connell (1974) also identified accessibility to work as being very important in people moving to a commuter settlement near to London. In both of these earlier studies a large proportion of the respondents had to travel outside of their village to obtain this work, particularly those who lived in settlements in the vicinity of larger centres. For both Maynooth and Celbridge residents the venue was largely Dublin, whereas in Kilcock many respondents identified places within 8 kilometres or actually in the town. This may illustrate the effect of distance from Dublin on the level of influence of the opportunities for employment there. In all of the recent studies cost of accommodation was the next most selected reason after access, which would appear to correspond broadly to the most important reason in the Gillmor study. Interestingly, only in Maynooth was the attractiveness of the property considered to be important by nearly as many people as price. In the 1974 study the attractiveness of the surrounding area was considered to be an important factor, and this was also the case in Kilcock, where twelve percent regarded this as being the most important factor. In comparison, only 5.6 percent of Celbridge respondents identified this factor as being the most important one - possibly reflecting the larger size of the town. Those residents were generally amongst those who had lived longest in the town, suggesting a decrease in importance of this factor as the town had increased in size. Price of accommodation was considered to be most important by more recent residents when compared with those who had been living in the north Kildare towns for longer periods, reflecting the recent increases in house prices in the Greater Dublin area.

Most attractive features of life in north Kildare

In addition to identifying why they had chosen to move to north Kildare, the respondents in Maynooth and Celbridge were also asked to identify the most attractive and least attractive features of life in their towns. While there were obviously some variations in specific attractions, e.g. the River Liffey in Celbridge or St Patrick's College in Maynooth, there was considerable agreement on general type of features (Table 5). In both towns more than twelve percent of respondents considered aspects of the community or local people were attractions to their town, supporting the view that these towns did retain a sense of community despite their growth in recent limes. The attractions of the country/ rural aspects of life were also considerable, particularly in Celbridge (23.9 percent of respondents) and to a lesser degree in Maynooth (12.6 percent). A smaller group of Maynooth respondents did identify the small size of the town as being attractive. All of these would suggest that the towns were seen as still rural communities by their residents. However, it must be noted that more than twelve percent also considered access to Dublin as being the most attractive feature of life in their town, suggesting that a sense of community was not particularly strong for these people.

Table 4: Most important reasons for choosing to live in the towns (percent respondents).

	Maynooth	*Celbridge*	*Kilcock*
Access to Dublin	36.4	28.9	5.8
Access elsewhere	19.4	12.1	14.1
Cost of accommodation	14.2	23.3	16.9
Attraction of property	12.9	12.5	8.3
Appearance of town	3.4	8.2	4.1
Amenities	3.6	3.6	3.3
Access to home	2.3		
Local industry		2.2	
Village/rural life		5.6	12.0
Multiple reasons			21.9
Other	7.8	3.6	3.5
Number of respondents	387	305	242

Least attractive features of life in north Kildare

Factors associated with traffic and road works were seen in both towns as major detractions to life. At the time of the Celbridge survey traffic congestion in the main street of the town was regarded by inhabitants (and other interested parties) as a major problem. Since the Community Council was anxious to test public opinion about possible solutions, this was an important focus of the survey. This was likely to have had some influence on the proportion of respondents who would regard traffic as the least attractive feature of their town, so that the finding that this was the least attractive feature of life for 52.2 percent of respondents may be somewhat exaggerated. In Maynooth only 10.1 percent regarded traffic as a major detraction to life in the town, but a further 24.7 percent regarded road works, inadequate footpaths or poor repair of roads as detractions.

At the time of the survey the construction of the Leixlip-Kilcock section of the M4 was nearing completion and the associated link roads were being built, bringing considerable disruption to the town (Table 6). Only in Celbridge did a sizeable number of respondents (8.7 percent) consider the growth of the town to be a detraction to life and in neither town did many people report that the community or groups of people within the community to be an unattractive feature of life. The higher percentage in Maynooth (4.4 percent compared to 1.1 percent in Celbridge) related mostly to some hostility to students expressed by other residents.

Table 5: Most attractive features of life in north Kildare towns.

Attractive feature	*Percent responses*	
	Maynooth	Celbridge
Community / people	12.4	14.0
Country / rural	12.6	23.9
Quietness	9.9	6.5
College	17.0	
Access to Dublin	13.1	12.5
Pubs / nightlife	6.4	1.3
Small size	5.4	
Royal canal	2.7	
Historic features		16.5
River Liffey		
Nothing / no idea	5.2	4.0
Other	15.3	17.1
Number of respondents	400	449

Table 6: Least attractive features of life in north Kildare.

Unattractive feature	*Percent responses*	
	Maynooth	Celbridge
Traffic	10.1	52.2
Litter / dirt	11.6	7.8
Size / growth of town		8.7
Community / people	4.0	1.1
Lack amenities / facilities	17.4	2.5
Drink / drugs / pubs	4.4	3.6
Road works / roads/ footpaths	24.7	
Specific area of town	13.1	
No opinion	3.8	2.5
Other	10.9	21.6
Number of respondents	391	386

Facilities/Amenities in the towns

One obvious change between the 1960s and the studies of the 1990s was the large increase in numbers of both retail and service establishments provided locally. This growth obviously reflects the increase in population of all of the settlements and also the increasing variety of types of retail outlet and professional services required by people. For example garden centres, video hire shops, beauty salons and

leisure/fitness clubs were not present anywhere in 1968 (Table 7). However the importance of local shops has declined markedly. For example in 1970, Kilcock was stated to be the largest service centre in North Kildare and it had more shops than Celbridge, Maynooth or Leixlip. It served a large hinterland and provided a large range of basic goods and services for its inhabitants and those of the surrounding area. Less than six percent of the residents surveyed shopped for food outside of Kilcock (although many households did make a shopping trip to Dublin at least once every three to four weeks).

By 1998 only approximately 20 percent of residents of Kilcock shopped locally for their major food purchases, probably a reflection on the fact that this was the only one of the survey towns which did not have a major supermarket. There were a large number of purchases still made in the town but these were commonly convenience goods or petrol. In contrast 61.4 percent of Celbridge respondents and 79.8 percent of Maynooth residents did their food shopping in their own town. Questions about other purchases were not asked in Kilcock. But in the Maynooth and Celbridge the degree of focus on Dublin city centre was considerable, for example more than 75 percent of clothes purchases and over 60 percent of electrical goods were purchased there. Despite the presence relatively close to the three towns of out of town shopping centres, central Dublin retained its massive dominance, with less than ten percent of purchase of any type made in these centres.

Table 7: Retail establishments in the towns.

	Percent establishments in each category				
1968 *	Food	Household	Other non-food	Services	Total
Maynooth	46.5	17.9	7.1	28.6	28
Celbridge	51.5	19.3	9.7	19.3	31
Kilcock	43.7	20.5	7.7	28.3	39
Present**					
Maynooth	15.5	20.0	21.8	42.7	110
Celbridge	10.9	25.2	20.2	43.7	119
Kilcock	27.1	20.3	11.9	40.7	59

* Aalen *et al.* (1970)
** Survey, 1999.

Professional service provision has also increased greatly in the three towns during the period between the 1968 survey and the present (Table 8) particularly reflecting the increase of population. In both Celbridge and Maynooth a large majority of the children received their second level education in their home town. In 1968 this would not have been possible due to lack of provision of suitable establishments. While Maynooth had a post-primary section attached to the boys' national school (and a junior vocational school was under construction - to provide classes up to age

15) there was no post-Intermediate Certificate education provided and there was no boys' second level school in Celbridge. No questions were asked about the use of the other professional services but it must be presumed that sufficient of the local population used them to ensure their financial viability as it would be unlikely that many people would travel large distances to use many of them. Maynooth was, and still remains, the location of the only third level provision in the three towns.

Amenity provision

In 1968, no questions were asked about what amenities people resident in north Kildare felt they required, although there were certainly relatively few facilities available according to the report, which mentions only community halls in Maynooth and Kilcock and a small branch library in Maynooth. There were also GAA clubs in all three towns and another sports club was located between Maynooth and Kilcock. Maynooth was identified as being one of four sites for a swimming pool within county Kildare. It was noted that "construction of this pool has not yet commenced". This remains true in the 1990s though demand is very strong in all three towns, with 48 percent of Kilcock residents, 44 percent Celbridge and 44 percent of those of Maynooth suggesting that this amenity was required in their town. In both Kilcock and Maynooth the provision of a gym or sports centre was regarded as desirable by more than 25 percent of respondents. Only thirteen percent of respondents in Celbridge felt that this was required. Facilities of this type were available in the town, suggesting that these were inadequate, too expensive or not known to respondents. In 1970, the only leisure activity for which an out-of-town venue other than Dublin city centre was suggested was the cinema. At that time the nearest cinema to the three towns was located in Lucan. This has subsequently closed, but facilities were available in the 1990s both in the city centre and at the nearest out-of-town shopping centres of Blanchardstown, Liffey Valley and Tallaght. This was reflected in the relatively low percentages of respondents who felt that a cinema in their town was desirable - seven percent in Maynooth, less than five percent in Celbridge and two percent in Kilcock.

The variety of leisure facilities has grown in the three towns, particularly in Maynooth and Celbridge to include golf and pitch and putt facilities, tennis clubs, soccer clubs, and a variety of other clubs and societies. In Celbridge, the Community Council own premises in which various gym and fitness activities are held. This provision is reflected in the level of focus on the towns for these activities, for example 39 percent of Maynooth respondents who carried out any type of sporting activity did so in their town and a further fifteen percent within 5 miles (8 km) of the town. However, the Dublin focus was maintained for the rest as 20 percent went to Dublin, although it must be noted that 25 percent went elsewhere. In Celbridge more detailed questions were asked dealing with particular sports, of which almost all were carried out by the majority of their participants in the town. Those for which people travelled outside

the town were particularly swimming, golf, hockey and fishing. Only for the playing of hockey did more than 20 percent of respondents travel to Dublin. The only other leisure activity for which information was collected was a visit to a public house. In all three towns more than 70 percent who visited a public house did so in their town of residence, while in Maynooth 10.3 percent and in Celbridge 6.7 percent went to Dublin. No information was collected about this in the earlier study, and so it is impossible to make comparisons but it is likely that relatively few people other than those who worked in Dublin would have gone regularly to drink there in the past, although decreased tolerance of drinking and driving would tend to inhibit people from moving out of their place of residence more in the 1990s than in the past.

Table 8: Provision of Professional Services.

	1968			*1999*		
	May-nooth	Cel-bridge	Kilcock	May-nooth	Cel-bridge	Kilcock
2nd level boys			*		*	
2nd level girls		*			*	
2nd level mixed	*			*		*
Public library				*	*	*
Solicitor	*			*	*	*
Auctioneer	*			*	*	*
Accountant				*	*	*
Architect				*	*	
Hotel				*	*	
Doctor	*	*	*	*	*	*
Dentist		*	*	*	*	*
Optician				*	*	*
Chiropodist				*	*	
Chiropractor				*		
Physiotherapist				*	*	

Conclusions

There have been considerable changes in the towns of north Kildare since the late 1960s, some related to their increase in size and others to the changing lifestyles of those who are resident in them. They show increasing dependence on Dublin for employment and increasing reliance on private transport, but there are greater amenities and services within all of the towns, suggesting that they are providing more for their residents than just becoming a "huge hotel without a roof (Frankenberg, 1966). Unlike in some dormitory towns, the residents appear to have made commitments to their place of residence as they generally expect to be there in the long term. They carry out much of their leisure activities in the towns and wish to develop these possibilities further, rather than continue to travel outside for these. The increasing property prices in the

Greater Dublin area and continuing improvements in transport infrastructure, such as road building further west, are likely to lead to similar developments taking place increasingly further from Dublin. Further studies of towns more distant from the Capital would be likely to provide examples of change similar to that reported here just beginning to take place.

This paper raises a number of more general possibilities for further geographical study. It would be informative to contrast the development of settlement in north Kildare with a similar area on the fringe of a major conurbation where there was a unitary planning system for the whole region. The relationship between the growth of the north Kildare towns and the improvements in transport infrastructure provide pointers towards further change within the Dublin region. The social behaviour of the inhabitants of the area and the changing provision of services to meet their needs, illustrate possible more general changes in life in Irish towns. An aspect of immediate note is the changing central place role of Kilcock. This provides an interesting pointer to the effects of the expansion of the influence of larger settlements on the centrality of smaller towns which were formerly relatively outside their influence. Both in terms of town planning and of landscape change, the towns of North Kildare provide a case study, which is of use for monitoring future local development and to facilitate comparisons with other areas of greater Dublin.

Acknowledgements Thanks are due to Brendan Bartley for his helpful comments on previous drafts of this paper, to the students who participated in the questionnaire surveys, the Celbridge Community Council, the Kilcock and Districts Community Council and to the communities of Maynooth, Celbridge and Kilcock who so willingly answered the questions. The author gratefully acknowledges the support of KELT, the Department of Agriculture and Food and the European Union, under the Leader 2 programme, in the production of the Kilcock and Districts Survey.

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CHAPTER 14

GEOGRAPHY OF PRODUCTION LINKAGES IN THE IRISH AND SCOTTISH MICROCOMPUTER INDUSTRY: THE ROLE OF LOGISTICS

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First published in *Economic Geography* (2005), 81(3), 283-303.

Introduction

According to some, the economic crisis of the mid 1970s marked the transition from the traditional Fordist mode of industrial organization to one of Time-Based-Competition (Schoenberger, 1997; Stalk, 1988; Stalk and Hout, 1990). As an industrial paradigm, the 'old', ideal-type, Fordism was a system of 'assembly-line-based mass production' of standardized goods (Asheim, 1992). Production took place in large vertically integrated plants owned and centrally controlled by large, often multinational, corporations. Rising productivity was based on mechanization, the pursuit of internal economies of scale, a detailed division of tasks and work intensification (Amin, 1994). Long production runs and dedicated machinery were intended to minimize downtime. Driven by similar considerations, suppliers produced and delivered standardized components in large, infrequent, batches. Price competitiveness was the single most important criterion in supplier-selection (Sayer, 1986). Finally, as regards the geography of production, the narrow focus on price, production costs and labor cost minimization meant that the Fordist system was often characterized by an extreme spatial division of labor and spaced-out supply chains. Peripheral regions were incorporated in a dependent way through branch-plant investment that contributed little to regional development.

The Fordist methods of work organization had reached their limits in terms of productivity growth by the 1970s. Furthermore, due to its inherent rigidities, the Fordist system was unable to cater for modern markets, characterized by a demand for variety, quality and responsiveness and by shorter product life cycles. For these reasons, among others, the economic crisis of the mid-1970s has been interpreted as a 'crisis of Fordism' (Amin, 1994; Schoenberger, 1997). One idea is that a resolution of this crisis, if possible at all, requires a return to a more flexible, craft-based mode of production[1].

Others point at many firms that are successfully competing in the new market environment with new flexible forms of high volume production that are blurring the distinction between craft and mass production

[1] See, for example, Piore and Sabel (1984) on 'flexible specialization' and Storper and Scott (1989) on 'flexible accumulation'.

(Jessop, 1992; Tomaney, 1994). These firms are not producing standardized end-products but instead have succeeded in combining mass production with product variety and customization. All new high volume production firms, in one way or another, "combine the benefits of economies of scope and greater flexibility in responding to consumer demand, which are characteristic of small batch production, with those of economies of scale, characteristic of mass production" (Hudson, 1997b, p. 303). These ideas are captured in a number of production concepts, including Lean Production (Womack, Jones and Roos, 1990), Mass Customisation (Pine, 1993), Dynamic Flexibility (Coriat, 1991, Veltz, 1991), Diversified Quality Production (Jessop, 1992) and Time-Based-Competition (Stalk and Hout, 1990; Schoenberger, 1997).

The Time-Based-Competition (TBC) model emphasizes the fact that the new competitive environment and the requirements of modern markets have drastically changed the role of time in competition. According to the proponents of the model, firms now compete primarily on the basis of their ability to compress time in all elements of the value chain and, beyond that, in the firms' relations with upstream and downstream partners. The central focus is on reducing product development times and order-to-delivery cycles. This, in theory, results in a highly flexible production system that offers a combination of fast response, increased variety, high value and low cost (Stalk and Hout, 1990).

Schoenberger (1997) postulates that the rise of TBC will have repercussions for the geography of production and regional development. She depicts a stylized scenario of 'concentrated deconcentration' where the multinational firm creates tightly integrated production complexes in each of its primary market regions, including, for example, North America, the European Union, East Asia and Southeast Asia. The regional complexes would include various manufacturing functions as well as some degree of technical and strategic responsibility which would allow the firm to respond to particular needs of the individual regional markets.

She also postulates that TBC will lead towards a greater proximity between buyers and their suppliers and an increase in local and regional production linkages. The argument basically involves two buyer-supplier proximity drivers: efficient technical information exchange and efficient product flow or logistical efficiency. As regards efficient product flow, one of the central targets of TBC is a reduction of the order-to-delivery cycles or chain cycle times (Stalk and Hout, 1990). Towards this end TBC envelopes the Just-In-Time (JIT) production and supply principles which are expected to lead towards close buyer-supplier proximity.

The relevance of these ideas was tested in a case study of the microcomputer hardware industry in Ireland and Scotland. The microcomputer industry is here defined as the industry producing

personal computers (including laptops and notebooks), workstations and entry-level servers costing less than $100,000 in 2001. It involves both microcomputer assemblers and the manufacturers of components and parts. Companies in this industry have been portrayed as prime examples of TBC and JIT supply (Hudson, 1997; *International Business Week*, 3 November 1983 and 14 May 1984; Sayer, 1986). The microcomputer sector is a good example of an industry facing highly volatile markets and irregular and unpredictable demand - characteristics that will prove to be central to the analysis later in this paper. The findings concerning the relevance of the first driver, efficient technical information exchange, have been documented elsewhere (van Egeraat, 2002; van Egeraat, Jacobson, and Phelps, 2002). This article will focus on how the logistical considerations have influenced the geography of production linkages in the industry. Related studies on the industry (e.g. Angel and Engstrom, 1995; Dedrick and Kraemer, 2002) tend to focus on the geography of production networks in the USA and/or the Far East. Our study specifically focused on the production networks of companies located in the European semi-periphery. Furthermore, Angel and Engstrom analyzed the role of technical information exchange and paid no attention to logistical considerations.

This article focuses strongly on the relevance of the efficiency argument for buyer-supplier proximity. Less attention is paid to other aspects of buyer-supplier relationships, notably a shift from producer-driven to buyer-driven commodity chains (Gereffi, 2001) or from supplier to client markets and the associated shift of relative power among chain members. Whether governance mechanisms in the microcomputer hardware industry are really shifting towards buyer-driven chains is a matter for debate (see, for example, Chen, 2002). Nevertheless, power-relations in general could have a confounding effect on the analysis of logistical arrangements and their influence will therefore receive attention as well.

Most data were collected during interviews with general managers, materials managers and logistics managers employed by the 11 branded microcomputer makers located in Ireland (Apple, AST, Dell, Gateway and Intel) and Scotland (Apricot-Mitsubishi, Compaq, Digital, IBM, Packard Bell-NEC and Sun Microsystems) - from here on referred to as 'the focal companies' or 'the focal plants'. Three rounds of semi-structured and structured interviews were conducted in the period 1998-2001. Unless stated otherwise, all data presented in this article pertain to the situation during the period 1998 to early 1999. Additional data were collected via postal questionnaires completed by staff at the focal companies and newspaper research. Finally, telephone interviews were conducted with staff at a selection of local supplier firms.

The next section will more closely examine the logic underlying the idea that logistical considerations in the context of TBC will drive close buyer-supplier proximity. This is followed by an outline of the geography of the

supply chains of the microcomputer companies in Ireland and Scotland. It will be shown that the focal companies source the vast majority of material inputs from regions outside Ireland and Britain, notably from the Far East. The next section provides an insight into the way the focal companies structured their inbound logistics pipelines. This provides the basis for the subsequent analysis of data on inventory levels, shipment frequencies and modes of transport. We focus on the question whether the focal companies are still operating sub-optimal inbound logistics system organized on traditional Fordist, Mass Production, principles, or whether, in line with TBC, the focal companies have optimal (or at least less sub-optimal)[2] inbound logistics systems that take full account of the modern comprehensive logistics management principles underlying TBC. If the latter is the case, then we will have to conclude that these principles do not necessarily lead to buyer-supplier proximity. In the conclusion we consider the implications of this for industrial policy.

Comprehensive logistics management principles

One of the central components of Time Based Competition is JIT supply. Textbook 'true JIT' (Morris, 1989; Morris, 1992), 'full JIT' (Mair, 1992), or 'pure JIT' (Fawcett and Birou, 1992) is a logistics system characterized by very low buffer inventories, near synchronous production and delivery of inputs on a daily basis[3] directly to the assembly line. The term sequential JIT has been used for situations where suppliers manufacture and deliver components in the same order as they are used at the assembly lines of their customers (Larsson, 2000). Such systems are believed to lead to close buyer-supplier proximity (Estall, 1985; Kenney and Florida, 1992; Mair, 1992; Mair, Florida, and Kenney, 1988; Sayer, 1986; Schoenberger, 1997). True JIT is often presented as the optimal supply system. However, true JIT supply should really be interpreted as an extreme outcome in a spectrum of possible optimal outcomes based on modern comprehensive logistics management principles. The explanation requires a closer look at the comprehensive logistics management principles underlying JIT supply.

Logistics management systems have always involved calculating the minimum required component inventory levels and related individual order quantities. In the old system, the individual order quantities, or lot sizes, were typically based on a traditional economic order quantity (EOQ) formulation (Christopher, 1992; McCann, 1998). The EOQ model is based on the idea that it is possible to calculate order quantities/ shipment frequencies, involving minimal 'total logistics costs' (TLCs). These TLCs are the sum of the ordering/set-up costs, the costs of

[2] This paper does not prove that the logistical solutions reported in this article are perfectly optimal. However, the data do show that the companies have adopted the modern comprehensive logistics management principles and that their systems are at least less sub-optimal than the systems organized on traditional Fordist principles.

[3] The criteria are arbitrary. Some authors reserve the term 'true JIT' for cases involving multiple deliveries a day (Morris, 1989; Morris, 1992).

holding inventories and the costs of transporting goods. The ordering/set-up costs included the administration costs involved in organizing an individual purchase, plus the labor costs involved in machinery set-up. The inventory holding costs were traditionally reduced to interest costs. The EOQ was derived by balancing these cost components.[4]

The modern comprehensive logistics management principles that underlie JIT, involve a more inclusive interpretation of inventory holding costs. According to McCann (1998), compared to the traditional models, two extra cost factors are considered and are believed to represent a significant part of the inventory holding costs: space costs and total quality costs (TQCs).

The space costs of inventory are the space and space handling costs of storage and warehouse space, comprising the land costs and the labor costs involved in inventory handling operations. The quality costs are the combined costs of lost market share due to poor quality and reliability of the final product and the costs of final quality control administration, which are the costs of expediting materials, the costs of lost orders, back-orders, scrap and rejects. The greater the average volume of inventory held, the greater is the risk that faults in individual components will go undetected during the production process – the greater the quality costs.

These cost components were not included in traditional Western purchasing techniques, which, as a consequence, underestimated the real costs of holding inventories. In other words the adoption of the comprehensive logistics management principles creates an incentive to further reduce the average volume of inventories by reducing the shipment size and increasing the shipment frequency. In modern quality-competitive markets the significance of TQCs and space costs may be so

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[4] The traditional formulation of the EOQ is expressed as $Q^* = \sqrt{\frac{2mS}{Ic}}$, where Q^* is the economic order quantity, m is the quantity of input per time period, S is the ordering/set-up costs of conducting each individual shipment, *I* is the rate of interest and c is the source price per unit of input (McCann, 1998). With his broader logistics costs model McCann (1996; 1998) shows how total input logistics costs are generally a positive function of transport costs and, thus, of distance. Correspondingly, the EOQ is dependent on transport costs and distance. Integration of this idea, and assuming shipment economies of scale, leads to the following formulation for the EOQ $Q_i^* = \sqrt{\frac{2m(S + ad_i)}{Ic}}$, where a is movement costs per mile and d is delivery distance.

great that the EOQ tends towards zero, i.e. lot sizes of one.[5] However, if shipment sizes go down, and shipment frequencies go up, the transport cost and ordering/set-up cost components of the TLCs will rise. There are two ways this can be prevented. First, firms can work towards a reduction of the ordering/set-up costs of conducting each individual shipment, for example by streamlining the order entry system. Secondly, and more importantly for the present discussion, firms can attempt to reduce the input delivery distance. This is the basic logic behind the JIT-proximity argument (Mair, 1992; McCann, 1996; McCann, 1998).

The idea that there are forces that drive customer-supplier proximity is obviously not new. Even the traditional logistics models and the traditional way of calculating the EOQ could lead to a situation where the transport costs and the interest costs of holding inventories would drive customer-supplier co-location. In fact, one could consider buyer-supplier co-location as the 'normal' situation. It is only because of issues such as differences in labor costs between locations, economies of scale in component production, and a whole range of reasons related to history, the technological capabilities of a region's suppliers and locational inertia, that customers use suppliers located in other regions. The difference with the comprehensive logistics management principles that underlie JIT is that the forces tending towards buyer-supplier proximity are stronger due to a greater appreciation of the role of space costs and TQCs.

However, the specifics of the logistical arrangements and the effects on linkage distance remain dependent on a range of component characteristics and contextual conditions. Paraphrasing Christopher (1992), companies still have to make a range of 'trade-offs' in working towards the improvement of total supply chain cost effectiveness – the ultimate goal of any logistics system. Here we briefly consider the four issues which were investigated in the course of the study: differences in labor cost among production locations; value, volume and weight of components; minimum efficient scale of component production; and component variety. Other issues, notably superior technological capability and locational inertia will not be discussed since, because they were clearly less relevant for our case, they were not specifically addressed in the study.

Labor cost differences among regions, as reflected in the price of components, are very important. More distant suppliers may be able to compete with lower prices because of cheaper labor costs. If these price

[5] Taking account of the space costs and TQC, the new formulation of the EOQ becomes: $Q_i^* = \sqrt{\frac{2m(S + ad_i)}{q + s + Ic_i}}$, where *s* is the logistics space cost coefficient and *q* expresses the impact of the TQC. Thus the higher the value of *s* and *q* the closer the EOQ will be to zero (McCann, 1998).

advantages outweigh the efficiencies gained by co-location, then a firm might operate JIT supply over longer distances (McCann, 1998) or operate logistics systems that diverge substantially from the prototypical true JIT system.

Another oft-cited issue relates to the value and the bulk or weight of individual components. The incentive for increasing shipment frequency, decreasing order size and decreasing linkage distance will be greater for high value components than for low value components (Christopher, 1992), *ceteris paribus*, since components with a high value will incur much higher interest and insurance costs. Likewise, the incentives for increasing shipment frequency and decreasing linkage distance are greater for physically bulky and heavy components than for small and light components, *ceteris paribus* (Lubben, 1988; McKinnon, 1997), since physically bulky components will incur higher space costs while the transport costs are higher for both physically bulky and heavy components.

The minimum efficient scale of component production also impinges on the logistical arrangements and linkage distance. Production at minimum efficient scale often means that component manufacturers need to supply several customers, which can mean that suppliers are located at considerable distances from some of these customers (Bordenave and Lung, 1996; Jones and North, 1991; McKinnon, 1997; Milne, 1990; Morris, 1992; Schamp, 1991).

Finally, the incentives for increasing the shipment frequency and proximity will be stronger for component categories involving a high variety of options (e.g. different colors or styles) than for more standardized component categories. This is because the greater the variety of options within a component category, the higher the inventory holding costs involved in stockpiling a certain level of finished components in all possible permutations (Christopher, 1992; van Hoek, 1998; Bordenave and Lung, 1996), particularly in situations of highly unpredictable demand. Therefore, the greater the variety of options, the greater the incentive to delay the final assembly of component materials into finished components. The greater the delay in final assembly, the greater the shipment frequency, the greater the drive for buyer-supplier proximity.

All these component characteristics and the difference in labor costs among regions mean that the adoption of comprehensive logistics management principles can have a variety of outcomes, involving both local and overseas sources and a combination of delivery methods (Lubben, 1988). At one end of the spectrum, the pipeline of some components will be organized along the lines of a true JIT system with suppliers located in close proximity to the customer. Because of technical developments in transport and logistics, even such a true JIT system does

not necessarily involve buyer-supplier co-location. Indeed, some companies have been reported to operate such systems with suppliers located in other countries or even other continents (Clarke and Beany, 1993; Glasmeier and McCluskey, 1987; Lamming, 1993; McCann, 1998; Milne, 1990). However, these examples remain the exceptions. Frequency, distance, speed, reliability and the cost of transport are interrelated issues that have to be traded off against one another (McKinnon, 1997). In general, the literature suggests maximum workable distances for true JIT supply ranging from 30 to 150 miles (Estall, 1985; Kenney and Florida, 1992; Mair, 1992; Mair, Florida and Kenney, 1988; Sayer, 1986; Schoenberger, 1997).

Alternatively, the adoption of comprehensive logistics management principles might lead to a "JIT-type" supply system (Crowley, 1996) involving slightly less frequent shipments and slightly higher buffer inventories and suppliers somewhat further away. In such instances, "the meaning of JIT delivery starts to change" (Lubben, 1988, p. 192). At the other end of the spectrum of outcomes, the pipelines of components might involve even less frequent shipments, still higher (though tightly managed) buffer inventory levels, and suppliers located at great distances (Fawcett and Birou, 1992).

Geography of production linkages

This section outlines the sources of the parts and components used by the 11 focal companies. Interviewees provided the names of their suppliers as well as the location of manufacturing. The precise detail of the geographical configuration of the supplier networks differed from company to company. However, great commonalities did exist, especially with respect to the regional supply situation. The main area of difference concerned the location of the motherboard/backpanel suppliers. The geographical origin of parts and components is summarized in Table 1. For more detailed data at individual company level, see: van Egeraat, Turok and Jacobson (1999) and van Egeraat, (2002).

The vast majority of components and parts were imported from regions outside Ireland and Britain, notably from the Far East and, to a lesser extent, the USA. The only items characterized by significant sourcing in Ireland and/or Scotland were: enclosures, motherboards/backpanels (mainly from Scotland), network cards (from Ireland only), non-English language keyboards, digital/printed media, accessory kits [6], cables/interconnect and packaging material. Furthermore, England and Wales figured to a small extent in the area of monitors while England played a role in the supply of motherboards as well. However, most of these components were imported from other regions as well. Thus, the majority of motherboards/backpanels, network cards, cables, keyboards

[6] Items such as media, mice, cables and connectors were typically packaged in a 'country' or 'accessory' kit. Some focal companies had subcontracted the packaging of these kits to local supply-chain-managers that were also responsible for the sourcing of the items.

Table 1 Summary of Geographical Sources of Material Inputs of Focal Companies, 1998-1999

Material input	*Main geographical sources**
Enclosures and racks (high volume models)	Mainly local and to a lesser extent Far East;
Enclosures and racks (less current models); Screws, fasteners and other c-class items	USA and, to a lesser extent, local
Motherboards, backpanels and riser cards	For most focal companies: Mainly Far East and, to a lesser extent, USA; For two focal companies: mainly Scotland and England
Microprocessors	Mainly South-East Asia, small amounts from Ireland; For proprietary technology: USA
Floppy drives; CD-ROM drives; CD-RW drives; DVD drives; low-end technology high capacity disc and tape drives; Batteries and AC-adapter (for portables); Digital cameras; Hard disk drives; Speakers and microphones; Docking stations; Keyboards; mice; joysticks; low-end power supply; portable computers (contract manufacturing)	Far East
High-end high capacity disc and tape drives; high-end power supply	USA, Far East, Europe and England
Heatsinks; Cooling fans	Mainly Far East; to a lesser extent USA, England and Germany
Modems and network components	Mainly Far East and USA, although four suppliers were manufacturing in Ireland
Graphics, video and sound cards; Printers; Other semiconductors; Capacitors and resistors; Memory	Mainly Far East
Cables and interconnect	Mainly the Far East and, to a lesser extent, Ireland and Scotland.
Displays	Mainly Far East; Wales and England for few selected models.
Media	Printed manuals: mainly Ireland, and to a lesser extent Scotland; CD replication: Ireland, Scotland, Wales, Germany and USA; Wrapping of digital and printed media: local
Accessory kits; Packaging material; Sub-assembly and rework services; Printing of non-English language key-board models	Local
Complete computer systems (contract manufacturing)	Mainly local, England and Taiwan;
Etched boards; Interconnect, jumpers, switches	Mainly Far East and USA

* For the sake of brevity, much of the detail in this table has been omitted. For the complete table, please contact corresponding author.

Source: Company interviews.

and monitors, were manufactured in other regions, notably in the Far East. Only enclosures, packaging, media, kits and non-English language keyboards were mainly sourced from suppliers in Ireland or Scotland.

The local supply networks of the five microcomputer assemblers in Ireland included 47 (mainly foreign owned) companies operating 57 component plants. The local supply networks of the six focal companies in Scotland included 49 (mainly foreign owned) companies operating 51 plants. However, the actual production activities in many plants were very limited or added limited value to the product. Apart from limited digital printing activity, 11 kitting plants merely packaged media and other language specific parts into a box. Similarly, five keyboard localization plants merely laser printed (non-English language) keyboards manufactured overseas. Finally, the production activities of the turnkey suppliers involved in rework activities were of a very limited nature.

Ten focal companies provided an estimate of expenditure on locally (Ireland or Scotland) manufactured components as a percentage of total expenditure. Figures were also provided for the share of components sourced in Ireland and Britain together. At the time the interviews were conducted, on average, ten per cent of the parts and components sourced by the focal companies in Ireland were manufactured in Ireland (ranging from seven to twelve per cent). The items manufactured in Britain were good for another four per cent on average (ranging from zero to nine per cent). As regards the focal companies in Scotland, on average seven per cent of the material inputs was manufactured in Scotland (ranging from two to nine per cent). The items manufactured in the rest of Britain and Ireland made up another nine per cent (ranging from three to ten per cent).

The figures on local sourcing presented above are substantially lower than those presented in other studies, based on data collected by the industrial development agencies in Ireland and Scotland. Turok (1997) reports that in 1995 the 16 largest foreign owned electronics companies in Scotland (including all the main computer assemblers) sourced 21 per cent of their total purchases (excluding electronic components, inter-company trading and services) from Scotland. In Ireland local sourcing figures are collected by Forfas as part of the annual Irish Economy Expenditure (IEE) survey. An extract of survey data on four microcomputer assemblers provided an average local sourcing figure of 28 per cent for the year 1998 (van Egeraat, 2002).

The discrepancy between the figures based on the surveys carried out by the industrial development agencies and our figures is partly explained by a less inclusive definition of local sourcing in our research. Thus, the IEE figures include expenditure on items bought from local supply-chain-managers but manufactured in other regions as well as expenditure on complete systems manufactured by contract manufacturers with local

operations. These items were not considered vertical production linkages and were excluded from the data collected during the company interviews.

Inbound pipeline strategies and structures

The focal companies had always had a mix of logistical arrangements. Before the mid-1990s, a small part of the inputs was manufactured and supplied on a virtually true JIT basis, involving minimal buffer inventories. In fact, Apple had implemented true JIT supply systems for selected components as early as 1983 (*International Business Week*, 14 May 1984). However, the supply chains of most other components still involved larger buffer stocks, in most cases stored in customers' warehouses as customer-owned inventory. These components were typically supplied on the basis of a push model, with vendors reacting to relatively inflexible purchase orders, detailing a fixed amount of product and a fixed delivery date on which customers had to accept the material. Supplies could either come direct from the suppliers' manufacturing facilities or be delivered via the suppliers' regional warehouses.

Since the mid-1990s, the strategy of all focal companies has been shifting towards a 'hubbing' system. In a hubbing system, suppliers that are not able to supply their customers directly from their manufacturing facilities within a certain lead-time are requested to hold an agreed minimum amount of inventory at a location near to their customers – the 'hub'. On a very frequent basis, the customers pull from these hubs, either their exact material requirements or the amount necessary to replenish minimal on-site buffers. The suppliers have the responsibility for maintaining sufficient inventories in the hubs and hold title to these inventories. Customers only own the material from the moment they pull it from the hubs. Suppliers produce and deliver on the basis of very flexible purchase orders, often 'blanket purchase orders'.

Some of the focal companies pulled material from a multitude of hubs, individually organized by the various suppliers, i.e. vendor hubs. However, there was an increasing trend to consolidate the hubbed inventories of multiple suppliers into one or two super hubs. This significantly reduced the complexity of the pull system. Some focal companies managed their own super hub. However, in most cases these super hubs were owned and managed by third-party-logistics (3pl) providers that offered integrated logistics services. These '3pl hubs' could serve several focal companies.

Delivery lead-time requirements of individual focal companies varied from 24 hours to as low as one hour. Most 3pl hubs were therefore located close to the focal companies (see Figure 1) and some focal companies had organized hubbing facilities on-site. Such proximity allowed companies to pull materials multiple times a day, leading to extremely low inbound inventory levels on the books of the customers. It

is this hubbing system that partly explains the discrepancy between the use of overseas component sources and the high inventory turns published by some of the focal companies (Casey, 1997; Oram, 1997).

Apart from hubbing, the focal companies still used a range of other pipeline structures, including true JIT. But most structures had one thing in common with the hubbing system: they involved locally stored inventories on the books of the suppliers. Thus, focal companies made increasing use of supply-chain-management companies that not only organized the logistics of components, but actually bought and held title to components until they were delivered to the assembly plants. Items sourced in this way could include many c-class items, cables and interconnect material, mice, keyboards and media. From an inbound logistics point of view there are great parallels between receiving supplies in this way and from a local hub. In both cases the customer pulls on a very frequent basis from agreed buffers located in close proximity and owned by the supplier/supply-chain-manager.

In many cases local suppliers were requested to hold (at their own premises) minimum buffers of finished goods at levels similar to those requested from suppliers delivering through the hubs. Customers did not have to take the material and did not own it until the moment they pulled it from the local suppliers. Again, in those cases there was not that much difference between a hub and a local supplier.

Through the hubbing system, and through most of the other pipeline arrangements, focal companies reduced their inbound inventories to a minimum by requesting suppliers to provide JIT deliveries from finished component inventories, stored in local warehouses. Such supply systems are typically referred to as 'apparent JIT' (Lamming, 1993; Ryan, 1997) or 'pseudo JIT' (Hudson, 1994). It has been suggested that these systems are sub-optimal and hold no benefit for the supply chain as a whole, since the costs of inventory remain in the system (Lamming, 1993). Suppliers are allegedly 'forced to eat inventories' (Morris, Munday, and Wilkinson, 1993; Roper, Prabhu, and van Zwanenberg, 1997) and the burden of inventory is simply transferred from the customers to the suppliers. However, the use of hubs, in itself, does not necessarily mean that the supply system is sub-optimal. The fact that the supply system diverges from the prototypical true JIT picture does not mean that the modern comprehensive logistics management principles are not appreciated. To determine this one requires data on the actual size of the inventories, the shipment frequencies and the mode of transport. These data are presented in the next section. However, additional information regarding the detail of the hubbing arrangements/contracts can already cast some light on the issue.

Figure 1 Location of Main Third Party Logistics Hubs in Ireland and Scotland – 1998/1999

Source: Company interviews

With regard to the idea of suppliers being forced to eat inventories, all but one of the interviewees indicated that suppliers were compensated for hubbing. Focal companies were paying more than the standard price for hubbed components. Furthermore, hubbing contracts could involve different liability clauses which meant that the risk of obsolescence was not always entirely transferred to the supplier. Thus although in the case of many components the focal companies were not liable to take the inventories in the hub at any stage, in other cases, particularly in cases of customised components, focal companies had to take the material in the pipeline after a certain period. Anyway, the risk of obsolescence of

hubbed materials was generally kept to a minimum by the intensive sharing of information regarding inventory data and demand forecasts.

So if suppliers are compensated for maintaining inventories in the hubs and the focal companies have to bear the cost of inventories anyway, the question arises: what drives the rise of hubbing? There are several advantages of hubbing. First, a hubbing system, as opposed to a system where each individual focal company carries its own inventories, provides economies of scale in the management of industry standard inventories and allows total inventories to be reduced since inventories in the hubs can be, and are, switched between various focal companies. Secondly, most focal companies were extremely focussed on short-term performance indicators, such as return on investment, and hubbing allowed them to improve some of these indicators. As one interviewee put it: "[our company] is a public company … the first thing a Street analyst will look for is our inventory and our turns. Obviously this is a huge opportunity" (Interview Operations Manager, Gateway EMEA, 1999).

The use of 3pl hubs creates additional advantages over the use of vendor hubs. Both customers and suppliers can tap into the full set of integrated services offered by the 3pl providers. The bigger 3pl providers have developed or acquired core technologies and competencies in the area of logistics and supply-chain-management, notably sophisticated EDI, satellite tracking, radio-frequency scanning and automated customs handling systems.

Logistical efficiency

The focal companies imported the vast majority of components and parts from regions outside Ireland and Britain, notably from the Far East, and the pipelines of most components involved inventories, often hubbed in local warehouses. This section will investigate whether this situation reflects a sub-optimal inbound logistics system organized on traditional Fordist, Mass Production principles, or whether it came about in the context of a more efficient inbound logistics system, taking account of the modern comprehensive logistics management principles underlying JIT and TBC.

The interviews with the focal companies made clear that the costs of holding inventories in the inbound pipeline were well appreciated in all focal companies. This was reflected in the high level of control focal companies kept over the inbound inventories and pipelines, as illustrated by the following quote.

> I give [the suppliers] my material requirements plan every week for that product and I expect them to manage the chain between them and the hub, I expect them to turn it up, down, slow it fasten it and manage it so that I always have 10 days

> [worth of inventory] in the hub. … We run queries here every day by part number which sends out an exception report which shows me what suppliers have less than 10 days. And the buyers call them. And it also shows us what we have too much of. And we than proactively take actions twice a week. … All the vendors are on-line to Irish Express Cargo [the 3pl hub]. All the vendors have the same kind of contact. That is a criterion that Gateway gives (Interview Operations Manager, Gateway Ireland, Sept. 1999).

In order to get an insight into how tightly the inbound inventories were managed, the focal companies were asked to provide a set of key logistics data for individual components from the various source regions. Table 2 summarizes these data. The first column lists the various material inputs. With the exception of data on microprocessors and memory, no data are presented on the components for the board assembly lines. Only four focal companies were assembling limited amounts of printed circuit boards on site. The second column lists the target buffer or inventory levels (average for respondent companies) that companies tried to maintain for the various components. The data on target buffer levels represent buffers kept at hubs, suppliers' local/regional manufacturing facilities, warehouses of the focal companies, supply-chain-managers or at a combination of these facilities. The data do not include the (small) inventories kept at the plants of the focal companies in the context of hubbing or true JIT supply. In most cases the size of these on-site buffers was minimal. Finally, the third column lists the target number of days between shipments from the location of manufacturing into the main buffer (average for respondent companies). This is a measure of the shipment frequency.

The key logistics data paint a picture of tightly managed inbound inventories with modest target buffer levels and high shipment frequencies. To some extent the target buffer levels for individual component pipelines varied, depending on a number of interrelated issues that will be discussed later in this section. However, all companies worked with a generic figure for target inbound inventory that applied to most parts and components. All but two focal companies worked towards a buffer of ten days (of forecasted demand) for most of their material inputs. One managed its inventories even more tightly, working towards a five day generic buffer level and applying a higher shipment frequency than other companies for most of its material inputs. The second worked towards a mixture of ten day and five day target buffer levels.

Broken down by geographical origin, most components manufactured in the Far East and the Americas involved target buffers of between eight and ten days and shipment frequencies between weekly and bi-weekly (averages for respondent companies). For most materials from these

regions the typical mode of transport was plane[7], leading to relatively small inventories caught up in transit and relatively small fluctuations in the actual inbound inventory levels. Most components manufactured in Europe again involved target buffer levels of between eight and ten days but shipments were more frequent – ranging from one to five times a week. All European material was trucked by road/ferry and the delivery lead-time was generally under 24 hours.

Finally, regarding material inputs manufactured in the UK and Ireland, although a number of components involved very low target buffer levels – as low as two days (average for respondent companies) – most components involved buffer levels comparable to those applicable to items manufactured in other regions. Table 2 does not show shipment frequencies for locally sourced components since in most cases the main buffers were positioned at the suppliers' manufacturing facilities and fed directly from the manufacturing lines. Focal companies typically pulled materials from these suppliers on a daily basis, or even more frequently.[8]

Where the main buffers were not positioned at the suppliers' manufacturing facilities, the hubs or the customers' facilities were typically supplied very frequently – often daily or every second day. The main exceptions included modem/network cards, which were typically shipped on a weekly or bi-weekly basis.

Thus, the general picture is one of modest inbound target buffer levels and high shipment frequencies.[9] Although modest compared to the traditional Western logistics systems, these inbound target buffer levels were slightly higher than one would expect on the basis of comprehensive logistics management principles alone. The market conditions faced by the focal companies in combination with their production strategy provide an explanation for why the inbound buffer levels were in fact not less than optimal.

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[7] Plane was the typical preferred mode of transport for the following items: microprocessors; memory; partly integrated portables; autoloaders; AC adapters; hard disk drives; CD ROM drives; Zip drives; sound, video and graphics cards; DVD drives; modem and network cards; motherboards; riser cards; mice; screws and fasteners.

[8] Thus, most enclosures, racks, heat sinks, configured hard-disk drives, and cables, manufactured in Ireland or the UK, were pulled on a daily basis or even more frequently, from buffers positioned at the suppliers. Similarly, country kits, wrapped media, non-English language keyboards and packaging were generally pulled daily, or even more frequently, from very small (true JIT) buffers kept at the suppliers' premises.

[9] The figures should be compared to the traditional Western logistics systems during the 1970s in which it was not uncommon for components like processors to be delivered every two or three months and to be transported by ship (personal communication, Dr. Philip McCann).

Table 2. Summary of Key Logistics Data (Averages for Focal Companies)

	Target buffer levels (days)	*Target number of days between shipments*
Material inputs Far East and Americas		
Microprocessors	4	2
Flat panel monitors	5	5
Memory	8	3
LCD displays	8	4
Partly integrated portables	10	4
Tape back-up/ autoloaders; AC adapter; Hard disk drives; CRT monitors; Small plastic metal parts; Floppy drive; CD ROM drive; CD RW drive; Combo drive; Zip drive; Docking stations; Joysticks; Scanner; Server racks; Sound/video/graphics cards; Power supplies; DVD drive; Modem/network cards; Enclosures; Motherboards/backpanels; English language keyboards; Printers; Enclosures for portables; Heat sinks; Microphone; Cooling fans; Riser cards	8-10	5-10
Battery for portable; Speakers; Mice; Power cables	13-14	6-10
Other cables	15	11
Screws and fasteners	35	40
Material inputs Europe		
Power supplies	5	2
m' boards/ backpanels	10	1
CRT monitors; Tape back-up/ autoloaders; Memory; Enclosures for portables; Cooling fans; Hard disk drives; Other cables	8-10	2-4
Printers; Sound/video/graphics cards	10	5
Material Inputs Ireland and UK		
Packaging; Non-English language keyboards; Country kits	2	
CD ROMs (wrapped); Printed media (wrapped)	4	
Heat sinks; Enclosures	5	
Hard disk drives; Server racks	6	
Small plastic metal parts; Modem/network cards; m' boards/ backpanels; Power supplies; CRT monitors; Printers; Flexcircuit	9- 10	
Printed labels; Power cables; Other cables	13	

Source: Company interviews.

All focal companies offered a great variety of product configurations, often customized to individual orders, in combination with extremely short order lead times – typically, the companies applied a target order lead time of less than five days. At the same time, the companies aimed to minimize the inventories of finished computer systems. These objectives are fully consistent with textbook TBC (Hise, 1995; Stalk and Hout, 1990). All focal companies addressed this combination of objectives with a build-to-order (BTO) production strategy for the majority of their output. The focal companies generally did not build

systems to stock. Instead, computer assembly activities usually only started after customer order receipt.

The problem was that the focal companies were facing strongly fluctuating and unpredictable demand. In such an environment a BTO strategy in combination with very short lead times results in strongly fluctuating and unpredictable demand from final assembly on upstream functions. Although a JIT manufacturing system is designed to deal with small fluctuations in demand from final assembly, it cannot deal with highly fluctuating and unpredictable demand since this brings the danger of inefficient use of labor and machinery upstream and the build up of in-process inventories (Sayer, 1986). In the factories of the focal companies this problem was partly solved by a reduction of the number of separate phases in the production process. Production typically involved a very short uninterrupted sequence of system assembly, software downloading, testing and packing, with no in-process buffers. In a sense, the first upstream activity to be encountered was component production and that virtually all took place outside the boundaries of the plant, at the component suppliers. The problem of zero productivity of workers was addressed with numerical labor flexibility.

However, as the first upstream function, the suppliers were confronted with a highly irregular and unpredictable sequence of pulls by the focal companies. In such a situation a virtual elimination of buffer inventories on the basis of the comprehensive logistics management principles would lead to an inefficient use of labor at the suppliers or an increased risk of stock-out. A BTO production system with short order lead times in an environment of erratic final demand simply requires certain buffers between the suppliers and the manufacturing lines of the customer, except in situations of extremely short manufacturing cycles at the suppliers. All this is totally consistent with the comprehensive logistics management principles underlying JIT and TBC. In effect, the focal companies were simply trading-off the costs of inbound pipeline inventories against the loss of market share and revenue due to stock-out.[10]

This partly explains why in many cases the supply pipelines of components manufactured in Ireland, the UK and Europe involved similar target buffer levels to those that applied to inputs manufactured in the Far East or the Americas. Many of these components involved target buffer levels of between five and ten days. A number of items manufactured in Ireland or the UK tended to involve lower target buffer levels of (finished) components. However, in most of these cases the suppliers involved were committed to holding the balance of the generic target levels in the form of unfinished or non-configured components

[10] A similar challenge of combining JIT principles, global sourcing and BTO production for a volatile market has been described in an article on the logistics operations at Bose's speaker plant in the USA (Bradley, 1989).

while the final assembly or configuration process was made extremely short.

For example, four focal companies that received hard disks from Quantum in Ireland worked towards relatively low target levels of fully configured/pre-assembled hard disks. However, Quantum was committed to holding the balance of the ten days generic target buffer level in non-configured form, while the configuration cycle was very short and added minimal value. Three other focal companies applied the generic target buffer levels for finished hard disks.

To reiterate, there is abundant evidence that the inbound inventories and logistics pipelines were tightly managed. What can also be shown is that the impact of contextual conditions and component characteristics on the way companies managed their inbound logistics and the geography of the supply linkages was in line with the comprehensive logistics management principles. In the following paragraphs we show the empirical importance of the four main issues we introduced at the theoretical level above. It is essential to note that in all cases the eventual outcome was the result of a complex trade-off among a variety of component characteristics and contextual conditions. The eventual outcome therefore does not always directly reflect the importance of an individual factor. Moreover, the characteristics of some components, notably monitors, were such that companies had a choice of different supply-chain solutions, any one of which would have been equally efficient.

Regional differences in labor costs: These remained a strong force against a reduction of the linkage distance. Interviewees stated that producers in other regions, particularly in the Far East, could offer material inputs at a substantially lower price than producers in Ireland or the UK. This was mainly due to far lower wage rates and high flexibility of the labor force, while currency exchange rates played an important role as well. To attain total supply chain cost effectiveness companies balanced the efficiencies in logistics gained by using local suppliers against material cost price advantages gained by using suppliers in low-wage regions. In many cases the more efficient solution involved suppliers located in the Far East.

> It [the reason for not sourcing monitors locally] is basically an argument between the actual unit cost and the actual component part in terms of labor content, etc. So if labor content is a high proportion of the unit cost then it makes sense to manufacture that in a low labor cost arena. … So you take into account the differential between labor content and the actual transport cost, your [inventory] financing costs, and money while on the sea, etc., etc. (Interview Logistics Manager, Apple Computer Ireland, Dec. 2000).

Value, volume and weight of components: Also in line with the comprehensive logistics management principles was the fact that the inventories of components with a high unit value were most tightly managed. As regards material inputs manufactured in the Far East and the Americas, the inventories of high value microprocessors, flat panel monitors and memory tended to be managed most tightly (see Table 2). For example, on average the focal companies and their suppliers worked towards microprocessor inventory levels that fluctuated between four and six days. The high value of these components led to a higher shipment frequency, which should theoretically increase the tendency towards proximity. However, this force towards proximity was simply outweighed by the labor cost savings and exchange rate advantages involved in producing these items in the Far East in combination with the relatively low costs involved in transporting these items frequently by air. On the other hand, the inventories of items with a low unit value such as mice, cables, screws and printed labels incurred limited inventory holding costs and were managed least tightly.

The effect of bulkiness of individual components is most clearly illustrated by packaging material. Packaging material, although of low unit value, required much warehouse space, thereby incurring extremely high inventory holding costs. Therefore, packaging tended to be sourced locally on a true JIT basis involving buffer levels of less than one to two days and one or more shipments a day. In this case the characteristic of bulkiness weighed stronger than the characteristic of low unit value, resulting in true JIT supply.

The bulkiness and weight of the components also had a more indirect effect on the logistics management and the geography of the supply linkages – via their implications for the mode of transport. Most material inputs manufactured in the Far East or the Americas were typically transported by plane leading to low in-transit inventories and low fluctuations in the target buffer inventories. Companies mentioned transit times typically ranging from three to five days including time lost at customs authorities on both sides. However, airfreight rates rise steeply for components with a high physical volume or weight with the result that for many components airfreight is simply not an option on a continuous basis.

The alternative was ocean freight. The downside of ocean freight is that, compared to airfreight, it involves substantial in-transit inventories. Companies typically mentioned transit times of four to five weeks in the case of ocean freight from the Far East and two to three weeks from the USA. Furthermore, ocean freight involves larger fluctuations in the actual inbound inventory levels than airfreight, even though the target buffer levels might be similar. In spite of these downsides, for many components with lower value-to-weight or value-to-volume ratios the outcome of the trade-off of all factors was sourcing in the Far East and

shipment by sea. Thus, power supplies, cooling fans, heat sinks, CRT monitors, keyboards, joysticks, microphones, scanners, speakers, printers, power cables and enclosures sourced in the Far East were typically transported by ship. The downsides of ocean freight were reduced by using different ocean-freight services, offering a range of transit times, and by the occasional use of airfreight services.

In other cases, the combination of component characteristics and regional labor cost differences / exchange rate advantages led to the use of local or regional suppliers. For example, most focal companies sourced enclosures from local suppliers.[11] Sourcing bulky enclosures in the Far East incurred high inventory holding costs due to the space costs of local warehousing and high in-transit inventories associated with ocean freight. This strong force for proximity was not offset by the labor cost savings associated with production in the Far East.

Minimum efficient scale (MES) of component production: This does explain some of the detail in the geographical configuration at a national and regional level. Components such as country kits, packaging and a service like keyboard localization can be produced or offered efficiently at a relatively low scale that requires only one customer. This allowed suppliers to set up relatively small operations in very close proximity to individual customers, often in the same town or city. The production of motherboards, monitors, enclosures and higher-end technology components, involves a higher minimum efficient scale that requires a level of business that can exceed that offered by one or a few individual microcomputer companies. As a result, the larger operations of these suppliers tended to be located at greater distances from at least some of their customers, often in a different country on the British Isles.

Component variety: The variety of options per component category was a relevant issue as well. The research showed that the components with a high variety of options – country kits, shrink-wrapped media, non-English language keyboard models and the customer configured hard disk drives of Quantum – were indeed produced on a true JIT or virtually true JIT basis, generally by local suppliers. Holding standard target buffer levels of these components in all their possible configurations and languages would greatly increase the inventory holding costs. The local supplier facilities were involved in the delayed or postponed final assembly or configuration activities, while they were generally committed

[11] A number of companies imported their volume enclosure models from the Far East. The reason for this lay in the relatively limited volumes required – volumes that did not warrant the costs of developing a local source and the cost of a second tool. Two of the companies that used imported enclosures were in the process of contracting a local supplier. Less current enclosure models and server racks were often imported from the USA. Again, the reason was that the volumes involved did not warrant the development of a second source locally.

to holding higher buffer levels of unfinished or non-configured components, often produced in other regions.

Clearly, component characteristics, regional differences in labor costs, and exchange rate changes affected the way companies managed their inbound logistics and the geography of the supply linkages. In many cases these characteristics led to logistics systems that diverged substantially from the prototypical true JIT system. However, in all cases the divergences were totally consistent with the comprehensive logistics management principles.

Conclusion

Schoenberger (1997) believes that after the era of Fordist mass production, that lasted until the mid-1970s, the capitalist world entered a new era of TBC. She argues that this transition will lead to a new geography of production, a kind of concentrated deconcentration organized around geographically coherent multinational market regions. One aspect of this model is the idea that the increased focus on reducing order-to-delivery cycles and logistical efficiency will lead to a greater proximity between buyers and their suppliers and an increase in the local and regional production linkages. The relevance of this idea has been tested in a case study of the microcomputer hardware industry in Ireland and Scotland.

It was shown that the microcomputer assemblers imported the vast majority of components and parts from regions outside Ireland and Britain, notably from the Far East, and that the pipelines of most components involved inventories, often hubbed in local warehouses. Some have interpreted such supply systems as apparent JIT or pseudo JIT, a sub-optimal inbound logistics system organized on traditional Fordist, Mass Production principles. We have argued that the logistics systems and the geography of the supply linkages were not sub-optimal. The necessary inbound inventories were tightly managed leading to modest target buffer levels and high shipment frequencies. By sourcing from the Far East, companies were simply trading-off price advantages gained by using suppliers in low-wage regions against the efficiencies in logistics gained by using local suppliers, totally consistent with the modern comprehensive logistics management principles underlying JIT and TBC. Similarly, the effects of various component characteristics were consistent with what could be expected on the basis of the comprehensive logistics management principles.

The inbound inventory levels were slightly higher than one would expect on the basis of comprehensive logistics management principles alone. However, we have shown that this was not indicative of a sub-optimal supply chain solution. Rather, the main reason for the slightly higher levels lay in the BTO production strategies of the focal companies. Clearly, the modern comprehensive logistics management principles

underlying JIT and TBC can lead to supply systems that diverge substantially from the prototypical true JIT system.

What are the lessons for industrial development policy in Ireland and Scotland? Industrial policy and the strategies of the industrial development agencies in Ireland and Scotland have long included the idea of building integrated vertical production clusters around subsidiaries of MNEs (Industrial Policy Review Group, 1992; Turok, 1997). This can be called the "local sourcing route" to cluster development (Young, Hood and Peters, 1994, p. 669). The findings of this research suggest that such a strategy is becoming increasingly unsuitable, at least in the context of the microcomputer industry.

The suitability of a strategy of building integrated clusters around subsidiaries of MNEs in the microcomputer assembly industry might well become of theoretical interest only since Ireland and Scotland have recently experienced a wave of plant closures and job losses in the microcomputer assembly industry. During the 1980s and most of the 1990s Ireland and Scotland were important locations for computer assembly activity. Supplying the European market with build-to-order, often customized, bulky and relatively valuable systems with short order lead times required a production location in Europe. Within Europe, Ireland and Scotland offered the required combination of relatively low wages (on a European scale), flexible labor markets, and literate and trainable labor forces. In terms of Schoenberger's (1997) model of concentrated deconcentration, both countries functioned as the "new semi-periphery" of Europe.

The situation started to change during the second half of the 1990s. Wage rates in Ireland and Scotland were rising rapidly. At the same time, Eastern Europe was progressively opening up for capitalist economic activity, which created new production locations, offering low wages and a relatively skilled labor force, at a short distance from, and soon to become part of, the EU market.

As a result, since 1998, much system assembly activity has been shifting to Eastern European countries such as the Czech Republic and Hungary (van Egeraat and Jacobson, 2004). This shift of assembly activity, in combination with a competition-induced shakeout of branded microcomputer makers, has led to a serious reduction in microcomputer assembly activity in Ireland and Scotland. Of the original five focal companies operating in Ireland in 1998, by 2003 only Dell and Apple were still assembling microcomputers, and Apple's system assembly operation was substantially downsized. Similarly, of the six original focal companies in Scotland, only Sun, Packard Bell-NEC, IBM and Compaq/HP were still assembling systems by 2003 and IBM and Compaq/HP had significantly downsized their assembly operations while Packard Bell-NEC was planning to close its plant. The reduction of

computer assembly activity resulted in further job-losses in the component sector, notably in plants producing the bulky enclosures that had always required relative proximity to the system assemblers.

Clearly a strategy of building integrated vertical clusters around manufacturing subsidiaries of MNEs does not look very promising in the context of Ireland and Scotland. The alternative route identified by Young, Hood and Peters (1994, p. 669) is via "technological innovation". Here, technological cluster development might be stimulated through co-operative R&D projects involving companies, university research labs and government research institutions. This appears to be the more appropriate route for Ireland and Scotland to take. Both IDA Ireland and Scottish Enterprise have indeed adopted elements of such a strategy.

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CHAPTER 15

CODE AND THE TRANSDUCTION OF SPACE

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First published in *Annals of the Association of American Geographers* (2005), 95(1), 162-180.

> [S]pace is neither absolute, relative or relational *in itself*, but it can become one or all simultaneously depending on the circumstances. The problem of the proper conceptualization of space is resolved through human practice with respect to it.
>
> — (Harvey 1973, 13, italics original, our underline).

Software, commonly referred to as code, is increasingly central to the spatial formation of collective life. Code produces, monitors, surveys, augments, and controls many aspects of daily living, including the infrastructures of communication, transport, finance, and utilities such as water and electricity. Indeed, such is the importance of code that everyday tasks associated with work, travel, communication, consumption, health, and domestic living are ever more dependent on code for their functioning. In some cases, this dependence is so great that if the code "crashes,"[1] then the task cannot be completed because manual alternatives have been discontinued or are inadequate to cope with demand. For example, the "crash" of the air traffic control system at Tokyo Air Traffic Control Center, 1–2 March 2003, meant the cancellation of over 203 flights, with flights resuming only after the system was reestablished (Risks List 2003). Seemingly minor failures in relatively insignificant software systems for routine monitoring can have very serious consequences, as demonstrated by the large-scale power outage affecting millions of people in Northeast United States and Canada in August 2003. Official reports conclude that a software failure in the alarm system in the control center of FirstEnergy in Akron, Ohio was a significant contributing factor (U.S.–Canada Power System Outage Task Force 2004). Perhaps the best illustration of the contemporary social and economic importance of code was the global panic associated with the Y2K "millennium bug," which triggered a worldwide overhaul of operating systems. The cost to the U.S. federal government alone was estimated at $8.34 billion, while governments and businesses across the world spent an estimated $200–600 billion to address the problem (Bennett and Dodd 2000). And yet, despite the growing use and pervasiveness of code in contemporary society, code and its effects on the production of space have largely been ignored by geographers in

[1] Software is said to "crash" when it ceases to function.

favor of studying the technologies and infrastructures that code facilitates (although see Thrift and French 2002). Accordingly, this article provides an analysis of the effects of code on daily life and the production of space and explains the *difference* code makes through an interrogation of the relationship between technology, society, and space.

To structure the discussion, the article is divided into six sections. The first section details the form and nature of code and provides a typology of the various ways it is embedded in everyday objects, infrastructures, and processes. The extent and effects of code on everyday life are then illustrated through three vignettes, each of which details a day in the life of an individual living in London. In the third section, a theoretical framework for understanding the effects of code and making sense of the vignettes is developed. This framework draws on the ideas of Bruno Latour, Guy Simondon, and Adrian Mackenzie and utilizes the concepts of *technicity* (the productive power of technology to make things happen) and *transduction* (the constant making anew of a domain in reiterative and transformative practices) to explain the difference code makes to everyday life. In the following section, these theoretical ideas are extended to argue that one of the prime reasons why code makes a difference to everyday life is because its technicity alternatively modulates space through the process of transduction. Here, an ontogenetic [2] understanding of space is developed in which space is understood as continually being brought into existence through everyday transductive practices. In the fifth section, the nature of transduced space is elaborated, and in the final section, the vignettes are used to illustrate various code-induced spatial transductions with respect to domestic living, work, communication, transport, and consumption.

The Nature of Code

For the purposes of this article, code consists of instructions and rules that, when combined, produce programs capable of complex digital functions that operate on computer hardware. We therefore use the term code in a restricted sense to refer to the rules and instructions of software rather than broader notions of codes as sociocultural structures and technical/legalistic protocols of ordering and control, such as national laws, international treaties, etiquette, standards, systems of measurement, institutional customs, and professional codes of conduct. Code, as software, takes multiple forms, including hard-coded applications with no or limited programmability (e.g., embedded on chips in alarm clocks, GPS receivers), specialized applications (e.g., banking software, traffic management systems), generic applications (e.g., word processing, spreadsheets, web browsers) and operating systems (e.g., Windows, MacOS, Unix, Linux) that run on a variety of hardware (e.g., embedded chips, dedicated units, PCs, workstations) and can distribute,

[2] Ontogenesis refers to how something comes to be, as opposed to ontology, which refers to what something is.

generate, monitor, control data exchange and flow across a range of infrastructures (e.g., printed circuit boards, coaxial and fiberoptic cables, wireless, satellites) using a variety of forms (e.g., electrical, light, microwave, radio). The coding within these programs varies from abstract machine code and assembly language to more formal programming languages, applications, user created macros, and scripts. These forms of code are embedded in everyday life in at least four main ways, producing what we term coded objects, coded infrastructures, coded processes, and coded assemblages.

Coded objects refer to non-networked objects that use code to function or permanently store digital data that cannot be accessed without software. The former range from simple household items such as alarm clocks, "smart" irons or kettles, televisions, washing machines that use basic code to augment their use, through to complex, but isolated machines, such as DVD players and PCs. The latter include credit and cash cards, floppy disks, and CD-ROMs. Though these coded objects vary in their scope, sophistication, and programmability, the importance of code to their function is such that if the code (or hardware that supports its use) fails or miscomputes, the object ceases to function as intended (e.g., a cash card fails to work as a cash card). In all cases, unless networked, the remit of the code is limited purely to that object.

Coded infrastructures refer both to networks that link coded objects and infrastructure that is monitored and regulated, either fully or in part, by code. Such coded infrastructure (or ensembles) include distributed infrastructures such as computing networks (e.g., Internet, intranets), communication and broadcast entertainment networks (e.g., mail, telephone, mobile phones, television, radio, satellite), utility networks (e.g., water, electricity, gas, sewerage), transport and logistics networks (e.g., air, train, road, shipping), financial networks (e.g., bank intranets, electronic fund transfer systems, stock markets), security and policing networks (e.g., criminal identification databases, surveillance cameras), and relatively small-scale and closed systems such as localized surveillance (say, within one building complex), and small but complex systems such as an individual car. The geographical coverage of distributed infrastructures thus varies from global coverage, as with GPSs (which, literally, can be accessed from any point on the Earth) to more localized coverage.

In all these infrastructures, code is now an integral component in complex systems that consist of electronic, electrical, mechanical, and physical components. Within an infrastructure, these components are organized hierarchically, with components becoming more complex and more significant toward the top of the hierarchy and, at the same time, tending to become less numerous and less visible. If we take the example of the car as a relatively closed coded infrastructure, the physical components would be the body shell, the wheels, the seats, and so on, as well as

the fuel; the mechanical would be the pistons, the gears, the brakes; the electrical would be the ignition system, the battery, the lights, the radio; the electronic would be the fuel gauge, the engine temperature sensor, the alarm and immobilizer, and so on; the code would be the various "black boxes" such as the engine management system that monitors the car, continuously adjusting for performance, road conditions, and driver demands. The result of these black boxes is that for most modern-day cars, there is no longer a direct electromechanical connection between the key in the ignition and the start of the engine. Code mediates and dominates this transaction. In the case of a distributed network such as a water utility system,[3] while the vast bulk of the infrastructure is still "dumb," consisting of pipes, valves, pumps, taps, and so on that are not coded objects, the network is now likely to be operated and regulated by code (programs for monitoring water quality, reservoir levels, and channeling water supplies through a network of pipes; measurement and billing software for charging customers). Water is still water, and the network still "dumb" pipes, but the flow of water is now dependent on code.

Coded processes refer to the transaction and flow of digital data across coded infrastructure. Here, the flow of data consists of more than simple instructions to regulate coded objects within an infrastructure. Rather, the flow consists of the transfer of information. Flows become particularly important when they involve the accessing, updating, and monitoring of relational databases that hold individual and institutional data. Such databases can be accessed at a distance and used to verify, monitor (say for billing purposes), and regulate user access to a network, update personal files, and so on. An example of a coded process is the use of an ATM. Here, data and transaction flow are transferred across the coded infrastructure of the bank's secure intranet based on access via a coded object (the customer's bank card), verifying the customer based on a personal identification number (PIN), determining whether a transaction will take place, instructing the ATM to complete an action, and updating the user's bank account. Part of the power of relational databases is that they hold common fields that allow several databases to be cross-referenced and compared. Other coded processes center on databases relating to mortgages, shares, taxation, insurance, health, crime, utility usage, service usage, and so on, all of which can be accessed across open or, more commonly, closed networks. While coded processes are largely invisible and distant, they are revealed to individuals through letters, statements, bills, receipts, print-outs, licenses, and so on, and through unique personal identification numbers on the coded objects used to access them (e.g., bank and credit cards, library cards, transport season tickets, store loyalty cards) (Dodge and Kitchin forthcoming).

[3] Much of the infrastructure of the utilities has evolved over many decades as a patchwork of systems have been installed, upgraded, and interlinked. Their true extent and complexity remain largely hidden from public view (see Clayton 2000).

Coded assemblages occur where several different coded infrastructures converge, working together—either in nested systems or in parallel, some using coded processes, others not—and, over time, become integral to one another in producing particular environments, such as office complexes, transport systems, and shopping centers. For example, the combined coded infrastructures and coded processes of billing, ticketing, check-in, baggage routing, security, safety, customs, immigration, air traffic control, airplane instruments, work together to create a coded assemblage that defines and produces airports and passenger air travel (see Dodge and Kitchin 2004). Similarly, the coded infrastructures of water, electricity, gas, banks and mortgage lenders, commodities, Internet, telephone, mail, television, government database systems, and so on, work together to create an assemblage that produces individual households. The power of these assemblages is their interconnection and interdependence, creating systems whose complexity and power are much greater than the sum of their parts.

These elements, taken together, make it clear that code is something very difficult to avoid; code makes a difference to the constitution and material and discursive practices of everyday life. It is now almost impossible not to live within the orbit of code, anywhere on the planet. To do so would mean being born outside of collective life so that one does not appear in government databases, does not use any utilities (e.g., water, electricity), does not use modern convenience items (e.g., kettle, washing machine), does not watch or take part in entertainment or recreational activity (e.g., television, cinema), and avoids consumptive and societal activities such as shopping (thereby avoiding barcodes, credit cards, surveillance cameras, and the like). In short, code, to varying degrees, conditions existence.

Three Vignettes

> [M]ore and more . . . the spaces of everyday life come loaded up with software (Thrift and French 2002, 309).

The extent and effects of code on everyday life can be illustrated by considering the daily lives of people and the extent to which code mediates, augments, regulates, and facilitates their activities. The three vignettes presented in this section each depict a day in the life of an individual living in London. Each individual lives in a different part of the city (reflective of income and class) and works in a different occupational sector. (Table 1 provides part of the ACORN geodemographic profiles of the residential locations.) While the individuals themselves are fictions, the coded assemblages of homes, work places, recreational sites, and the routes between them, along with coded objects, infrastructures, and processes encountered in those assemblages, are real (and were observed in situ through fieldwork on 25

and 26 June 2003[4]). We believe that the vignettes are not extreme or exceptional cases and are representative of how code is embedded in the daily lives of individuals living in the city. While the vignettes concentrate on individual narratives, it should be clear that the effects that occur are not simply of individual and code, but are largely manufactured collectively, mediated by the presence of others (indeed, they are part of complex sociotechnological relations). Here, for purposes of illustration, we want to concentrate on individual rather than collective production.

Table 1. Geodemographic Details of the Three Vignettes Based on Their Residential Postcode Location (Source: ACORN geodemographic produced by CACI. Obtained from http://www.upmystreet.com.)

Vignette	**Naomi (postcode - SE1 6SX**	**Elizabeth (postcode - N22 5DT)**	**John (postcode - BR7 5QE)**
ACORN type	Type 47: Estates with high unemployment	Type 38: Multiethnic areas, white collar workers	Type 1: Wealthy suburbs, large detached houses
Socioeconomic profile	The unemployment rate is nearly double the national average. The proportion of people working in the service sector is 14 percent above average, and there is a correspondingly lower than average proportion of manufacturing workers. The level of secretarial and clerical workers is 28 percent higher than average. There are also 61 percent more unskilled workers than average. The proportion of people travelling to work by public transport is 2.7 times higher than average; in	The unemployment rate is 56 percent higher than average. The proportion of people working in the service sector is slightly above average, but there are 30 percent fewer than average manufacturing workers. There is a broad mix of occupations across the socioeconomic scale, but the largest concentration is in the skilled, nonmanual category. There are also above average numbers of students in these areas. Public transport is the dominant mode of travel to work; in particular, the proportion of people using rail is 4.7 times higher than average	ACORN Type 1 comprises a highly educated population: almost three times the national level of residents have degrees. In terms of employment, these are largely professional and managerial people. Unemployment is around a third of the national level.

[4] The fieldwork consisted of conducting detailed software and hardware audits for journeys taking place in local environments and across the city to work. Each of the routes was traced by both authors, and the location and type of coded object and infrastructure were documented in a field notebook, onto a 1:1250 scale map, and by taking photographs.

	particular, 3.6 times more people than nationally travel to work by train.		
Durables	Car ownership levels are very low—64 percent of households have no car. The proportions of new and expensive cars and company cars are very low. A number of durable products are purchased at above average rates by people in these areas: computer games, microwaves, washing machines, washer/dryers, tumble dryers, and fridge freezers. Other products are purchased at well below average rates. Home improvement activity is practically nonexistent.	Thirty-four percent fewer households than average have a car. Company car ownership is 29 percent higher than average. Typically, cars are small, 2–4 years old, and costing under d10,000. People in this ACORN Type are more likely than average to purchase the following durables: hardback books, computer games systems and games, video cameras, and ski clothing. Purchase rates for most household durables are very low, with the exception of fridge freezers. The proportion of homes having secondary glazing fitted is 50 percent above average.	Levels of car ownership are very high: 3.5 times the national level of households have three or more cars. Cars are likely to be new, large, and very expensive. The proportion of cars costing over d20,000 is nearly ten times higher than average, and the proportion of 2500cc1 cars is nearly four times higher than average. The incidence of company cars is also above average—at 13 percent, this is three times higher than the national rate. There is not a great deal of home improvement activity in these areas. Purchase rates of white and brown goods are average. Installation rates for new central heating and double glazing are well below average.
Financials	Although there are 37 percent more people than average with incomes under d5,000 per annum, over a quarter earn more than £25,000 per annum. Ownership of financial products is very low, and there are scarcely any new, current, or savings accounts being opened.	The income profile of these areas peaks in two places. The proportion of people earning £10–15,000 per annum is slightly above average, and there are 47 percent more people than average earning £30–40,000 per annum. Ownership of financial products is generally lower than average—much lower than might be expected, given the income profile. The rate of new savings	These are extremely high income areas—the proportion of households earning more than £40,000 per annum is 5.4 times higher than average. Ownership of National Savings Certificates is 2.8 times higher than average, and there are also well above average holdings of stocks and shares, all plastic cards, and personal pensions.

		account opening is 32 percent above average, while people are 15 percent more likely than average to have a mortgage from a lender other than a building society.	
Media	The proportion of homes with cable television is over double the average, but satellite television ownership is 5 daily newspapers is concentrated basically on two titles: *The Mirror* and *The Sun*. The Sunday papers with the largest readerships are *The News of the World*, *The Sunday Mirror*, and *The Sunday People* but *The Observer* is read by twice as many people here as average. Both ITV viewing and commercial radio listening are heavy.	The number of homes with cable television is almost three times higher than average, while satellite television penetration is 10 percent up on the average. A wide range of newspapers are popular in these areas. Readership of *The Independent* is 2.3 times higher than average, while that of *The Guardian*, *The Mirror*, and *The Sun* are all around 60 percent above average. All the national Sunday titles except *The Sunday Express*, and *The Mail on Sunday* have higher than average readerships. ITV viewing is light, but commercial radio listening is heavy.	By far the most popular daily newspaper is The Telegraph, which has a readership level 3.5 times higher than average. The Times is read by almost five times more people in these neighbourhoods than nationally, and readership of *The Financial Times* is also over three times higher than average. The most widely read Sunday newspaper is *The Sunday Times*, which is read by 3.3 times more people in this ACORN Type than nationally. The readership of *The Sunday Telegraph* is 4.2 times higher than average, and both *The Observer* and *The Independent on Sunday* are more than twice as popular as nationally. ITV viewing levels are very low, with 57 percent of people classified as light viewers. Commercial radio listening levels, however, are average.
Leisure	Fifty percent of people do not take holidays at all. Those who do are 31 percent more likely to go to a far-flung destination. Their propensity to visit pubs, clubs, and	The proportion of people taking holidays is about 13 percent less than average. People who do go on holiday, however, are much more likely than average to go away in the winter, to take a	Winter holidays and long holidays are very popular, and the proportion of people holidaying in their own holiday home or timeshare is over three times higher than average. Gardening is a

	wine bars regularly is roughly average, but they are much less likely to eat out. Participation rates for most sports are very low, but football, cricket, fishing, and table tennis are more popular than average. Extremely popular activities are betting, bingo, darts, and snooker.	long holiday and to go to far-flung destinations. People are less likely than average to go to pubs, clubs, and wine bars and to eat out during the day. Their propensity to eat out in the evenings is average, and a wide range of restaurant types are popular. Italian and British cuisine is less popular than average in these areas though. These are very active, busy people. Sporting and other activities which are particularly popular with people in ACORN Type 38 are: running, cricket, athletics, squash, skating, skiing, climbing, and going to the cinema and art galleries.	popular activity. People are less likely than average to go to pubs, clubs, and wine bars, but much more likely than average to eat out, with French, Italian, and Greek cuisines all being highly favored. People in these neighbourhoods are very active, with above average participation rates in many sports. Tennis, skiing, sailing, windsurfing, and ten-pin bowling are particularly popular. Theater attendance is over twice the national rate, and people are much more likely than average to visit stately homes.

Naomi

Naomi is in her early thirties. She is married with three children and lives in Draper House, a tower block close to the Elephant and Castle (site of a large shopping mall and major road intersection in the borough of Southwark in inner south London) (Table 1). Her day starts at 6:30 a.m. when her youngest child wakes her. For the next two hours she prepares breakfast and gets the children ready for school. The two youngest children watch satellite television while the eldest stays in his bedroom playing on his Xbox. Her husband returns home from working a nightshift at 8:10 a.m. She checks the electricity meter to see if the payment card needs topping up, and at 8:25 she and the children leave the flat and take the lift to the ground floor foyer of the block, where they are filmed by the council housing security camera network, installed to deter strangers and vandalism. They leave through a security door and head toward the Elephant and Castle Day Nursery on Hampton Street. She drops off the youngest child and is filmed at the door by a single, miniature security camera. She then walks down Canterbury Place, onto Peacock Street, leaving her other two children at Crampton Primary School.

At 8:45 Naomi largely retraces her steps, passing Draper House, and heading toward the Elephant and Castle Shopping Centre. She negotiates

the busy road via a pedestrian underpass, which is equipped with Closed Circuit Television (CCTV) cameras at entrances and exits. At street level, she passes workmen excavating the pavement to repair cables. At the entrance to the shopping center, she is filmed by the private security system for the center, and three larger dome cameras cover her passage through the center. She enters the Tesco Metro supermarket where she works and is assigned a checkout station by the store manager. Logging onto the checkout, she is recognized by the store's computer system, which begins to log her performance. The store itself is covered by a number of dome surveillance cameras monitoring the customers and also the staff. She spends the day seated at the checkout, serving customers, scanning products, processing payments, and logging customer loyalty cards. Her checkout screen informs her of required actions.

At lunchtime, she eats a sandwich in the canteen while speaking to her sister on a prepaid mobile telephone, arranging a weekend family get together. She also pops into the KNS News and Food Store on Newington Butts, the nearest PayPoint facility to her place of work, to top up her electricity payment card and to buy a lottery ticket. She is filmed by the store's interior CCTV. She returns to work in the afternoon for a short period before leaving at 3:20 to collect the children from nursery and school. Arriving back at Draper House at 4:00, she accesses the tower with an electronic key fob. She charges up the electricity meter and then prepares dinner, while the children watch satellite television. At 6:30 she takes the kids to the playground next to tower block, where she chats with neighbors for an hour. At 8:30 she puts the children to bed, and at 9.30 her husband leaves for work. She watches television for an hour and then goes to bed herself.

Elizabeth

Elizabeth is in her late twenties and lives on her own in a one-bedroom flat on lower Eldon Road, in Noel Park, near Wood Green in the inner suburbs of north London (Table 1). She works as an anesthetist in St Bart's Hospital, near to St Paul's in central London.

Elizabeth's day starts at 7:00 a.m. After an hour of getting ready, she heads out of the house, turning her iPod on, and walks down Eldon Road, crosses Lordship Lane, and walks along Moselle Street. At the end of the street, she turns right onto The Broadway under the gaze of two private security cameras stationed above an estate agent's. She waits at the curb of Bull Road as three double-decker buses pass. The buses, unbeknown to her, transmit their locations to a small transponder box mounted on a lamppost that updates the estimated arrival time on the "countdown" digital displays along the buses' routes. She crosses the road and walks past one such bus stop, another transponder, under the gaze of a cluster of six security cameras that provide full coverage of the front of a cinema and entertainment complex. She skirts a council information kiosk that gives details on local services, ignoring the

electronic screen, and waits at the crossing of Lordship Lane for the traffic lights to change. On the other side of the road, she waits at a short queue at Barclays Bank ATM and withdraws fifty pounds, her account automatically being updated with the time, place, and amount withdrawn. She receives a printed receipt.

Just after 8:10, she heads into the Tube station. She waves her "smart" card ticket over a transponder, and the ticket barrier opens, a debit is taken against her card, and she is logged into the Underground monitoring system. Around her, a cluster of five security cameras, part of the Underground's integrated passenger management and security system that covers the entire network, tracks her and the other customers' movements as she descends to the platform where four more cameras are located. After a couple of minutes wait, glancing up at an arrivals information display, she boards a southbound train, and standing, reads her book. For twenty minutes, she travels on the Northern Line to Holborn, where she changes to the Central Line, passing eight cameras as she wanders through the connecting tunnels between platforms, listening to her music and blocking out the background noise of an automated security message not to leave baggage unattended. As she walks onto the platform, an eastbound train arrives, and she travels the short distance to St Paul's station, where she again passes under the gaze of several cameras, and exits, swiping her smart-card ticket again to open the barrier. She reaches ground level at 8:40, and her mobile telephone bleeps to let her know a text message is waiting. As she waits in the throng of commuters for the lights to cross Martin's Le Grand, she uses her mobile phone to text her friend Sally about meeting up that evening. She crosses the road and heads up Newgate Street, turning into King Edward Street. Again, she passes several security cameras before turning into the entrance of St Bart's.

She enters the hospital at 8:55 and turns off her iPod. After checking her internal mail, she gossips with colleagues, checks her schedule, makes sure her pager is activated, and then starts her rounds with patients, first looking up their records on a computer database. She passes through the hospital under the gaze of a plethora of surveillance cameras and uses a swipe card to pass through doors that have restricted access. She leaves the hospital at 12:30 with a colleague and has lunch at Caffe` Nero on Newgate Street, paying with cash. She makes two mobile phone calls to friends and rings up her insurance company to make a query about her home insurance bill. The insurance agent explains that the rate has been set using a computer package that uses demographic and crime data. She returns to the hospital at 1:20. In the afternoon, she is on duty in the operating theater, administering the anaesthetic to patients she consulted earlier. The effects of the anaesthetic and the progress of the operations are monitored by sophisticated healthcare equipment.

After responding to a last-minute pager call, she leaves the hospital at

5:12 and retraces her Tube route to Wood Green station. On exiting the station, she crosses the road beneath a traffic camera and enters a Safeway supermarket, passing through the magnetic gates, which scan for antitheft tags. She buys some groceries for her evening meal, paying with a credit card, which logs her transaction and its location, and heads home. On opening the door, she finds two letters and a small parcel on the doormat. One letter is an itemized mobile telephone bill (which has been paid automatically by direct debit), the other a piece of targeted junk mail inviting her to open another credit card account. The small parcel contains two compact discs from Amazon.co.uk, plus a discount coupon as an incentive to buy other CDs selected by their customer profile system based on previous purchases. She cooks dinner, using a microwave, and watches some television before going on-line, using a dial-up connection, to check her e-mail. After typing some responses and deleting some spam (e-junk mail), she looks up responses to her advertisement on an Internet dating service and the web pages for the local cinema to see what films are playing and then browses the British Broadcasting Corporation (BBC) news site. At 8:15, after a call from Sally on her mobile, she heads out to The Goose pub near Wood Green station to meet Sally and some other friends. She is filmed by the cameras on The Broadway and when entering the pub. She receives several text messages while with her friends. She returns home at 11:30.

John

John is forty-eight years old, married with two teenaged children. He lives in a large detached house in Chislehurst in the outer suburbs of southeast London (Table 1). His day starts at 6:45 a.m. when the digital radio alarm clock sounds. After a shower, he dresses, has breakfast, and checks the mail. He has an electricity bill that has already been paid by direct debit. He then collects his laptop, PDA, and 3G picture phone from his study and heads to the garage, passing under the discrete CCTV camera mounted on the side of the garage to monitor the driveway. As he approaches the car, he uses a remote control to open the garage door, and unlocks his BMW with a remote radio fob. On starting the car, the vehicle's management system undertakes a series of system checks.

He turns onto Manor Park and switches on the digital radio, automatically picking up real-time traffic reports. He has his in-car navigation system turned off. He drives into the city center along the A20, A2, and through the Blackwall Tunnel, passing through a series of traffic cameras, red light cameras, and speed cameras, responding appropriately. He receives a call on his mobile phone, which he answers with a 'hands free" unit, from the office in Singapore, giving him a progress report on a merger negotiation. As he approaches Aldgate East, a congestion charge camera recognizes his license plate and automatically checks that he has prepaid the fee. At Bishopsgate, he passes into the "ring of steel," a concentrated set of high-security cameras that surround the City; again, his license plate is logged. At his work place, a large office

complex on Finsbury Square, he turns into a small side street, and a barrier rises in response to a transponder in the car. He drives into the subterranean car park, parking in a designated slot. He stands under a security camera, calls the lift using a swipe card, and ascends to his office floor. He gains access to his corridor again using a swipe card. Once in his office, he checks the fax machine, logs onto his computer to check e-mail, and docks his PDA to update his shared diary. At 9:00 he confers with his secretary to confirm his schedule and liaise about work.

From 9:00 until 10:10, he answers e-mail and takes a couple of telephone calls. At 10:15, he moves to a small boardroom for a meeting. On the table is a speakerphone that connects the room to colleagues in Singapore. From 10:50 until lunchtime, he works on compiling a report and producing tables and charts. For lunch, he joins a client at a small bistro, where he pays for the meal with his credit card. In the afternoon, he catches up with his e-mail, monitors financial transaction data, takes calls from colleagues and clients, and continues to write his report. At 4:30 he receives a text message from his wife to say that she and the children are going to the cinema. At 5:35, he uploads his updated diary to his PDA, shuts down his computer, and heads up to a private gymnasium on the top floor, where he works out on machines equipped with fitness and health monitors. After showering, he descends to the car park and heads out of the city to his home, retracing his earlier route. On arrival, he enters the house and turns off the motion-sensor alarm system, using a keypad. He connects his laptop computer to the broadband Internet connection and checks e-mail from the New York office, replying where necessary. He then checks his share prices on a financial website. At 8:00 his wife and children return. At 10:00 he watches a satellite-delivered news channel for twenty minutes to catch up on world events. He and his wife retire to bed at 11:10.

The Power of Code

The three vignettes highlight the effect of code on everyday life in relation to home, work, transport, communication, and consumption and show how code mediates, supplements, augments, monitors, regulates, facilitates, and produces collective life. While these vignettes can be read uncritically in an empiricist or deterministic manner, making sense of the difference code makes to everyday life requires a nuanced analysis. Code does not simply exist, created and working in easily defined and examined ways. Code, and the hardware and infrastructures it operates and communicates across, following Latour (1993), need to be recognized and theorized as the outcomes of "complex interactions involving the commodity production, organizational life, technoscientific knowledges and enterprises, the organization of work, manifold identities and geo-politicaltechnological zones of contact" (Mackenzie 2003a, 3). Code is bound up in, and contributes to, complex discursive and material practices, relating both to living and nonliving humans and technology, which work across scales and time. In this view, society consists of

collectives that are hybrid assemblages of humans and nonhumans (Latour 1993), wherein the relationship between human and technology is complex, contingent, relational, and productive.

The indeterminacy and contingency that technology induces "neither belongs solely to human life nor belongs to some intrinsic dynamism of technology" (Mackenzie 2002, 10) but, rather, human life and technology are produced through, or *folded* into, each other in complex ways. Technologies thus need to be understood "processually . . . as events rather than objects, as contingent the whole way down"; "as networks of social-material interactions rather than simply reflections of human capacities or innately alien objects" (Mackenzie 2003b, 4, 8). In other words, it makes little sense to conceive of either humans or technology without reference to the other. As such, the distinction between living and nonliving (technological), wherein humans shape or are shaped by technology, is rendered problematic (Mackenzie 2002). Instead of there being an interface between humans and technology, they become entwined as hybrids. To understand technology, then, means to comprehend the ways in which technology is plotted, designed, made; to understand humans means to comprehend their relationship with the nonliving (e.g., coded objects) and nonhumans (e.g., landscapes, animals) (Whatmore 2002). This understanding necessitates a nuanced reading of the work that code, in conjunction with people, does and how this work unfolds in practice. A profitable way to achieve such an understanding is to employ the concepts of technicity and transduction.

Technicity

> [T]echnicity and transduction account for how things *become* what they are rather than what they are (Mackenzie 2002, 16, our emphasis).

The extent to which code is embedded in everyday society (as objects, infrastructure, processes, and assemblages) is not the same thing as the extent to which it makes a difference to everyday life. The power of code to transform everyday life is not simply a function of extent or pervasiveness or visibility, but primarily of effect. Technicity refers to the extent to which technologies mediate, supplement, and augment collective life; the extent to which technologies are fundamental to the constitution and grounding of human endeavor; and the unfolding or evolutive power of technologies to make things happen in *conjunction* with people (Mackenzie 2002). For an individual technical element such as a saw, its technicity might be its hardness and flexibility (a product of human knowledge and production skills) that enables it, in conjunction with human mediation, to cut well (note that the constitution and use of the saw is dependent on both human and technology; they are inseparable). As Star and Ruhleder (1996, 112; our emphasis) note, "[A] tool is not just a thing with pre-given attributes frozen in time — but a

thing becomes a tool *in practice*, for someone, when connected to some particular activity . . . The tool emerges in situ." "In large-scale ensembles, such as an automobile engine consisting of many components, technicity is complex and cannot be isolated from the sum of individual components (and their design, manufacture, and assembly), its "associated milieu" (e.g., flow of air, lubricants, fuel), and its human operator(s), that "conditions and is conditioned by the working of the engine" (Mackenzie 2002, 12).

As the vignettes demonstrated, code is productive; it possesses high technicity. Code enables everyday acts to occur, such as watching television, using the Internet, traveling across a city, buying goods, making transnational phone calls, operating healthcare equipment, and withdrawing money from an ATM. While some of these practices were possible before the invention of code, code is now vital to their operation, and in some cases possible only through the work of code. The technicity of code is not, however, deterministic (i.e., code determines, in absolute, nonnegotiable means, everyday practices) or universal (i.e., such determinations occur in all places and at all times in a simple cause-and-effect manner). Rather, as noted, technicity is contingent, negotiated, and nuanced; it is realized through its practice by people in relation to historical and geographical context. As such, there is no neat marriage between coded objects, infrastructures, processes and assemblages, and particular effects of code. Instead, technicity varies as a function of the nature of code, people, and context.

The technicity of code varies, depending on the autonomy and consequences of code. Autonomy relates to the extent to which code can do its "work" without direct human oversight or authorization. The degree of autonomy is a function of the amount of input (the system's knowledge of its environment and memory of past events), sophistication of processing, and the range of outputs code can produce. If code "crashes" then the consequences of its failure can range from mild inconvenience (e.g., travel delays) to serious economic and political impacts (e.g., failure of the power grid) to life-threatening situations (e.g., vital medical equipment unable to function or air traffic control unable to direct planes). All types of code do not, therefore, have similar qualities or impacts. For example, the technicity of code employed in the London Underground is radically different from that employed in a hospital intensive care unit.

Further, the technicity of code varies as a function of the nature of individuals. Not all individuals experience or interact with the same code in the same way, depending on their personality, characteristics (e.g., gender, class, race), status, individual reflexivity, their personal histories and experiences, whether they are working or passing through a place, their intentions, their technical competencies, whether they are on their own or in groups, and so on. As the definition of technicity denotes,

code and its effects are peopled. For example, somebody familiar with a computer system may experience that system in a more banal and ambivalent way than somebody using it for the first time.

The relationship between code and people also varies as a function of wider context. Mobilities, transactions, and interactions that involve code are historically, geographically, and institutionally embedded and do not arise "from nowhere." Rather, the code works within conventions, standards, representations, habits, routines, practices, economic climates, discursive formations, and so on, that position how code engages and is engaged with. The use of code is then always prefaced by, and contingent upon, this wider context.

Transduction

> A "happening in the world" is what needs to be understood. From time to time, and always in time, new forms emerge that catalyse previously existing actors, things, temporalities, or spatialities into new modes of existence, a new assemblage, one that makes things work in a different manner and produces and instantiates new capacities. A form/event makes many other things more or less suddenly conceivable (Rabinow 1999, 180; cited in Mackenzie 2003b, 3).

Technicity is realized through the process of transduction (a concept developed by Adrian Mackenzie (2002, 2003b) from Gilbert Simondon's (1989a, b, 1992, 1995) work). For Mackenzie, "transduction is a kind of operation, in which a particular domain undergoes a certain kind of ontogenetic modulation. Through this modulation, *in-formation* or individuation occurs. That is, transduction involves a domain taking-on-form, sometimes repeatedly" (2003b, 10, his emphasis). Transduction, then, is a process of ontogenesis, the making anew of a domain in reiterative and trans-formative individuations. According to Simondon (1992, 313), "[t]he simplest image of the transductive process is furnished if one thinks of a crystal, beginning as a tiny seed, which grows and extends itself in all directions in its mother-water. Each layer of molecules that has already been constituted serves as the structuring basis for the layer that is being formed next, and the result is amplifying reticular structure."

Individuation can consist of speech acts, physical actions, occurrences, memories, perceptions, and so on. The process of individuation results in a modulation in conditions of the person and his or her milieu. Most individuations are ordinary, reiterating previous individuations (e.g., placing one foot in front of the other); others are singular and result in radical transformation (e.g., starting, stopping, changing direction). Ordinary individuations are routine and banal. Individuations are

citational in that they imperfectly cite previous individuations, as in Butler's (1990, 1993) theory of performativity. The process of individuation in domains of living things is ongoing; an individuation may provisionally solve a problem within a domain, but these are replaced by new problems. For example, as the vignettes illustrated, a person traveling through a city constantly changes his or her relation to their milieu, thus posing a continuous supply of new problems such as maintaining a bearing, avoiding obstacles and traffic, and reacting to surrounding situations such as traffic lights, speed cameras, requests for tickets, and so on. As such, "[t]hrough transduction, a domain structures itself as a partial, always incomplete solution to a relational problem" (Mackenzie 2003b,10).

Code solves relational problems by acting as a catalyst for transductions to occur and sustaining individuations within a modulation. Code changes the conditions through which everyday life occurs because it modulates how other technologies function. Code enhances the technicity of coded objects and infrastructures, enabling them to perform as intended; using a computer to access an online shop transduces, that is, alternatively modulates, how a person buys goods. Naomi, Elizabeth, and John's lives thus unfold in the moment as conjunctions between themselves and coded objects (e.g., bank cards), infrastructures (e.g., mobile phone networks), processes (e.g., direct debit billing), and assemblages (e.g., the Underground). Their worlds are being brought into being in situ as coded practices—practices produced through the conjunction of the technicity of coded objects, infrastructures, and processes, and their mediation through human action. For example, the technicity of the computerized check-out is combined with the action of Naomi to transduce a financial transaction. If the computer "crashes" or Naomi does not perform her role, the transaction either does not occur or occurs differently than how it was intended. It should be noted that most transductions occur automatically and ambivalently, that is, they do not require conscious thought by the person solving the problem.

Code and Space

Coded practices make a difference to Naomi, Elizabeth and John's lives, not simply because they effect mobilities, interactions, and transactions, but because they *modulate space*. The use of code makes a difference to the form, function, and meaning of space, which is endlessly (re)created in the moment. As such, to explain why software makes a difference to everyday lives necessitates an ontogenetic understanding of space.

The ontology of space has changed markedly over time. Most geographers until relatively recently adopted (implicitly, if not explicitly) an absolute ontology of space (Shields 1997). Within an absolute ontology of space, space is understood as a geometrical system of organization, "a kind of absolute grid, within which objects are located and events occur" (Curry 1995, 5). This grid is defined and understood

through Euclidean geometry (with x, y, and z dimensions) and treated analytically as "an absolute *container* of static, though movable, objects and dynamic flows of behaviour" (Gleeson 1996, 390, our emphasis). This absolute ontology of space is essentialist in formulation. It effectively reduces space to its geometric essence and depicts that essence as natural and given.

Recently, this viewpoint has been challenged by relational ontologies that understand space as being constituted and given meaning through human endeavor. Within these relational ontologies, space is not a given, neutral, and passive geometry but rather is produced through social relations. Space, it is posited, is not essential or objective in nature, but produced: "constituted through social relations and material social practices" (Massey 1994, 254). This relational view is perhaps most fully developed by Lefebvre (1991). The consequence of relational ontologies of space, as M. Crang and Thrift (2000) detail, is that space assumes a variety of new formulations, especially to those outside the discipline of geography, where it has taken on metaphorical qualities that seem far removed from absolute conceptions of "space as container." As a result, space can be conceived to exist separate from social conceptions of space, or taken to always be social (Hubbard et al. 2002). Equally, space can be conceived as fixed outside time, or always in a "state of becoming," known only in, and through, time (Unwin 2000).

The three vignettes highlight the latter point, that as people traverse space, individual mobilities, interactions, and transactions in conjunction with code (that is, coded practices) beckon space into being. The coded practices of Naomi, Elizabeth, and John constantly transformed the form, function, and meaning of space, where space is conceived as a combination of material fabric (form) and associated spatiality (function and meaning) that is constantly being remade. Space in these terms is not ontologically predetermined or defined, it is ontogenetic.

This ontogenetic conception of space acknowledges that the forms and spatial relations of the world around us are clearly not static and fixed; they are constantly being altered, updated, and constructed in ways that alter sociospatial relations. At a macroscale, there are new local, regional, and national development schemes that are constantly in the process of transforming and regenerating built and transport infrastructure and "natural" environments. For example, modifications in road layout, new buildings, and infrastructure, a new city airport, the introduction of the "ring of steel" and the congestion charge zone, and the usage of wide-scale CCTV have radically altered the physical landscape and space-time relations of the city of London (through processes of convergence, compression, and distanciation: see Janelle 1969; Harvey 1989; Giddens 1990). At a more microscale, infrastructure is constantly being modified, repaired, redesigned, and so on, so that streets and rooms are constantly in a process of being refashioned and remodeled and spatial layouts

modified. For example, streets are dug for cabling, shop fronts updated, shop interiors redesigned, trees planted, buildings painted, grass mowed, litter dropped, and so on. In other words, space is constantly (re)created, most often in subtle and banal ways, but sometimes more dramatically.

Similarly, the functions of spaces are not static but alter with time (e.g., seasonally: tourist destinations; daily: day-and nighttime economy), and the use of space is negotiated and contested between individuals and groups (Cresswell 1996; Mitchell 2003). Spaces thus have multiple functions and are used differently by individuals. For example, Trafalgar Square in London functions as somewhere to meet, to have lunch, to chat, to visit museums, to gather for protests, to party, to take tourist photos, and so on. In all these cases, the function of space is constantly created in the moment, usually as a collective manufacture composed of the recursive interactions between different users.

Likewise, the meanings associated with spaces shift, changing with mood, action, memory, events, and so on. To return to the example of Trafalgar Square, the meanings associated with it vary as a function of how the space is used (as tourist or Londoner), how the viewer interprets Nelson's Column and the surrounding buildings (as visually stimulating scenery or imperialist celebration), the social background and attitudes of a person, that person's memories and understandings of the square, and so on. Likewise, meanings attached to home, work, buildings, and routes mutate over time. The meaning of space is therefore never static, but emerges, varying over time and across people and context.

Space, in these terms, is a practice, a doing, an event, a becoming—a material and social reality forever (re)created in the moment. To paraphrase Star and Ruhleder's earlier quote, space is not a container with pregiven attributes frozen in time; rather, space gains its form, function, and meaning in practice. Space emerges through a process of ontogenesis.

Ontogenetic understandings of space have started to be examined by others, notably through Gillian Rose's reworking of Butler's (1990, 1993) theory of performativity. Rose (1999, 248) argues that "space is a doing, that does not pre-exist its doing, and that its doing is the articulation of relational performances . . . space then is not an anterior actant to be filled or spanned or constructed . . . [i]nstead, space is practised, a matrix of play, dynamic and iterative, its forms and shapes produced through the citational performance of self-other relations." To Rose, space itself, and thus its production, is brought into being through performativity. While Rose's formulation has utility, it is more profitable, we believe, following our earlier discussion, to think of the ongoing production of space as one of transduction in which performativity is one component, and the salience of objects and nonhumans another. Space in these terms is ontogenetically produced through transductive individuations. Space is

thus constantly being brought into being as an incomplete solution to a relational problem.

In the vignettes, one of the predominant relational problems was an ongoing encounter between the individual and the built environment, where the problems were navigating and negotiating the buildings and infrastructures of the city and the solution, to a greater or lesser extent, was code. For example, as we examine in detail below, code regulated the traffic lights and speed cameras, the functioning of the Underground, and the security measures required to enter buildings. Other relational problems where the solution was code dependent concerned communication (e.g., communicating by mobile phone and Internet), domestic living (e.g., cooking dinner using a microwave), work (e.g., accessing patient files), and consumption (e.g., processing payment transactions). In these cases, for the entire period that code is employed as the solution to the relational problem, a particular kind of transduction is occurring wherein code induces a particular modulation of space.

Spatial Transductions

Coded objects, infrastructures, processes and assemblages, and the technicity they engender, transduce space—beckon new spatial formations and spatiality into existence—in three related ways.

Code/space refers to a transduction wherein the relational problem *cannot* be solved without code. Here, code dominates the transduction of space to the extent that the transduction is *dependent* on code. For example, without code, Naomi cannot scan goods and process payments that allow the shop to function, Elizabeth cannot travel on the Underground, and John cannot hold a transnational business meeting. In all three cases, coded objects, infrastructures, and processes have entirely replaced older (wholly manual, electromechanical) systems, meaning that they can no longer be undertaken in an alternative way. Shops, particularly chain stores and supermarkets, given the volume of turnover, are reliant on systems that scan barcodes. Staff are not trained to process goods manually, they no longer rote-learn the price of goods, and prices are not usually printed on items. Consequently, in such cases, if the code in the point-of-sales till fails to operate, or the product order/supply information system "crashes," or the network supporting the information system is "down," shop staff have no way of processing a customer's shopping. In other words, the shop fails to be a place where items can be bought and, instead, becomes a temporary warehouse until such time as the code functions again. Similarly, in Elizabeth's case, if the system that controls the signaling in the Underground "crashes," then the transport infrastructure grinds to a halt because the old manual system has been replaced (rather than merely supplemented); passengers become stranded and must seek alternative travel arrangements until the system is brought back online. Likewise, if the code supporting the communication between Singapore and John's office "fails," then the boardroom is not

transformed into the desired transnational meeting room as the required effect of distanciation is not supported.

In these cases, code and space are *dyadic*, with the relationship so mutually constituted that if one half of the dyad is put "out of action," then the entire intended spatial transduction fails (the shop does not operate as a shop, the Underground does not facilitate travel, the transnational meeting space is not produced) (see Dodge and Kitchin 2004 for other examples related to air travel). In other words, because the technicity of code is transformed from high effect to low through its "failure," space cannot be brought into being as intended in order to solve the relational problem posed (buying groceries, traveling across the city, discussing business between offices); the transduction, and therefore the form, function, and meaning of space, is alternatively modulated.

Coded space is a transduction mediated by code, but differs from code/space in that the relationship between code and space is not dyadic (mutually constituted). Here, code matters to the transduction of a space, but if the code does not work as intended or not at all, the space continues to be brought into being largely as intended, although not necessarily as efficiently or least costly or safely. Code mediates the solution to a spatial problem, but it is not the only solution available. In other words, code's role is mostly one of augmentation and facilitation, rather than control and regulation. For example, the networked surveillance camera system in the store Naomi works in modulates a particular form of transduction by (potentially) affecting customer and staff behavior, but if the camera does not work, the shop still functions as a shop, in that it can still sell goods. Similarly, if the "next bus" digital displays and warning messages at the bus stops on Elizabeth's route to work cease to function, the bus stop continues to function as a location from which passengers can catch a bus (they just do not know the exact time the bus will arrive). Likewise, if the system that monitors the zone of the Congestion Charge "crashes," vehicles can still access and travel this part of London, but they will not be recognized and charged. In all these cases, code modulates the form, function, and meaning of space; it affects how space is brought into being, but it is not essential to enable a suitable transduction to occur that solves the relational problem.

Background coded space occurs where code has the potential to mediate a solution if purposefully activated. Potential codings include local, but turned-off, sources of code such as coded objects and infrastructures (e.g., water, electricity), and GPS, radio, and mobile phone signals that are always present, but mute until activated. Once the code is activated, the transduction of space is alternatively modulated to one of coded space or code/ space. For example, the mobile phone answered in a restaurant not only alters the nature of that space for the person answering the phone, but also those around him or her. In the case of water or electricity, code does not obviously or explicitly mediate the

solution of accessing supply (e.g., turning the tap), but it is an important component that is several steps removed from the remit of the individual filling a glass with water. As we noted above, just about all utility infrastructures are now reliant (to some degree) on code for their functioning.

Given that coded infrastructures are distributed, the extensibility of the transduction of space is an important aspect to consider. The transduction of space by code does not simply consist of localized individuations. Instead, it is more productive to conceptualize the transduction of space through code as ongoing individuations across networks of greater or shorter length. In this sense, a complex, progressive conception of space is produced, wherein people and things are located within complex networks of mobilities, interactions, and transactions that bind them together across scales. In the case of the instantaneous nature of coded infrastructure and processes, scales such as "local" and "global" become redundant, with each network simultaneously connecting all locations within the network. Such a conceptualization thus renders fixed spatial boundaries and scales problematic (Whatmore and Thorne 1997; Amin and Thrift 2002). Moreover, it recognizes that each network is just one of a multitude of networks, thus creating multiple, simultaneous but partial, spatial-time configurations that are at once "local" and "beyond." Such scaleless configurations induce a constant mode of time-space distanciation, although they do not necessarily mean that decisions or actions at one location produce material outcomes at another. For example, the use of the ATM by Elizabeth leads to the communication with and updating of a banking database located somewhere else in the world but does not change the material conditions there. This is not to deny that for each individual these networks, and the transduction of space they help induce, occur at the site at which they are physically located. Rather, it is to acknowledge that this localized transduction is the grounding of one part (or several) of a complex, geographically distributed network(s), and that this grounding might be just one of a number that are simultaneously happening across the network. Here, the network becomes "a mass of currents rather than a single line of force" (Whatmore and Thorne 1997, 291) and is a "performative ordering (always in the making) rather than a systematic or structural entity (always already constituted)" (Whatmore and Thorne 1997, 289).

The creation of coded assemblages, coupled with the complexities of people's lives, means that it is often the case that several forms of code simultaneously modulate space, creating unique, hybrid, spatial formations and spatiality. For example, an individual may be using a mobile telephone, while cooking dinner using a microwave, while a digital television is on in the background. Here, different forms of code interact or coalesce to produce a particularized transduction of space: a hybrid composed of forms of code/space and coded space. Alternatively, the same locale might be transduced differentially for different individuals,

for example, as coded space for a pedestrian waiting to cross a road and code/ space for a car driver. This means that the coded transduction of space is never fixed and shifts with place, time, and context. Here, the combination of many individuals occupying or interacting with the same locale, plus the many coded infrastructures and processes they are at that moment connected to, each beckoning space into being in relation to code, transduces complex spatial formations and spatiality. This means, of course, that the experience of individuals located in backgrounded coded space can be mediated by others transducing code/space. For example, a person talking loudly on a mobile telephone in a restaurant shapes the experience of the meal for the other diners. In this sense, space is a "collaborative manufacture" (P. Crang 1994, 686), a collective, heterogeneous series of transductions.

It should be noted that this conceptualization of space as an ontogenetic, collaborative manufacture does not deny the salience of structural forces such as political economy or capitalism or neoliberalism or institutional structures such as the state and its agencies; rather, it refigures all of these elements as sets of ongoing, relational, and contingent discursive and material practices that are citational and transformative. These practices, too, are in a state of ontogenesis, always being remade in ongoing processes, and inducing transductions in collective life. These structures do not sit outside of collective life, but are (re)made through its performance, providing citational context at the same time that they are perpetuated.

Code as Incomplete Solutions to Relational Spatial Problems

> The modern city exists as a haze of software instructions. Nearly every urban practice is becoming mediated by code (Amin and Thrift 2002, 125).

Conceptualizing space ontogenetically, constantly coming into being through transductive processes as an incomplete solution to a relation problem, helps to explain why code makes a difference to everyday life. As the vignettes illustrate, while there are substantial differences between Naomi, Elizabeth, and John in personal circumstances, income, employment, lifestyle, housing, and so on, code was integral to how all three solved the relational problems of undertaking domestic tasks, traveling between locations, conducting work, communicating between people, and practicing consumption. Code, by altering the components, practices, and infrastructures of domestic living, travel, work, communication, and consumption, transduced new spatial formations and spatiality, alternatively modulating the home, streets, workplaces, shops, and so on.

Domestic Living

In all three cases, the tasks and routines (the relational problems) of everyday home life were augmented, mediated, and regulated by code. For example, John was awakened by a digital alarm clock, Elizabeth cooked her evening meal using a programmable microwave, and Naomi and her children watched satellite television and played a computer game. Code, once activated, transduced the material and social conditions of John's bedroom, Elizabeth's kitchen, and Naomi's living room, while continued interaction with the code consisted of individuations up until interaction ceased and a new transduction occurred or other coded objects or infrastructures were activated, creating a new hybrid transduction. Such transductions are commonplace, given that entertainment and play are increasingly reliant on coded objects that are enabled by several coded infrastructures (e.g., Internet, cable television, electricity).

While the use of code here is enabling—it facilitates waking, cooking, and entertainment—in other cases, it is used in domestic settings to regulate and discipline. This function is most obviously revealed when Naomi checks the status of her prepaid electricity meter to determine whether the payment card needs topping up. The code disciplines her use of electricity against her means to pay. In Elizabeth and John's cases, their use of domestic utilities is monitored centrally, and the bills (or receipts if direct debited) are mailed to them. Further, both Naomi's and John's homes are subject to a different kind of surveillance. In Naomi's case, the entrance to the tower block is surveyed by cameras linked into a wider, public-housing surveillance network. John's home is protected by a alarm system, with software-monitored motion sensors, networked into a private security company, which will respond to its activation if it is not turned off within thirty seconds of someone entering the house.

Surveillance systems can be seen as a key assemblage in the "societies of control" (Haggerty and Ericson 2000), of which video surveillance is a key form of coded infrastructure that, because of its growing pervasiveness, is featured in all classes of relational problems concerning public space (e.g., on the street, road traffic), semi-public space (e.g., shopping mall, public transportation, hospital, pub), and private space (e.g., home, office building). On a typical day, the average person living in London is "filmed by over three hundred cameras on over thirty separate CCTV systems" (Norris and Armstrong 1999, 42). McCahill and Norris (2002, 20) make an educated "guesstimate" that there are some half a million cameras in London, giving around one camera for every fourteen people. The geographical distribution of cameras across space is uneven, and their level of ownership and technical sophistication also vary (Graham 1998, 2002). Most are basic analogue systems (and may not even be recorded), some are dummy cameras that the installers hope will exploit the deterrent effect, and others are networked systems. The latter are highly coded infrastructures, increasingly built around software algorithms to sort and classify the observed. Surveillance in different

contexts is discussed further in each of the following sections.

Traveling

The movement of people and goods is essential for society to function. The relational problem to be solved is one of transferring people and goods from one location to another. Even though all three of our cases used different modes of travel throughout the day—walking, Underground train, lift, escalator, car—the journeys of all three were at some point solved (facilitated and regulated) by code. In the case of Elizabeth's use of the Underground and John's use of car transport, these transport systems have become dense assemblages centered around a particular coded infrastructure. Here, code is primarily employed as an operational management/control-related (e.g., payment, flow, maintenance) or surveillance/regulation-related (e.g., security, safety, taxation/licensing) tool. These functions are often highly interlinked so that management is augmented by surveillance that not only monitors flow and speed but also aims to discipline passenger and driver behavior.

The London Underground network handles 3 million passenger journeys daily and is reliant on code for its complex day-to-day operation on over 253 miles of track and 275 stations, from the ticketing of passengers (payment by credit/debit card or Elizabeth's use of a smart card or the validation of tickets at station turnstiles) to the operation of lifts and escalators; track management using a transponder system that monitors the real-time location of trains; control and monitoring of signaling; fire and smoke detection and alarm systems; displays that update passengers on the arrival of trains; computation of timetables and routes; staffing schedules; revenue and account databases; and embedded code in the trains themselves. Further, Elizabeth is subject to the gaze of a raft of networked surveillance cameras that monitor the entrances, passageways, platforms, and train carriages. These cameras are accompanied by automated, loudspeaker security messages that play every few minutes. As Elizabeth traverses the foyers, escalators, passageways, and trains of the coded assemblage of the underground, she (and her fellow passengers and staff) beckon into being a hybrid mix of coded space and code/space as a series of collective transductions. The London bus network consists of a similar assemblage.

John likewise travels through a road system that is increasingly managed and surveyed using code. Strategic planning is done using traffic simulations and software models of the road system; road maintenance and upgrading is planned using a GIS. Transport for London employ a network of forty-five cameras in order to monitor and coordinate traffic flow at strategic locations.[5] This system also feeds the media with congestion reports and updates an information website.

[5] Details from Transport for London, http://www.tfl.gov.uk/tfl/capitalcams/index.shtml (last accessed 30 July 2003).

Traffic-light sequencing is controlled using a comprehensive traffic management system. This system is augmented by speed cameras (there are approximately 650 speed cameras on London roads; McCahill and Norris 2002), mobile speed camera vans, red-light cameras, bus-lane and bus-mounted cameras that aim to discipline driver behavior (in these cases, from not driving too fast, not jumping red lights, and not occupying bus lanes). Most of these cameras are networked, and increasingly, they use an Automatic Number Plate Recognition (ANPR) system to pattern-match license plate numbers with owners and automatically print and post fines. Because John is driving to the center of the city, he is also subject to two special systems. The "ring of steel" consists of a sophisticated set of surveillance cameras that continuously monitors all traffic entering and leaving the City (the financial services area of London), introduced after IRA terrorist attacks in 1993 (Coaffee 2004). In addition, eight square miles of central London are regulated by a "congestion charge" payment system introduced in February 2003, again monitored and coordinated using a set of 688 networked cameras at 203 sites.[6] This system uses a centralized ANPR system to ensure payment. Even the final few yards of John's journey are regulated by a transponder-operated barrier into his office car park. Further, John's car is a sophisticated coded infrastructure, reliant on an engine management system, augmented by digital radio that updates him with real-time traffic reports, and an in-car navigation system that plots his position and can guide him along a route. Such is the "power" of the code within the engine management system that if the system fails, the car will not function. John's use of the car is also mediated by coded processes related to driving licenses, vehicle ownership, insurance, road tax, and road worthiness. Similar to the case in Elizabeth's use of public transport, then, John and his fellow drivers beckon a mix of coded spaces into being. Thus, all mechanized elements of mobility in large Western cities are coded to some degree, and the level of coding is increasing as more and more sophisticated telematics schemes are designed and deployed in an effort to "fix" the capacity constraints in congested urban areas.

Naomi and Elizabeth are not subject to active travel management via code while walking, but they are subject to the disciplinary gaze of a variety of public and private cameras that survey the street and underpasses. These cameras, while producing coded space, are little noticed by either woman due to their familiarity. Their effect on the individuations of spatial behavior is minimal. As such, in this case, while the code does affect the transduction of space, the awareness and impact of this transduction is low. That said, without surveillance, both women might feel less safe and more insecure as they traverse the city, and they might have taken different routes (see Koskela 2000 for discussion).

[6] Details from Congestion Charging fact sheets: Camera enforcement, Transport for London, http://www.tfl.gov.uk/tfl/ cc_fact_sheet_enforcement.shtml (last accessed 30 July 2003).

Moreover, this is not to say that the street is not managed by a number of overlapping coded processes (e.g., local government software for scheduling street cleaning and GIS inventory for signs and street furniture, pollution monitoring, police databases on street crimes, etc.) and coded infrastructures (e.g., computer-managed street lighting, centrally controlled sequencing of pedestrian crossing lights, and so on). In other words, all forms of travel infrastructure and their maintenance, regulation, and operation, are increasingly becoming reliant on code.

Working

Work consists of a series of relational problems concerning the production of goods and services. In order to solve these problems and fulfill orders and mandates, the workplace environment is increasingly dependent on code, with most workplaces' (particularly those of large organizations and multinationals) nodes in an extremely complex and dense assemblage of coded infrastructures and processes. These include utilities; logistics networks; customer, employment, and product management systems; intranets, and so on. Code is now the structural "glue" that binds distributed and distanciated corporate activities together. In all three of our vignettes, the jobs performed —the transductions of workspace—are highly code dependent. For example, Naomi spent most of her working day sitting at the checkout, scanning barcodes, updating loyalty cards, and processing customer payment by credit/debit cards. Elizabeth used code-dependent specialist machines for monitoring patients in the operating room and coded processes for looking up and updating patient health records. John used a computer to compile a report, a PDA to organize his meetings and transport files, and a company intranet to monitor the financial markets and the trading of stocks and shares. Moreover, all three work in environments that are heavily surveyed. Naomi's store employs surveillance cameras in the shopping area, the stock rooms, and loading bays; her use of the till is monitored (indeed, a number of companies now not only monitor number of key strokes, length of breaks, telephone calls, and e-mail, but also review computer files, see Ball and Wilson 2000); the customers' credit/debit cards are checked for their status and balance. Elizabeth and John have to use swipe cards to gain access to certain parts of the hospital or office building, respectively, which means all movement can potentially be logged, tied to individuals' records, and recalled and analyzed at some future time. All three gain access to computer systems with usernames and passwords. For Elizabeth and John, code-dependent communication using e-mail, phone, and fax is also a vital component of workplace practices. The consequence of such heavy reliance on code for work practices is that work environments are constantly being brought into being as hybrid mixes of coded space and code/ space.

Communicating

Code has become central to solving the relational problem of facilitating the communication between people over distances. Code is now integral

to the operation of communication infrastructures, many of which exist purely as a result of developments in software engineering. In all three vignettes, with the exception of face-to-face conversations, all communication between people took place via the coded infrastructures of telecommunications: mobile phones, conventional phones, fax, pagers, and e-mail. As noted by others, these technologies have profound impacts on space-time by allowing instantaneous communication across distance, and in the case of mobile phones and pagers, between moving devices. Such devices enable "always-on" communication that is transforming work and leisure practices. For the duration of any call, a transduction of code/ space occurs as the call alters individual performativity at the time a call is initiated or answered until the call is terminated. Consequently, any call, text, page, fax, and so on, means a transduction of code/space occurring simultaneously at the two places connected. For example, Elizabeth's mobile telephone text message to her friend Sally led to a simultaneous transduction that altered the performativity of Elizabeth's walk to work and whatever activity Sally was doing when she received the text. In the case of mobile phone texting or e-mail, a transduction occurs for one party when sent and the other when read (see Adams 1995 on issues of technology and human extensibility).

While the above communication infrastructures are entirely dependent on code, the delivery of conventional mail has also been massively augmented by code. Given the depth of embedding of code into mail systems, code has become vital to the day-to-day sorting and delivery of mail. Interestingly, most conventional mail now consists of bills and statements related to coded processes, along with junk mail targeted by customer profiling and geodemographics, as illustrated by the delivery of Elizabeth's compact discs and targeted vouchers and John's utility bill.

Consuming

The coded assemblages of financial services, logistics, and shop/leisure facilities provide solutions to the relational problems of supplying and buying goods and services. Elizabeth's use of an ATM connects her into the bank's coded infrastructure and uses coded processes to assess her status and dispense cash. John's use of his credit card to purchase lunch performs a similar operation. Naomi's use of electricity is defined by how much credit has been charged onto a payment card. These coded dealings leave a personal, digital, traceable trail of transactions, as opposed to Elizabeth's cash purchase of lunch (although this transaction appears in the coded processes related to the cafe such as tax returns). These transactions are constructed into a product in the form of customer profiling and geodemographics and used in marketing campaigns (hence Elizabeth's targeted marketing and John's junk mail). (See Goss 1995; Curry 1997 for discussion of some of the implications of geodemographic profiling.) In addition, purchases are increasingly tied into stock and logistics systems that track sales and place orders.

Consumption of services and leisure now also occurs across coded infrastructures. Elizabeth buys her insurance by telephone, she buys books and checks her dating agency service online, and she consumes other Web pages. Naomi buys a lottery ticket using a dedicated intranet accessed via a shop. And conventional leisure services are now augmented by code, such as that in the monitors that track John's performance and health in the gym. In all these examples, the spaces of consumption—the shop, the gym, the bank—are citationally remade as coded spaces (gym) and code/space (shop/bank); code makes a difference to the form, function, and meaning of the space.

Conclusions

> [T]ransduction aids in tracking processes that come into being at the intersection of diverse realities. These diverse realities include corporeal, geographical, economic, conceptual, biopolitical, geopolitical and affective dimensions. They entail a knotting together of commodities, signs, diagrams, stories, practices, concepts, human and non-human bodies, images and places. They entail new capacities, relations and practices whose advent is not always easy to recognize (Mackenzie 2002, 18).

There is little doubt that code is increasingly active in the production of everyday life. As the vignettes illustrate, code is routinely embedded in objects such as washing machines, alarm clocks, televisions, lifts, and cars to augment their use, thus creating coded objects. In many of these cases, the code has replaced the means by which they previously used to work, so that if the code fails, then the object fails to operate. For example, if the code that controls the wash cycle on a washing machine fails, the machine will not operate at all. Likewise, infrastructures such as transport and logistics networks, communication and broadcast entertainment networks, and utility networks, rely extensively on code for their operation. For example, code is used to plan, monitor, manage, and regulate flow of a commodity across a network and in the measurement of usage and billing of customers. Information related to individual and institutional finance, taxation, insurance, health, crime, education, utility usage, service usage, and so on are routinely held in digital databases that are accessed and managed using information systems and thus consist of coded processes. Coded objects, infrastructure, and processes, when used in relation to each other, entwine to create coded assemblages that permeate the practices of institutions and industries.

Code makes a difference to everyday life because it possesses high technicity, that is, the power to make things happen; code mediates, supplements, augments, monitors, regulates, operates, and facilitates many everyday tasks and routines related to domestic living, travel, work, communication, and consumption. This power to affect change is not

deterministic but is contingent and relational, the product of the conjunction between code and people. In other words, code and human life are produced through or folded into each other, taking the form of coded practices. As practices occur as ongoing processes and events—as partial, always incomplete, solutions to relational problems—it follows that code and human life need to be conceived as unstable and always in a state of becoming. And since practices happen somewhere and have material, spatial, and social outcomes, space, too, is endlessly re-created in the moment. Space is a continuous process of matter and meaning taking form as divergent realities—technical and nontechnical, human and nonhuman, living and nonliving—constantly come into contact to create new conditions. Reading the vignettes as catalogues of ontogenetic coded practices, it is clear that code makes a difference to everyday life because it alternatively modulates space. The form, function, and meaning of space are transduced by code.

Code modulates space by significantly altering the conditions through which space is continually beckoned into being. Code transduces space into two generic forms and is ever present in a third. Code/space is a form of transduced space wherein the production of space is wholly dependent on code, so that the relationship between code and space is dyadic. If the code "fails," then the entire transduction "fails" (is alternatively modulated). Coded space is where space is transduced by code, but the transduction is not dependent on code; code matters to the ontogenesis of space, but if the code "fails," space continues to be transduced. Background coded space is where code is present and has the potential to transduce space if purposefully activated. Since transduction is a function of the conjunction of people and the technicity of code, it follows that the transduction of space is similarly contingent and relational, varying as a function of the nature of the code and person, and with context. By understanding space to be ontogenetic, the vignettes demonstrated that code transduces space into code/space or coded space in an effort to provide a solution to a relational problem. In the vignettes these relational problems included undertaking domestic tasks, traveling between locations, conducting work, communicating between people, and practicing consumption. Code sought to partially solve these problems by alternatively modulating the home, streets, workplaces, shops, and so on.

This article has provided an initial analysis of the extent and impact of code on everyday life. In doing so, it has opened several potentially interesting lines of enquiry that warrant further attention and exploration. First, there is a need to more fully document the forms and functions of code in everyday life and the production of code itself. This documentation needs to consist of both synoptic overviews and more detailed case studies of particular coded objects, infrastructures, processes, and assemblages. Second, there is a need to further explore the merits of the theoretical framework advanced in relation to other theories

of technology and society and to evaluate the concepts of technicity and transduction in relation to other forms of technology. Third, there is a need to think through what it means to theorize space as ontogenetic rather than as an ontology, not just in relation to code and technology but more broadly in terms of what it means for how we think about the production of space. Such a rethinking of space has started to occur in the past few years, most notably in work that has explored the notion of performativity, and its continuation will be an enormously productive exercise for geographical analysis.

*Acknowledgements W*e would like to thank Barney Warf, Rob Shields, Anne Galloway, James Monagle, and James Sidaway for comments and those who attended seminars at Carleton University, Queen's University, and University of Toronto at which this work was first publicly presented in 2003. We also acknowledge the helpful comments of Audrey Kobayashi and the *Annals* referees.

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CHAPTER 16

'YOU'RE NOT A MAN AT ALL!': MASCULINITY, RESPONSIBILITY, AND STAYING ON THE LAND IN CONTEMPORARY IRELAND

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First published in *Irish Journal of Sociology* (2005), 14(2), 94-104.

Introduction

Rural Ireland, and in particular the agricultural sector, is undergoing significant restructuring, within the context of a rapidly urbanising society that has been radically transformed economically and socially in the past ten to twenty years. The decade since the mid-1990s in Ireland has witnessed an economic transformation, the reversal of emigration and unemployment, rapid urbanisation and suburbanisation, and the continued concentration of population in the urbanised East (Central Statistics Office, 2003). The importance of agriculture as an employer has declined and the rural economy has become more diversified (Frawley and O'Meara, 2004).

Young farmers are at the centre of these rural restructuring processes, making decisions to become farmers or not in the context of competing pressures. The economic and social landscape of farming is undergoing transformation, in which the viability of farming as an occupation and as a lifestyle in modem Ireland is being reduced. This means that some of the central pillars upon which Irish farm masculinities have been built are under threat, which has implications for the construction of masculine identities. However, at the same time, family farming carries with it certain responsibilities and retains a very strong socio-cultural meaning and importance, bound up closely with masculine identities. These competing pressures are in tension with one another and are lived out through the lives of farmers and their families. They are particularly apparent in the lives of young farmers and farm successors, who are the individuals who are facing or have recently faced, decisions regarding farm succession, inheritance or transfer of holdings, and their own futures.

This paper explores the ways in which these tensions are worked out through the lives of young farmers, unravelling the complex relationships between responsibility, risk, control and masculinity. The paper draws upon initial analysis of in-depth interviews with young farmers in different types of farming regions across Ireland. First, existing literature on the construction of masculinities in rural Ireland is discussed. Drawing on interviews with young farmers, the paper goes on to explore the implications of the changing economic and social landscapes of farming for fanner identities and farmers' lives, and sets this in the

context of the persistence of the high socio-cultural importance attached to the notion of the family farm in Irish rural society. Work by others such as McDowell (2000, 2002), Connell (1995) and Collinson and Heam (1996), on the ways in which masculine identities are negotiated at times of economic transformation, is useful in understanding some of the ways in which these issues are worked out in rural Ireland.

The research involved conducting semi-structured interviews during 2002-3 with farmers between the ages of 20 and 46, in three different types of farming region in Ireland. Two different commercial dairy, beef and tillage farming regions were chosen (the Clonakilty district in south-west Co. Cork, and the western part of Co. Meath), and one area of marginal sheep and beef farming in north Co. Mayo. Contact was made with young farmers through a variety of avenues, including local Teagasc advisers, farming organisations and agricultural colleges. The snowballing method was used with farmers to broaden the network of contacts. Interviews were also conducted with other key informants in the farming community at the local and regional levels.

A total of 33 young farmers were interviewed. Interviews were usually one-to-one, generally lasting between one and two hours, and were usually conducted in a quiet room in their own homes. All but one of the young farmers interviewed were male; one was a young female farmer. In addition, in two of the interviews, a female also sat in and made a significant contribution - one was a mother who shared the farm-work with her young son, and one was a farmer's wife. The interview topics included attitudes to farming as an occupation and lifestyle, farming methods and policies, and agriculture and rural life in general. These served in part to explore more hidden themes such as values and identities, gender relations, economic power relations and social well-being. The 33 participants were not intended to represent the entire spectrum of the young farm labour force in Ireland, but between them they reflect a range of particular situations within specific regional contexts. They were all young people working in farming at a time of agricultural change, whether they were successful commercial farmers or small part-time farmers, farm holders or future successors, young men in their twenties or family men in their thirties. As such their stories and their discourses provide insights into the many diverse implications of changes in the farming world for the construction of farming masculinities in the twenty-first century.

Farming masculinities

This work is situated in the context of a growing body of literature on masculine identities, and in particular the emerging research on geographies of masculinity (Berg and Longhurst, 2003) and rural masculinities (Brandth, 2002; Little, 2002). Research by geographers, sociologists and others, from feminist or post-feminist perspectives, has emphasised the need to explore the ways in which masculinity is

constructed, in order to understand how masculinism is created and reinforced. Connell's (2000) notion of hegemonic masculinities, defined as 'the most powerful in a given situation', is useful in understanding how particular masculine identities work to marginalise women and less powerful masculinities. Hegemonic masculinities are reproduced through the association of signs and symbols of masculinity with power and authority. A wealth of research has explored the reproduction, negotiation and representation of masculine identities in a wide range of contexts (see for example, collections by Cornwall and Lindisfarne, 1994, Pease and Pringle, 2001). It has become clear that hegemonic and subordinate masculinities are highly contingent, both spatially and temporally, reflecting different sets of practices, performances and values in different gendered contexts (Berg and Longhurst, 2003).

Since the late 1990s, there has been a proliferation of research on masculine identities in a rural context (for example, the special issue of *Rural Sociology,* 2000; Brandth, 2002), contributing to heightened understandings of the gendered nature of rural society and space, by highlighting the visible and invisible ways in which masculine practices and preferences are normalised and legitimised. The sphere of the farm is a highly significant space in the construction of rural masculinities. For example, Brandth (1995), Liepins (2000) and Saugeres (2002a, 2002b), working in different farming contexts, explore representations of masculinity in popular imagery of farmers. Conventional farming masculinities involve constructions of the farmer as a hard worker battling against environmental and economic obstacles and exerting 'his' authority over the natural landscape (Liepins, 2000, Peter et al., 2000). These conventional representations are replicated in many different agricultural contexts, from rural Ireland (NíLaoire, 2002) to southern France (Saugeres, 2002a, 2002b). Despite this apparent coherence, rural masculine identities are unstable and shifting, reflecting changing gender relations and rural change. For example, Brandth (1995), in her research on changing constructions of masculinity and femininity in rural Norway, found that constructions of masculinity are adapting to changing circumstances, emphasising business skills and a growing disconnection from nature. In rural Ireland also, it is evident that conventional hegemonic farming masculinities are being adapted in response to the demands of the marketplace and contemporary society, although the core values of tenacity and independence persist (NíLaoire, 2002).

In Ireland, traditional farming masculinities have been rooted in idealised notions of family life, morality, landownership and farm work. Farming has been seen as a male occupation, and landownership as a male preserve, one that confers status and prestige on the landowner (Shortall, 1997). From the nineteenth century onwards, the establishment of patterns of impartible and patrilineal inheritance, and gendered divisions of labour in agriculture meant the construction of an Irish rural masculinity that was closely associated with land-ownership, control of

property and the authority of a powerful father figure (Martin, 1997). Tenacity, self-reliance, autonomy and breadwinning status were important elements of this construction. Although the social structures of rural Ireland have changed since the nineteenth century, these values are still important in popular constructions of masculine identity in a farming context (NíLaoire, 2004). They are closely interrelated in the sense that masculine pride is vested in the ability to provide for one's family without external aid. The ability to work the land and to provide for their families or themselves is a source of pride and status. As in many other sectors of society, 'breadwinning' status and hard work are potent symbols of masculinity (Goodwin, 2002). However, traditional masculine identities are coming into conflict with changing social and economic structures in modem Ireland. Gender divisions of labour are changing and breadwinning status is no longer a male preserve. Goodwin's (2002) research outlines the implications of this for employed and unemployed men in north Dublin, highlighting the negative implications of not working for men's identities. Given that rural areas and the farming sector in particular are undergoing structural change, it is important to set the analysis of farming masculinities in the context of wider economic and social restructuring processes. McDowell's (2002) materialist and deconstructionist perspective is useful. She focuses on changing labour market structures in urban Britain and provides an analysis of the implications of the shift from Fordism to post-Fordism for the identities of young working class men. She argues that in the shift from manufacturing to service sector employment, working class masculinities are caught in a contradictory situation, whereby masculine identity is associated with physical work, but opportunities for earning a living from such work are disappearing. Drawing on the work of McDowell (2000, 2002) and similar work by Connell (1995), this paper explores some of the implications of economic and social transformation for masculine identities in an Irish farming context.

Agricultural change in Ireland

McDowell's (2000, 2002) research provides a useful framework, as restructuring processes in the agricultural sector are also characterised by a reduced reliance on manual labour, associated with rationalisation processes, increased technological inputs and concentration of production. Associated with the continued rationalisation of agriculture and a declining farming population, agricultural society in Ireland is undergoing significant restructuring. As is the case across the EU, the trend in agriculture in Ireland is towards declining farm employment and the specialisation and concentration of farm production (Frawley and Commins, 1996), as many farms go out of production and those who remain become more specialised. Agricultural employment in the Republic of Ireland declined by 63 per cent between 1961 and 1995 (Department of Agriculture, Food and Rural Development, 1999). The most recent figures show a fall of 17.0 and 17.5 per cent respectively in the total number of farms and number of farmers in the state between

1991 and 2000 (Central Statistics Office, 2004). This process of rationalisation varies regionally in intensity, with the decline in the number of holdings greatest in the north and north-west, such as for example, north Mayo, and less marked in the south and east, for example, Cork and Meath, but all areas have shown a gradual process of enlargement of holdings (Crowley and Meredith, 2004). Pluriactivity, another reflection of declining farm labour, has increased considerably (Kinsella et al., 2000). The number of farmers with farming as their sole occupation declined from 73.4 per cent in 1991 to only 55.7 per cent in 2000 (CSO, 2004).

The western part of Co. Meath is an area of intensive dairying and tillage, although pluriactivity is high and rising. Situated just within the commuter belt of the greater Dublin region, the influence of urbanisation provides off-farm employment for farmers and also attracts away farm labourers and young farmers. This is traditionally an area of relatively large holdings and good quality farmland by national standards, but the pressures of a highly commercialised sector, which is suffering from falling profit margins and external pressures, are evident now, and the result is a high transition to non-agricultural employment. Although average farm holdings are smaller in the Clonakilty district, average economic size of farms is higher (see maps in Crowley and Meredith, 2004), and there is also a strong tradition of farm diversification and tourism in the area. The main enterprise type is dairying, with some mixed tillage and dairying. In comparison to Co. Meath, there are a higher proportion of young full-time farmers, although pluriactivity is rising, and to facilitate this, there is evidence of a certain shift from dairying to drystock.

The majority of farms in the north Mayo study area are smallholdings with commonage rights, involved in beef and/or sheep enterprises, with relatively low gross margins. As such, there is a high dependence on direct payments. The proportion of young farmers in the farm labour force is low in county Mayo as a whole in comparison to the national average (Leonard, 1999). Pluriactivity is high, with farming as the sole occupation of only 53 per cent of farm-holders in the county. This compares to 56 per cent in Co. Meath, 61 per cent in Co. Cork, and a national average of 56 per cent (CSO, 2004).

Transformation in the economic landscape of farming

At the farm level, agricultural restructuring processes mean the necessity to expand in order to survive, regardless of farm size or type. 'The pressure to maintain economic viability in farming obliges farm operators to enlarge the scale of their farm business by acquiring extra land and/or intensifying the scale of their farm operations' (Commins, 1999: 6). The ability to expand can mean the difference between survival and loss in farming. Clearly, economic success in these terms relies very heavily on purchasing or borrowing power. This invariably means taking

on considerable debt and repayments, which can make future expansion or acquiring a mortgage difficult or impossible. An additional pressure comes from the highly unstable economic environment, where in the short-term, annual profitability depends very heavily on the weather, while in the longer term, the policy environment changes regularly, making planning ahead quite difficult. This is compounded by the restrictions of production quotas, which means that a farmer must first purchase 'quota', which is not always available, before being able to expand production.

These types of pressures are felt strongly by those farmers working in the commercial farming sector in Meath and Cork, in particular those who rely on farming as their primary source of income. Some of the farmers in this sector talk about the difficulties in remaining viable in the context of falling prices and rising costs.

> [The main challenge is] trying to survive. Like, costs have gone through the roof, trying to control costs is a big factor; also the price drop, although we're fortunate here in this area, the drop hasn't been as much as in other coops. Trying to get more quota is impossible, it's impossible, especially around here, because dairying is very intensive around here and everybody is trying to get more quota ... Inflation is a big issue that is eating into our pockets every year, like you know every year you need a few more cows just to maintain your living standard, you know; you've to run faster to stand still (Mike,[258] age 34, full-time, Co. Cork).

This notion of 'running faster to stand still' was mentioned by a number of farmers, which indicates an accumulation of pressure in their lives. There is a strong economic imperative to expand, but the constraints preventing expansion are considerable – production quotas, the immobility of the land market and lack of finance.

> There's land coming up there, I know I need to buy it, not to remain viable this year, but to remain viable in the future, and like you're talking the guts of €400,000. Now I went into the bank manager to talk to him, just to have a chat with him, and he says he thinks I'd be mad to buy it (Andy, age 25, part-time, Co. Meath).

There is significant pressure to accumulate debt, but in an increasingly risky economic environment. The strong tension between the imperative to expand and the opposing constraints makes farm planning and development very difficult and unpredictable, and therefore very risky.

[258] All names have been changed to protect participants' anonymity.

Research shows that rapid changes in farming are associated with depression and psychological stress among farmers, often associated with feelings of hopelessness (Gallagher and Sheehy, 1994, Monk and Thorogood, 1996). This may be related to a belief in the external control of one's financial situation, through factors such as constantly changing EU legislation, social isolation and bad weather (Boulanger et al., 1999). A number of studies of fanner stress in Britain have found the major cause of stress for farmers is adjusting to new government policies and regulations (Institute of Rural Health, 1998). This belief in external control, or sense of powerlessness, is particularly significant because of the important role of power in defining masculine identities (Connell, 2000). It is clear that the economic power of agriculture is declining, and as a result this traditional source of masculine pride is under threat.

Transformation in the social landscape of farming

Related to this, the social context of being a farmer is changing rapidly. Ongoing commercialisation and rationalisation of agriculture are resulting in a declining agricultural labour force, while simultaneously, an economic boom in other sectors of the Irish economy contributes to a certain devaluation of farming as an occupation. This means that young people have other opportunities available to them, and the number of farmers in any locality, especially young farmers, declines. Some of the implications of these processes for farmers include a decline in farming networks and social support structures, as there are fewer farmers in any locality. Some spoke of neighbours moving out of dairying for these reasons and because their sons are not interested, for economic and social reasons, in taking over.

> There's a number of [farmers] around [who have moved out of dairying]. There's two, three, four, now within a mile of my house. There are yeah, because it's squeezing on them now really like (Mike, age 34, full-time, Co. Cork).

This contributes to isolation, which is compounded by the increased mechanisation of farming, bulk milk collections and more transactions taking place inside the farm gate.

> [You] become very isolated. You could go out in the morning you mightn't see anyone till you go back into the house there for dinner there and see me mother, working all day on me own ... If it wasn't for the radio in the parlour and the tractor I wouldn't know what was going on in the world. You're living in your own little world ... Can be very boring, very frustrating ... can make life boring ... (Andy, age 25, part-time, Co. Meath).

Simultaneously, the recent economic boom has meant that there are now more off-farm opportunities than in the past, and expectations regarding

disposable income and consumption have risen. The new rural lifestyles do not necessarily fit with the unsociable hours of the farmer. Full-time farming, especially in the dairying sector, involves being on the farm twice a day every day for milking, and at busy times such as calving or lambing, involves very long and unsociable working hours. This kind of lifestyle is becoming less attractive or even acceptable to young people, who compare it to the lifestyles of their peers. 'Where it *really* used to stick out a mile was, we'd go to a match in Croke Park, we'd have to be home for milking, and the lads'd be there outside the pub drinking away till all hours' (Tim, age 35, full-time, Co. Meath).

As opportunities for socialising are limited, and farming lifestyles are deemed unattractive, it is felt by some young farmers that prospects for developing relationships or even marriage are limited. One farmer who gave up full-time farming mentioned that a turning point in his decision to do so was his realisation that he was never going to be able to provide his girlfriend with the lifestyle to which she was accustomed:

> It put a few things in motion for me at the time in that I decided I'd had enough of this game anyway like. And I knew ... I was looking at another person's life [his ex-girlfriend's], in another context, great life, car, holidays, trips abroad, couple of times a year, time off, VHI, shares, none of which I had, because that's the way it is with farming, on that scale anyway (Ian, age 37, part-time, Co. Cork).

It could be argued that this distinction between farming lifestyles and others is not a new one. What has brought it into sharp relief however is the rapid rate of change in general levels of consumption and lifestyle expectations in Ireland in recent years.

> I suppose that was influenced by the lifestyle that some of our friends had. It's not the work end of it you'd be afraid of, as long as you get something for the input. I mean, they have money every weekend, but you could be working fourteen hours a day on a farm and still you'd be doing well to scrape £4,000 or £5,000 a year back then, you know, which was nothing compared to what they were earning, and they seemed to be working half the time (Kieran, age 36, part-time, Co. Cork).

It is also related to a growing gender divide, where young rural men tend to have fewer educational qualifications and lower social mobility than women (NíLaoire, 1999). Many of the interviewed farmers in the three study areas mentioned that their sisters went away to university, in a way which implied an acceptance that girls' transitions to adulthood involve further education, while hoys have different priorities.

> My parents said it was alright [that I gave up college], I would always get a job. But for my sisters it was different; they were told if they didn't go to college they would end up packing shelves ... They did degrees. My parents paid for college, they never had to work, that was their hit; the boys got the land. (Cormac, age 26, part-time, Co. Mayo).

There seems to be a strong association between femininity and education, while masculinity is still closely associated with landownership and manual/physical work. Farmers' children are among the highest attainers in both second and third-level education in Ireland, with farmers' daughters having particularly high levels of achievement (O'Hara, 1997).

McDowell (2000), in her research in urban Britain, suggests that as the gender divide in educational achievement is being reversed, young working class men's opportunities for entering traditional family life as breadwinners are limited. In Ireland, farmers' sons also have relatively high levels of educational achievement, hut according to O'Hara (1997), this represents a long established tradition of securing educational opportunities for non-inheriting sons and daughters on farms (and increasingly also on smaller farms, for inheriting sons, in order to provide some off-farm options for them). It is probable that the tendency to associate farm-work with manual work persists however, restricting inheriting sons' access to third-level education.

As a result of these processes, prospects for reproducing family structures based on traditional gender roles are under threat as expectations of men and women diverge, and farming and non-farming lifestyles diverge. As Little (2003) shows in her research in rural Britain, the ideal of a normative heterosexuality based on traditional masculine and feminine identities and on the nuclear family is central to notions of continuity in family farming. This is particularly significant in Ireland, where farm viability continues to be defined in terms of the demographic viability of the farm family, in other words the presence of a nuclear family with a relatively young age structure (O'Hara, 1997). Current processes of change in the social landscape of farming in Ireland are threatening the hegemony of a traditional masculinity built on traditional gender roles, breadwinning status and a normative heterosexuality. This, together with the problems of growing isolation and financial pressures, means that it becomes increasingly difficult for young men to justify farming as an occupational and lifestyle choice.

Responsibility and duty

This begs the question, why do young people enter farming? The answer lies partly in the historical importance of the family farm in Irish society. The strong tradition of family farming and patrilineal impartible inheritance has meant that passing on the farm in a complete and intact state has been and continues to be seen as an important responsibility of

the farmer. Therefore farming carries with it certain responsibilities and duties. The economic pressures at work in agriculture are similar, clearly, to those operating elsewhere in the capitalist free market economy. However, the social and cultural framework in which these processes are set is quite distinctive. In this historical and cultural context, the loss of a farm is more than the loss of a business enterprise, but instead, can represent the loss of a way of life and of a family inheritance, and thus can be represented as a failure in upholding one's responsibilities.

Responsibility 1: The breadwinner

In the conventional construction of Irish farming masculinity, the responsibilities of the farm successor are two-fold. First, according to the set of values upon which this is based, 'he' is expected to be the breadwinner and to fulfil the good provider role. The role of the male as breadwinner is central to the construction of conventional masculine identities in a wide range of contexts (Connell, 1995; McDowell, 2000; Goodwin, 2002). As a result, work, employment and/or income generation become perceived as a man's duty. This is related to a clear separation of male and female roles in the household. Ferguson (2001) suggests that the ideal and hegemonic Irish masculinity has been constructed as heterosexual, a good family man, and a male breadwinner, in opposition to the ideal female roles of mother and domestic servant. He argues that high levels of emigration in the twentieth century reflect the extremes to which Irish men have gone in order to fulfil the duties associated with the breadwinner role.

However, as labour market structures are changing, and traditional male sources of employment are declining in importance, the relevance of the breadwinner model in contemporary society is declining. As McKeown et al. (1998) outline, changes in social structures, such as the growth in dual-earner households, the high number of no-earner households, the increase in one-parent families, have meant that the viability of the traditional household structure based on a nuclear family with one male breadwinner is declining. Men respond in different ways to these changes, negotiating new masculine identities where possible. Goodwin's (2002) research for example shows that unemployed men in north Dublin construct masculine identities for themselves based on their ability to generate income rather than their employment status. The factors contributing to a shift away from the breadwinner social model are exacerbated in the agricultural sector by the reduced earning power of farming.

Almost half of all farm households (47 per cent in 1998) are 'pluriactive', where the farm is not the only source of income (Kinsella et al, 2000). In some farm households, the main income earner is a woman who works off the farm, while the farm provides a supplementary income, if any. It is clearly extremely difficult to maintain a hegemonic masculinity based on the identity of the man as breadwinner in this context. This means

that the social structures on which conventional masculinities are built are under threat. For some, this is a source of anxiety:

> I only gave up working in June, and we do miss [the money]... it was only a little bit, but I still do part-time work. Minding me brother's child, my niece. You know it's sad that I would have to, it really is, like my mother, when they all got married, they gave up work (Ann, Tim's spouse, couple in their 30s, pluriactive farm household, Co. Meath).

But in north Mayo, pluriactivity is the norm. Cormac is a third-generation part-time farmer:

> Farming was never a first choice thing in our house. You always had to have another job like. Especially where I come from, down [that direction], it's all mountainy area, so people would have sheep farming and you'd have maybe suckler cows, that'd be it. You wouldn't survive on it (Cormac, age 26, part-time, Co. Mayo).

Two women farmers were interviewed in the Mayo study area (one young female farmer, one older woman who shared the farm-work with her son), both from family farms where two generations were involved in farm work, but none were full-time farmers. The male farmers who were interviewed in Co. Mayo spoke about pluriactivity in an unproblematic way. It seems that in areas where farming is economically marginal, but culturally important, the construction of masculine and feminine identities may have adapted to less rigid social structures, where the link between farm work, men's work and breadwinning has been broken. Instead, farm work is part of a suite of strategies adopted by families in order to generate household income while also continuing to maintain the family farm. In fact, Jervell (1999) states that a traditional survival strategy for small farms in Norway is pluriactivity which involves significant female labour input to the family farm. O'Hara (1997) suggests that in Ireland, farm wives' contribution to farm-work is greatest on small farms where farm operators have off-farm sources of income. In contrast, it seems that in areas of commercial farming, conventional masculine and feminine identities have persisted for longer along with the social structures upon which they are built.

Responsibility 2: Custodian of family farm

The second responsibility of the farm successor is to the family farm itself. From the nineteenth century onward, Irish rural society was based on patrilineal and impartible inheritance patterns, whereby landownership and control of family resources were concentrated in the hands of the male head of household. Up until the end of the twentieth century, the position of farm successor therefore (by default the eldest son) was one

of some power. The understanding was that along with this power came the responsibility to pass on the family farm in an intact state to the next generation. Therefore, the sense of responsibility extended beyond the nuclear family to the extended family - to past and future generations. Kennedy (1999) conceptualises this as a complex web of exchange relationships involving different generations of the same family. He argues that there are economic, social and emotional costs and benefits accruing to both the successor and the owner in this system. The position of landowner is one of some power within the family and the community, associated with the control of property (Shortall, 1997), and the ability to confer bequests (Kennedy, 1999). One of the benefits for the successor is the economic value of the inheritance, but it also entails certain responsibilities and obligations to other family members (Shortall, 1997, Kennedy, 1999). By the twenty-first century, it could be argued that the economic power associated with farm-ownership has been reduced, but the sense of responsibility in relation to custodianship of the family farm persists.

This means that there is still a great reluctance to sell a family farm, regardless of the economic reasons for doing so. Ownership of land has traditionally held great value not just as a source of economic self-sufficiency but also a source of social status and power within rural communities (Shortall, 1997, Kennedy, 1999). Although the symbolism of the land has declined somewhat in recent decades, farmland still holds great value, well beyond its economic worth. The result is a great reluctance to sell agricultural land and therefore the very low mobility of the agricultural land market in Ireland, despite its high value.

> We have thirty acres here now, and it wouldn't support anybody, but still it's worth 300,000 euros. I suppose the problem is then, how do you employ the asset? Do you sell sites off it? Or do you sell it or do you keep it? (Kieran, age 36, part-time, Co. Cork).

In addition to the traditional symbolism attached to the land and the family farm, land is not considered to be a sale-able asset as it must be kept to pass on to future generations. This is one effect of the kinship-based system of land transfer, which exists largely outside the marketplace and persists in Ireland (Kennedy, 1999). Therefore, according to this ideology, the farmer is under a certain obligation to his/her children and grandchildren to pass on the farm in as good a state as when s/he acquired it, and is also under a certain obligation to his/her parents, especially if they are still alive, for they may have worked all their lives in order to pass it on to him/her. Therefore farmers are under certain pressure to maintain the holding. Kieran said that others thought he was mad when he moved out of full-time farming, especially the older generation, to move out of farming, or change anything. They would be like 'His father had six kids and reared

them all, this guy is only in his mid-twenties and he's decided to up and go straight away' (Kieran, age 36, part-time, Co. Cork).

Some mention that the stigma attached to moving out of farming is less now than it was ten years ago. Ian (age 36, part-time farmer, Co. Cork) distinguishes between sustainable and non-sustainable farms, suggesting that it is now considered acceptable to leave the family farm if it is not economically viable. Ian had taken over his uncle's 40-acre farm when he had fallen ill, and eventually the farm was transferred to his own name. In this situation, although the bachelor uncle did not have children, it was understood that the farm would be passed on to someone of the next generation from within the extended family. Ian recognised his own responsibility to the extended family when his uncle fell ill, and he took a year out of school, eventually taking up full-time farming, in order to meet this responsibility:

> Well I kind of... I lost my colleagues because they moved on, on to their final year and then on to college then, so, I fell out of step with them in a way because I was a year behind them then when I did go back. That was a bit of a bummer alright for a while, 'twas kind of a nightmare alright like you know, but, it was, I knew it could be done like, and the fact that my uncle basically needed, 'twas sort of an emergency situation really for him you know ... and 'twas kind of plain, he made it kind of obvious to me, that he was going to be packing it in anyway you know ... (Ian, age 36, part-time farmer, Co. Cork).

His sense of duty to the family farm was maintained by the promise of eventual inheritance of the farm, an example of the power of the landowner in relation to the successor, as identified by Kennedy (1999). This sense of duty can be present whether the farm is 200 acres of prime agricultural land or 40 acres of marginal land. As Ian put it, when he eventually gave up dairying and sold the cows, this act to his uncle 'was seen like being Bill Gates' son and throwing away the business like! Y'know, like walking out of Microsoft - in his head! You'll appreciate the similarity like!' (Ian, age 36, part-time farmer, Co. Cork).

To his uncle, the value of the farm was not just its business worth, but its historical, cultural and familial worth. He believed it was his responsibility, and that of his successor, to maintain the farm and to pass it on intact to subsequent generations. This particular duty of the fanner is part of the construction of traditional Irish farming masculinity. If taken seriously, then it is clearly a very heavy responsibility as it involves multiple generations of an extended family, and is much more than a responsibility to one's dependents. For those farmers who are still in a position to earn a living from farming, or to maintain a farm while also working off the farm, it is possible to fulfil this responsibility, but for

others, the sense of duty comes into sharp conflict with the realities of farming.

Tensions and contradictions

These traditional 'masculine' responsibilities of the farm successor appear to be anomalous in the context of current changes occurring in agricultural society. Such changes can be conceptualised in terms of what Connell (1995) calls a crisis tendency in the prevailing gender order, associated with wider economic and social restructuring processes. In the agricultural sector, this means that the traditional gender order, based on patrilineal inheritance, patriarchal landownership and rigid gender roles, is being challenged as the labour demands of farming are changing. Connell (1995) argues that such crisis tendencies always implicate masculinities, even if they contribute to a reinforcement of traditional constructions of masculinity.

For young Irish farmers, the changing gender order means that there is a contradiction between, on the one hand, the persistence of a hegemonic masculine identity based on notions of responsibility for family and farm, and on the other, a degree of powerlessness in relation to fulfilling those responsibilities. The hegemony of a discourse of masculinity based on a strong sense of cultural and familial responsibility is in direct opposition to the sense of a lack of control over the current and future viability of the family farm. McDowell (2000) found a very similar situation with young working-class men in England, where they constructed masculine identities based on values of hard physical work, breadwinning ability and family values. However at the same time, their prospects for fulfilling the masculine ideal of the home-owning and hard-working family man seemed very slim, in the context of labour market restructuring in urban Britain. Similarly, farming masculinities in Ireland continue to be built on notions of the duties of the male farmer as custodian of the family farm, while the possibilities for viable family farming based on traditional gender roles are less and less. Therefore we see on the one hand, very strong pressures, economic and social, contributing to a movement out of farming, and other, equally strong forces tying young people to the land. Young farmers or farm successors are at the cutting edge of these tensions and have to make the decision to enter or stay in farming in the context of competing pressures, constraints and opportunities. These tensions are manifest in young farmers' lives in a myriad of different ways, related to their particular personal, household and agricultural circumstances. At their most extreme, they are manifest through a sense of culpability, related to feelings of guilt, stress and anxiety on the part of the young farmer. The weight of responsibility for maintaining the family farm is a heavy one, and there is a sense in which the successor is seen to be accountable for the emotional and financial investments of others in the farm. Ian describes the reaction of his uncle when he sold the cows:

> Well you know, he actually cried the day I sold the cows. 'Twas very hard. A couple of lorries came and they were loaded up and he was inside and he was broken-hearted, crying, crying, crying, which was very hard to look at. And 'twas, you know I'd basically sold the family heirloom like, the crown jewels were gone, what he'd always worked for, his Dad had always worked for, all the generations before that (Ian, age 36, part-time farmer, Co. Cork).

A decision to move out of farming, to sell or lease the land, even to sell a site for development, can imply the culpability of the farmer for what is seen as the loss of the family inheritance, even if it is an economically rational decision. Andy's defensiveness at being asked if he would consider moving out of farming reflects his feeling that he needs to justify that move:

> And to be honest with you I'm not going to stay there for the rest of me life, slaving into the ground, just to keep the farm going. Well I don't see in all honesty why. Like would you stay at a job where your income is diminishing every year, in all honesty ...? (Andy, age 25, part-time, Co. Meath).

The tension between pressures to stay in farming and to look elsewhere can contribute to stress and anxiety.

> Any young chap, would find that, it would nearly do his nut you know; he would feel that what he'd be going away to do would really want to be good you know; it would have to work out for him for it to be seen to be good for himself as well (Ian, age 36, part-time, Co. Cork).

This is bound up with the socio-cultural construction of farming as a masculine activity, with masculine responsibilities. Indeed, the close relationship between farm work and masculine identity means that the loss of the farm can have a devastating effect on the farmer's sense of self. After Ian sold the cows, his self-identity changed from that of the nephew who saved the family farm, to that of the 'failed son': 'So, I wouldn't say it was a rift, we never rightly fell out like, but it became difficult. I became the failed son then basically'.

In this sense, in areas of commercial farming, the pressures on farmers' sons are considerably greater than on daughters, as there are strong expectations of son(s) in relation to succession. Gendered divisions of labour are so rigid that agriculture is considered a masculine activity, and the principle of male inheritance is so strong that in cases where a son is not available to take over the family farm, it is often a nephew who does so instead. This close relationship between masculine identity and the

duty of family farming implies that one's masculine identity is challenged if the duties are not upheld. Ian talked about how he felt people reacted when he sold the cows: 'Oh, 'twas a total failure like, absolutely, total failure you know. 'That "I could do it and you couldn't - you weren't a man at all"!'

'Being a man' implied values of hard work, tenacity, duty and responsibility, reflected in a viable working farm. By not conforming to this ideal-type, Ian felt that his masculinity was being challenged. His sarcastic tone in re-telling this story a number of years later shows that he is critical of this discourse and has rejected it. Another farmer spoke about a certain loss of pride associated with going part-time: 'I know for a fact that [...] the brother, there's no way he'd do it. He's real proud you know. But jesus at the end of the day, you've got to make a life too you know' (Justin, age 29, part-time, Co. Cork).

These notions of masculine pride being vested in full-time farming serve little obvious function in an agricultural sector where almost half of all farmers have another source of income (CSO, 2004). Its futility is even more evident in a region like north Mayo, where pluriactivity has been the norm for some time. Kinsella et al. (2000) identify the existence of many 'old pluriactive' family farms in the west of Ireland, where farms have been pluriactive for more than one generation. The high rate of pluriactivity in places like north Mayo, together with fewer off-farm employment opportunities for women, are likely to result in higher rates of female on-farm labour input. The poor economic viability of farms also means that patterns of inheritance may differ from those prevailing in regions of more commercial farming, as there are likely to be difficulties in recruiting heirs (Kennedy, 1999). The farmers who were interviewed in the Mayo study area displayed little of the obsession with full-time farming or male landownership that was evident among some farmers in Cork and Meath. Instead their farms were run more as family enterprises, from which usually no-one earned a full-time income, and gender roles were not necessarily rigidly or conventionally defined.

> Even though I own about 70-75 per cent of the land now, I never look on it as my own farm, just as my father never looked on it as his. It's a family thing like. My brother helps out on it, he could have some of it he wanted but he's happy just doing a bit of work on it for me and me father and he's paid. Right down to my 12-year-old brother, he gets paid for work that he does on it (Cormac, age 26, part-time, Co. Mayo).

There is evidence that masculine identities were being constructed by these farmers in alternative ways to the ideal-type more commonly professed in the commercial agricultural sector in Cork and Meath. This has resulted from a long history of pluriactivity and reflects an openness

to acknowledge female involvement in farm work:

> Me older sister now, she did an awful lot of work on the farm. Because me father used to go to England you know. He was a seasonal worker in England, everyone had to muck in (Alan, age 45, part-time, Co. Mayo).

In the following quote, where he refers a little contemptuously to a neighbouring family, Cormac shows that he does not idealise the hardworking farmer or the notion of full-time farming.

> The lads in [that particular family] had no interest in school, and the parents didn't push them really hard to go, they just fell into farming. They just, they don't have much of another life besides that. I wouldn't go that particular route. And they work very hard, twice as hard as me. They're the only family that I know full-time farming (Cormac age 26, part-time, Co. Mayo).

For Alan, Cormac, and others like them, there is a strong tendency to construct farming as an interest or even a pastime, while still being an important part of the family heritage and identity.

> [A good farmer] has to just love what he's doing, and, understand what he's doing, and understand that he's only there for a short time and it has to go on somewhere else after, and that he didn't just make it, he inherited it from someone else and he's just passing it on to the next one, you know - he has to understand that (Alan age 45, part-time, Co. Mayo).

Farm masculinities in an area like north Mayo, then, where the social and economic structures of farming are different to those in area of more commercial agriculture, can be constructed more easily around notions of love of farming and custodianship of the land, without the heavy emphasis on breadwinning ability and farm viability. This reveals the spatial contingency of masculinity, reflecting local and regional geographies of gender. Indeed, there is evidence that values are undergoing change in the farming sector in general, as there is a growing realisation of the futility of traditional discourses of masculinity and femininity. In the Cork study area, there was a sense that the great stigma that had been attached to leaving dairying or going part-time in the mid-1990s, had already been modified by the time of the research in 2002-3. 'A lot of guys now are leaving and it's accepted that you can't survive on it, that you must have an outside income like' (Ian, age 36, part-time, Co. Cork). Most of the farmers interviewed, in all three areas under study, claimed that they would not put their own children under pressure to take over the farm; some that they would actively discourage it.

> And depending on how the kids go, and what path in life they take, if they're interested and you could do something for them in regards to buying land to increase it to a workable farm. But I can't see me having it as a workable farm or a feasible farm for income in my time (Harry, age 35, part-time, Co. Meath).

This may represent something of a shift in fanner attitudes. Alternatively, it is possible that these farmers' own parents may have made similar claims in the past and that the construction of masculine identities around ideas of farm work and responsibility is something that goes much deeper than this. The farmers who spoke about pressure to maintain the farm talked about feelings of responsibility towards parents and a sense of guilt at disappointing them, rather than overt pressure from parents. The construction of masculinities around the central notions of breadwinning and custodianship of the family farm has been bound up closely with a particular gender order and social structure, and has been reinforced as much, if not more, by public discourse, local cultures of masculinity and peer group dynamics, as it has by family dynamics.

Local cultures and peer group dynamics are very important in shaping constructions of masculinity. For those farmers who have already moved out of full-time farming, they can reflect with hindsight on the strong influence of their peer groups on their own values and ideals in the past. 'Well I was into farming at fifteen, straight out of school. I suppose it depends on who you hung around with as well. If your social group was farming, I mean you didn't know anything else as such' (Kieran, age 36, part-time, Co. Cork). The comfort of the peer group meant that the difficult issues such as how to remain viable, the pressures of debt and changing farm lifestyles, could be avoided.

> 'twas a kind of a peer thing, you had colleagues around you doing the same thing, so the blatant obvious thing wasn't obvious to you, the fact that you obviously weren't making money... because you'd meet up in the evenings and at weekends and down the local and stuff (Ian, age 36, part-time, Co. Cork).

In a similar way to that of young working-class men in urban Britain (McDowell, 2002), a traditional masculine identity could be reinforced in a group situation, even if it is an extremely vulnerable identity when viewed in a wider context.

Conclusions

Rural restructuring processes are contributing to a transformation in the economic and social landscape of farming in Ireland, involving something of a crisis in the existing gender order. For young farmers, the

changing gender order means that there is a contradiction between, on the one hand, the persistence of a hegemonic masculine identity based on notions of responsibility for family and farm, and on the other, a degree of powerlessness in relation to fulfilling those responsibilities. By the twenty-first century, it could be argued that although the economic power associated with farm-ownership has been reduced, the sense of responsibility in relation to the family provider role and custodianship of the family farm persists.

Young farmers and farm successors, then, are caught at the fulcrum of two different ways of life, where the 'Celtic Tiger' lifestyle and the values of commercial agriculture meet the traditional values and structures of family farming and landownership. In many ways, they embody the tensions of this encounter as they face the decision of whether or not to become farmers. There is an inherent contradiction in the persistence of a hegemonic masculinity identity based on certain responsibilities, in a context in which fulfilling those responsibilities becomes difficult or impossible.

This means that masculine and feminine identities are being re-negotiated as the traditional gendered structures of farm life are under threat. These processes of negotiation are spatially and temporally contingent, related to geographical and historical variations in rural restructuring. Thus, it appears that farm masculinities in an area of marginal agriculture like north Mayo have adapted in order to accept non-traditional gender roles. In contrast, masculine identities in areas of commercial agriculture, such as Cork and Meath, are more likely to be caught in a double bind. It seems that in areas where farming is economically marginal, but culturally important, the construction of masculine and feminine identities have adapted as the link between farm-work, men's work and breadwinning has been broken. In contrast, it may be that in areas of commercial farming, conventional masculine and feminine identities have persisted for longer along with the social structures upon which they are built. Therefore, the tension between the persistence of traditional masculine values of responsibility on the one hand, and the reduction in men's economic power on the other, is felt more keenly in this kind of geographical context. At their most extreme, these tensions are manifest in a sense of culpability, related to feelings of anxiety on the part of the young fanner. The close relationship between masculine identity and the duty of family farming implies that one's masculine identity is challenged if the duties are not upheld; in the words of one farmer: 'You're not a man at all!'

It is unclear if this represents a particular moment in a process of transition in the gender relations of commercial agriculture in Ireland, where there may be a shift towards a greater openness to non-traditional gender roles in farm households. What is clear is that Irish farm masculinities have been constructed around notions of responsibility,

which have traditionally been tied to economic power and the control of land and property. The separation of power from responsibility gives rise to anxieties around masculine identity, but in the less rigid gender relations of marginal farming and old pluriactive family farms can be found the seeds of alternative masculinities which are based less on patriarchal economic power.

Acknowledgement. The author would like to thank the National Institute for Regional and Spatial Analysis (NUI Maynooth) for funding this research.

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CHAPTER 17

GEOPHYSICAL INVESTIGATION OF THE SITE OF THE FORMER MONASTIC SETTLEMENT, CLONARD, COUNTY MEATH, IRELAND

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First published in *Archaeological Prospection* (2006), 13, 45–56.

Introduction

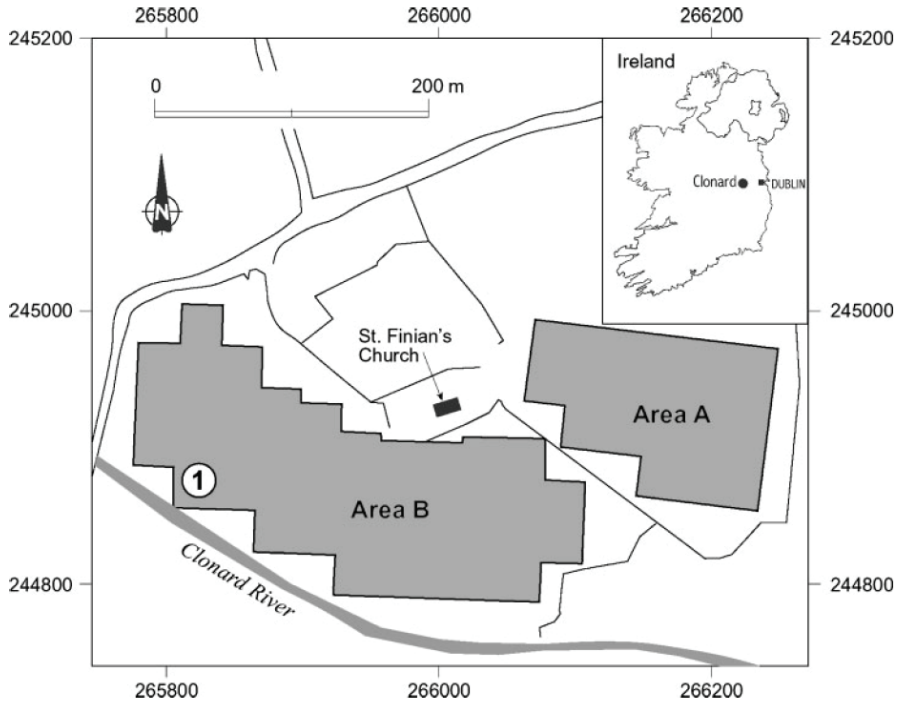
Clonard today is a small village in County Meath 62 km west of Dublin, Ireland (Figure 1 inset). However, for a period of at least 700 years it was one of the most important and influential ecclesiastical centres in Ireland. A monastery was founded at Clonard in the early sixth century by St Finian (Finnian), who is known as the Master of the Saints of Ireland due to the large number of important bishops who studied under him at Clonard, for example, Ciaran of Clonmacnoise, Colmcille of Iona, Molaise of Devenish and Brendan of Clonfert (D'Arcy, 1974; Flanagan, 1990). Archaeological finds in the area, such as a ninth century shrine and eleventh century crozier, also attest to the ecclesiastical importance of this site. The annals of Clonard record the major events in Clonard's history.

It was plundered in the year AD887 by the Vikings and in the year 970 by Domhnall Mac-Murchadh. Vikings also raided Clonard, along with other important monastic sites in AD 1012 and again in AD 1020 and in AD 1045 its great stone church was destroyed in such an attack (Cogan, 1874). The bishopric of Clonard maintained its ecclesiastical importance into the twelfth century when it became the diocesan town of East Meath (Hickey, 1998). However, the importance of Clonard then decreased and was dissolved by Henry VIII around 1542 in the Dissolution of the Monasteries. Up to the end of the eighteenth century, there are records of substantial parts of the monastery and its associated buildings remaining. Archdall (1786) reports the existence of buildings and that the choir was 'a large and elegant building, most of which remains'. However, nothing exists today and in the first edition 6 inch to 1 mile Ordnance Survey map of the Clonard area, published in 1836, not a single feature is shown, although it is recorded that the 'site of abbey' is located where the present day St Finian's church is shown (Figure 1).

A geophysical study was undertaken during the summer of 2004 in two areas (areas A and B, Figure 1) in the vicinity of St Finian's church in order to determine if any anomalies associated with Clonard monastery could be detected. The geology in this region consists of non-magnetic Carboniferous Limestone overlain by glacial sediments and soil. There is no published information on the thickness of the superficial cover but it is believed to be at least 3 m thick. Aerial photography shows a number

of linear features in area B which were shown by Sweetman (1978) to be late thirteenth century drainage channels. They are not related to the present-day Clonard river (a relatively recent canalized feature) which forms the southern boundary of Area B.

Figure 1. Location map of study area, Clonard, County Meath, Ireland. Areas A and B were investigated using magnetic gradiometry and resistance techniques. In addition, ground-penetrating radar and resistivity data were collected at locality 1. National Irish grid co-ordinates.



Data collection, techniques and processing

Data were collected at two locations: east (area A) and south and west (area B) of the present-day St Finian's church (Figure 1). Magnetic and resistance data were collected in 30 x 30 m grids, 20 grids in area A and 42 in area B.

The resistance survey was undertaken using a TRCIA twin electrode array with a 0.5 m electrode spacing. The data were collected in a zigzag fashion at 1 m intervals along 1 m spaced parallel lines. Nine hundred data points were collected for a 30 x 30 m grid resulting in 18 000 resistance readings for area A and 37 800 readings for area B. The data were combined into a mosaic using Geoscan Research's Geoplot software and where necessary the grids were matched. The processed data were output and gridded in Golden Software's Surfer program. A boundary file was used in order to 'cookie-cut' the resultant images so that they matched the area over which data were collected. The images

were georeferenced to Irish grid co-ordinates using GPS technology and input into the ArcMap Geographical Information System.

Magnetic data were collected along the same survey lines as those used in the resistance survey using a Bartington 601 gradiometer. Data were collected in a zig-zag pattern at a walking speed of 1.1 m s-1 along 1 m spaced lines with a station spacing of 0.25 m for each line. Thus 3600 readings were acquired for each 30 x 30 m grid (72 000 readings for area A and 151 200 readings for area B). A similar processing stream was used for the magnetic data as for the resistance data. However, in addition, the data were despiked in order to remove spurious high or low readings and a zero mean grid algorithm used.

Electrical imaging and ground-penetrating radar (GPR) surveys were conducted at one location in area B (1, Figure 1). Ten parallel lines of resistivity data were collected in a south–north direction along 19.2 m long lines spaced 1.5 m apart. A Campus Geopulse resistivity meter with 25 electrodes spaced 0.8 m apart was used in this investigation. The Wenner–Schlumberger electrode array was used as it gives a good signal strength and is reasonably good at detecting both lateral and vertical resistivity changes (Loke, 2001; Similox-Tohon et al., 2004). Two-dimensional electrical imaging allows the acquisition of apparent resistivity variations in both the vertical and horizontal directions, effectively producing a two-dimensional slice known as a pseudosection. Although this pseudosection provides some information about the subsurface, different results would be produced for the same profile if different electrode arrays were used. The data were subsequently modelled using the RES2DINV inversion program (produced by Geotomo Software) in order to determine how the 'true' resistivity may vary with depth. The subsurface is divided into a number of rectangles which are assigned true resistivity values and an initial model of the subsurface formed which shows the variation in 'true' resistivity with modelled depth. The apparent resistivity that this model would yield for the selected electrode array that is used is then calculated and compared with the measured apparent resistivity. The model is then progressively altered using a least-squares optimization approach in order to reduce the root mean square (RMS) error between the calculated and measured apparent resistivity (Loke and Barker, 1995, 1996). The number of iterations can be specified or the process can be stopped once the change between two iterations is below a specified threshold value. The ten individual parallel lines which together comprised a rectangle 19.2 m long in a north–south direction (25 electrodes with a spacing of 0.8 m) and 13 m wide in an east–west direction (each line 1.5 m from the adjacent ones) were modelled using the RES3DINV inversion program. This allowed the production of areal resistivity maps for different depths (see Figure 7).

A Sensors & Software pulseEKKO 100 system operating in constant separation mode at a central frequency of 200 MHz was used to collect ground-penetrating radar data in the same vicinity as the resistivity data. Twenty-one 13 m long parallel ground-penetrating radar (GPR) lines of data were collected in a south–north direction. Data were collected at 10 cm intervals along each line and each line was separated by 50 cm from adjacent ones. All GPR data were (dewowed) before being examined. This is because the low frequency component of the transmitted radar pulse slowly decays and the reflections are superimposed on this decaying transient (Sensors & Software Inc., 1996). Consequently, GPR data are high-pass filtered (dewowed) to pass the antenna centre frequency and to suppress the low frequency component. All data were also 'gained' in order to compensate for the considerable decrease in energy as the waves travel deeper, which produces weak signals from deeper sources. An automatic gain control (AGC) was applied which is inversely proportional to the decaying signal strength; thus a greater gain was applied to deeper reflectors. A time window of 100 ns was used and 16-fold stacking used to improve the signal-to-noise ratio. A subsurface velocity of 0.08 m ns-1 was used in all depth calculations. This value was obtained using a hyperbola matching technique (Gibson and George, 2004). The 21 closely spaced parallel lines of ground-penetrating radar data were merged using the Sensors & Software EkkoMapper computer program to produce a sequence of two-dimensional plots showing the spatial variation in amplitude for different depth slices (see Figure 9). The deviation from the norm is important and no differentiation is made between positive or negative amplitudes (Conyers and Goodman, 1997).

Results of magnetic investigation

The results of the magnetic investigation are shown in Figure 2. Examination of the magnetic data for area A shows there is a distinct difference between the western and eastern halves of the region. There are virtually no magnetic anomalies east of Irish Grid easting 266150 (1, Figure 2), whereas to the west the magnetic data are much more variable and a significant number of linear anomalies can be observed. This boundary is marked by a concentration of approximately N–S trending linear features.

This change may have a geological origin but the distinction does not appear on the resistance data (see Figure 3). An arcuate anomaly can be seen on the western side of area A (2, Figure 2). The magnetic data for Area B are dominated by the 300 m long undulating structure that crosses the entire image (3–4, Figure 2). This anomaly is approximately 6 m wide and has a positive (dark) magnetic signature in the core being flanked by a negative (paler) signature. This feature does not have an archaeological origin but represents an old unknown river channel which may have become silted up during the drainage of this area in the thirteenth century. The infilled channel is more magnetic than its adjacent banks because of the thicker sediment cover. The westward continuation

of this channel could not be determined due to the presence of high voltage wires and pylons (5, Figure 2).

Figure2. Magnetic data for areas A and B.

A very prominent 70 m arc can be observed in the western section of area B, which also may be a former channel (6, Figure 2). There are two areas in this field where there are zones of fine parallel lines extending for 60–70 m. These lines most likely represent old plough marks. They have different trends and are most prevalent in the northern section of area B. They have a NE– SW (6, Figure 2) and a WNW–ESE trend (7, Figure 2). The latter pattern extends northwards into area B.

In any large field there is often a random scatter of small isolated high and low magnetic anomalies caused by, for example, nails, slag, etc. However, any concentrations of such material tend to suggest general anthropogenic activity and possibly the location of settlement (Gaffney and Gater, 2003). Such concentrations, extending up to 50 m, are located at positions 7, 8 and 9, Figure 2. Location 7 is adjacent to the supposed site of the abbey and location 8 is beside the former river channel.

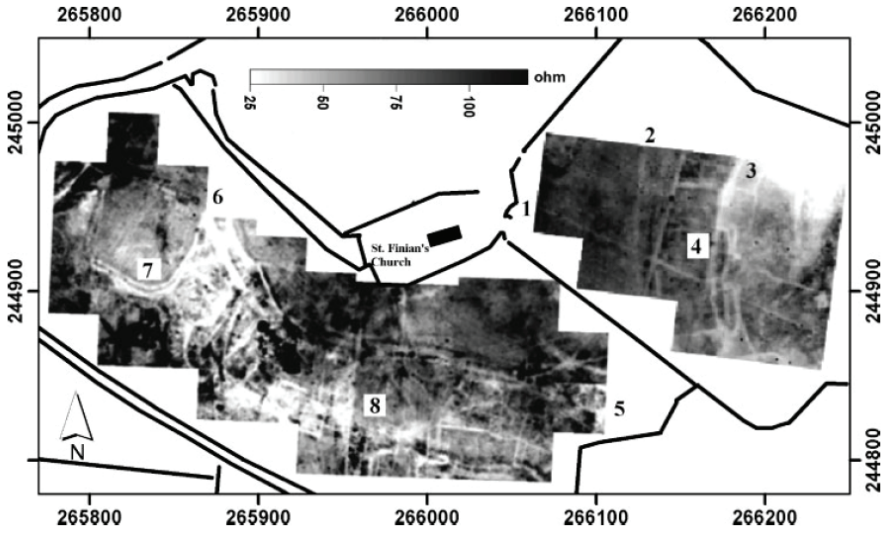
Results of resistance investigation

Area A is characterized by a number of major low resistance linear anomalies with different trends (Figure 3). The longest one (1, Figure 3) can be observed extending across this area for about 150 m.

It also corresponds with a former field boundary shown on the 1910 6 inch to 1 mile Ordnance Survey map of the area. A concentration of N–S trending resistance features is located in a similar position to magnetic lineaments (2, Figure 3). Whereas the eastern half of area A is magnetically quiet, a number of low resistance linear features can be observed in this region which probably represent former field boundaries

(3 and 4, Figure 3). There is a noticeable decrease in resistance east of the arcuate boundary (3, Figure 3).

Figure 3. Resistance data for areas A and B.

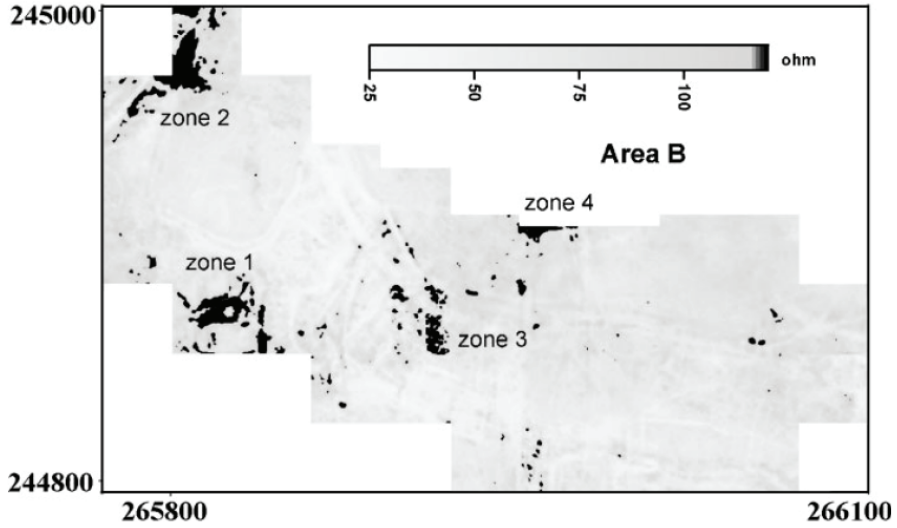


The river channel observed in the magnetic data for area B (Figure 2) can still be discerned on the resistance data, although the trend is not as clearly defined (5–6, Figure 3). A subsquare enclosure with dimensions approximately 60 x 60 m is located in the western part of area B (7, Figure 3). A distinctive ploughing pattern similar to that seen on the magnetics is evident at this location. The region south of the palaeo-channel is characterized by a network of short intersecting linear anomalies (8, Figure 3). They are absent north of the palaeochannel and most likely represent late thirteenth century drainage channels known to exist in this region (Sweetman, 1978).

Archdall (1786) recorded the presence of stone walls and buildings and such features are generally associated with high resistances (Gaffney and Gater, 2003; Gibson and George, 2004). A modified version of Figure 3 is displayed in Figure 4 in which low and medium resistance values are saturated to white and only the highest values represented by black. It is clear that the high resistance areas are not randomly scattered throughout area B but concentrated in small compact zones which suggest that these areas may represent the locations of walls or buildings. Four such zones are shown in Figure 4. The Irish grid co-ordinates for the centre of zone 1 are 265826 E 244874N; for zone 2 are 265816E 244978N; for zone 3 are 265918E 244862N; for zone 4 are 265963E 244906N. A directionally filtered version of zone 1 is displayed in Figure 5a and interpreted in Figure 5b. This area is topographical higher than areas around it and parts of stones could be determined above the soil. Background resistance of the order of 80 ohms whereas the linear anomalies that can be observed have resistances of up to 300 ohms. Two anomalies which

meet approximately at right angles may represent former field boundaries (1, Figure 5b). These appear to cut across another feature (2, Figure 5b) which due to its shape and resistance signature is interpreted as a building. This building has its long axis oriented E–W and an opening can be determined on the east wall. It is approximately 7 m wide (N–S direction) and about 15 m long (E–W). An internal division can be distinguished with the western half of the building being associated with a higher resistance than the eastern part. The eastern part may simply be an earthen floor whereas the western part of the building may have a stone floor. The building was further investigated using ground-penetrating radar and resistivity.

Figure 4. Resistance data for area B modified to show location of high resistance concentrations. Zone 1 was further investigated using ground-penetrating radar and resistivity.



Resistivity characteristics of zone 1

A series of parallel south–north resistivity lines was obtained across the building in zone 1, all of which showed the same consistent pattern. The modelled results of three of these traverses using RES2DINV inversion program are shown in Figure 6. Resistivity values are generally low (50–150 ohm m) except where the traverses cut across the east–west aligned walls. These are located at 6.4 m and 13.6 m and are represented by very high resistivity values in the range 1000– 3000 ohm m, an order of magnitude greater than the background readings. These high values are consistent with stone walls. It is difficult to accurately define the dimensions of the walls. However, the data suggest that they are of the order of 50–80 cm in thickness and extend to a depth of about 1 m below the surface, suggesting that this was a substantial building of some importance.

Figure 5. (a) Filtered resistance data and (b) interpretation. Numbers referred to in text. Large rectanglein (a) shows area covered by two-dimensional resistivity plots (see Figure 7) and the small rectangle in (a) shows area covered by ground-penetrating radar plots (see Figure 9).

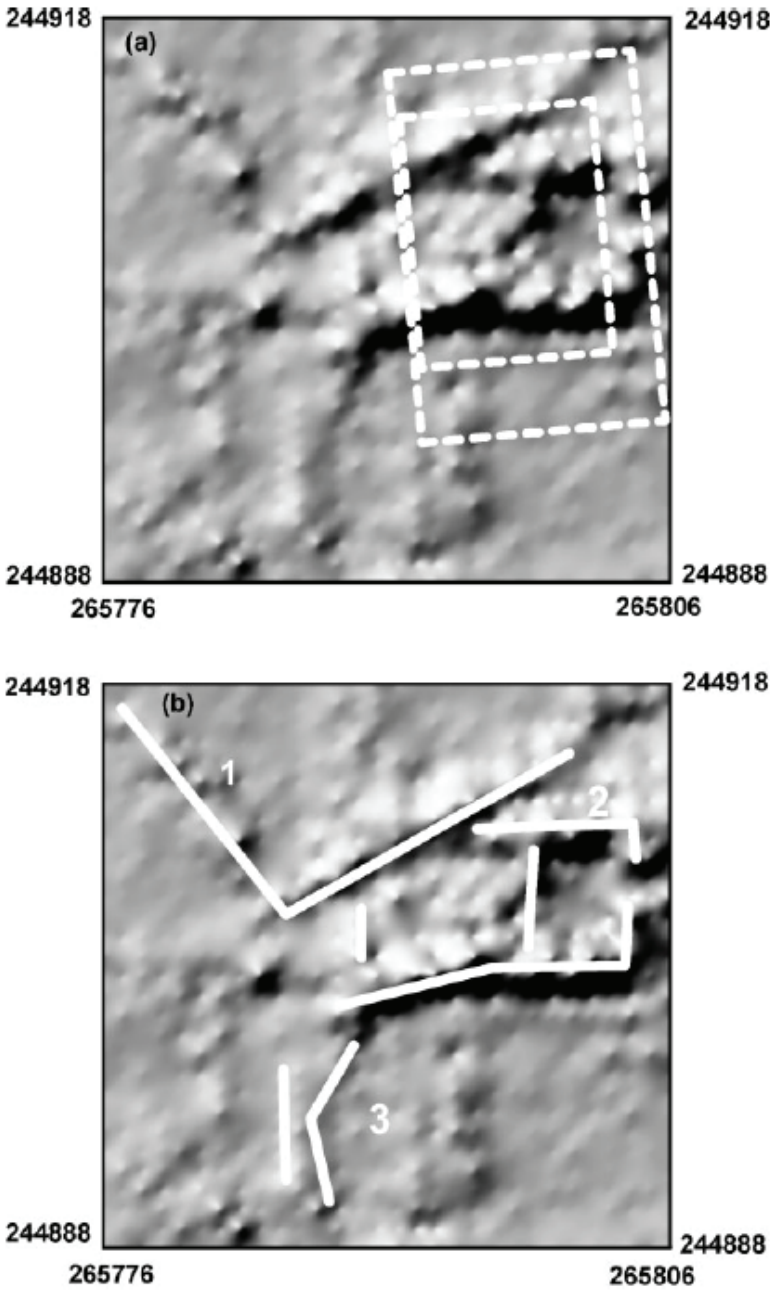
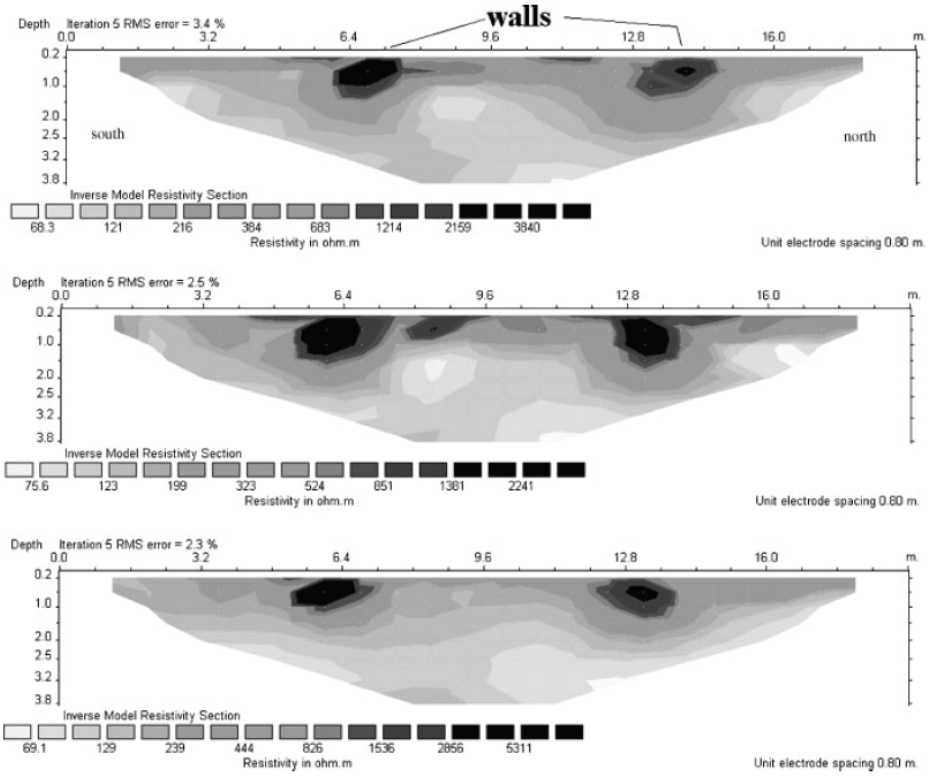


Figure 6. Three lines of two-dimensional resistivity models across zone 1 showing the location of high resistivity walls.



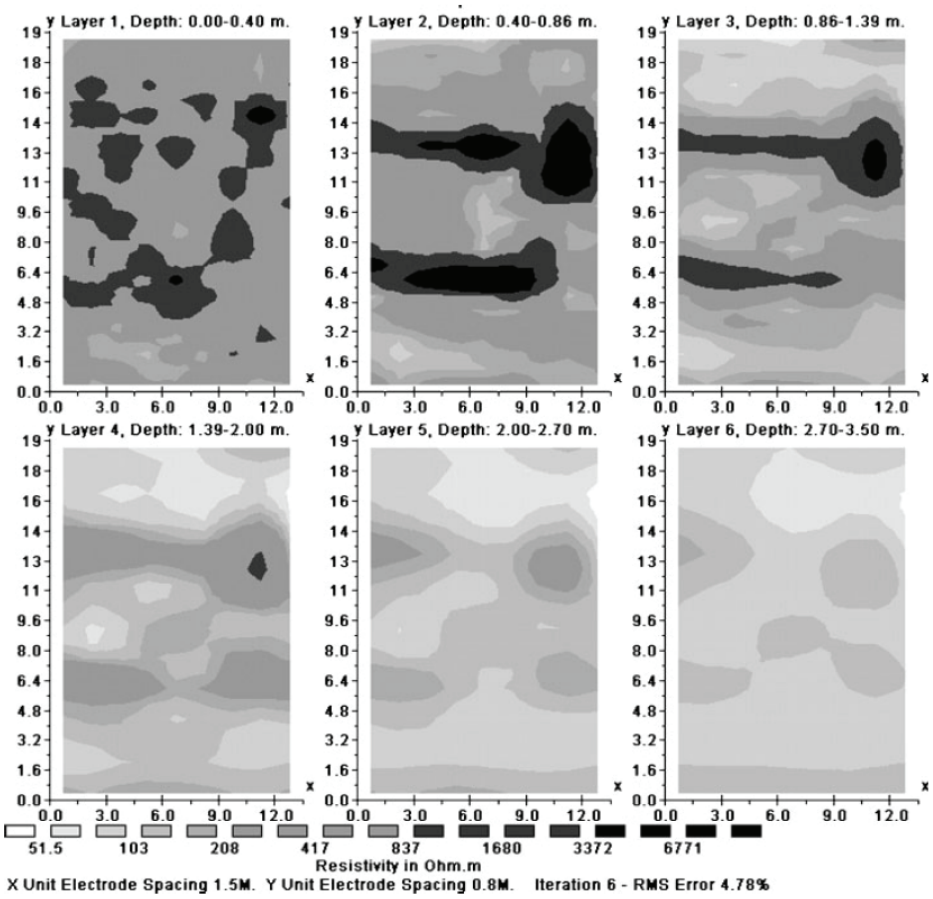
The parallel lines of resistivity data were combined and processed using RES3DINV—a three-dimensional inverse modelling program. The data were then sliced in order to provide a plan view of this feature at different depths (Figure 7). At shallow depths, down to about 40 cm, no clear pattern can be discerned, although there is evidence of some high resistivity blocks. However, the parallel walls of the building are clearly defined between 40 and 86 cm. The presence of the walls can still be discerned at a greater depth, but their presence cannot be determined below about 2 m.

Ground-penetrating radar characteristics of zone 1

A GPR section taken across zone 1 is shown in Figure 8 and is representative of all the radar lines. It shows two hyperbolic responses at depth due to the walls. They are located the same distance apart as the walls discovered by resistance and resistivity methods and confirm the existence of these features. The 21 closely spaced parallel lines of data collected were collated using the EkkoMapper program, depth slices were obtained for each GPR dataset and the data gridded to produce a sequence of two-dimensional plots showing the spatial variation in amplitude response for different depths. Figure 9 shows the results of depth slices for a 13 m (N–S) by 10 m (E–W) area. The thickness interval

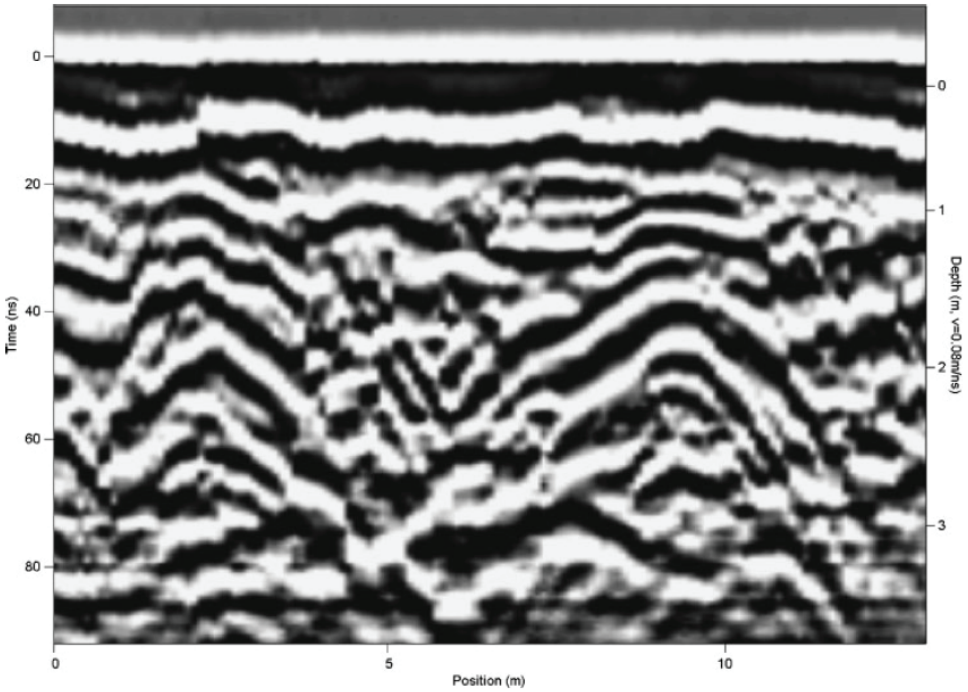
for each depth slice is 40 cm. As with the resistivity data, no distinctive patterns were obtained near the surface (Figure 9a). However, the presence of the walls is clearly delineated in the 0.8–1.6 m depth range as two linear pale bands extending across the image (Figures 9b and 9c). The signature for the walls is much reduced in the 1.6–2 m range (Figure 9d) and is absent at depths greater than 2 m.

Figure 7. Areal plot of resistivity for zone 1 at different depths. See Figure 5 for location of plots.



Approximately 5 m south of this building (location 3, Figure 5b) an excavation in the 1970s located nine skeletons (eight adults and one child) buried together at a depth of only about 15 cm (Sweetman, 1978). The skeletons post-date the late thirteenth century and appear to have been buried hurriedly presumably in a location which was considered 'religious' ground. Their close proximity to the building in zone 1 (5 m) and their alignment parallel to the walls of the building support the hypothesis that it had a religious significance and was a building associated with Clonard monastery.

Figure 8. Ground-penetrating radar section across zone1, south to the left.

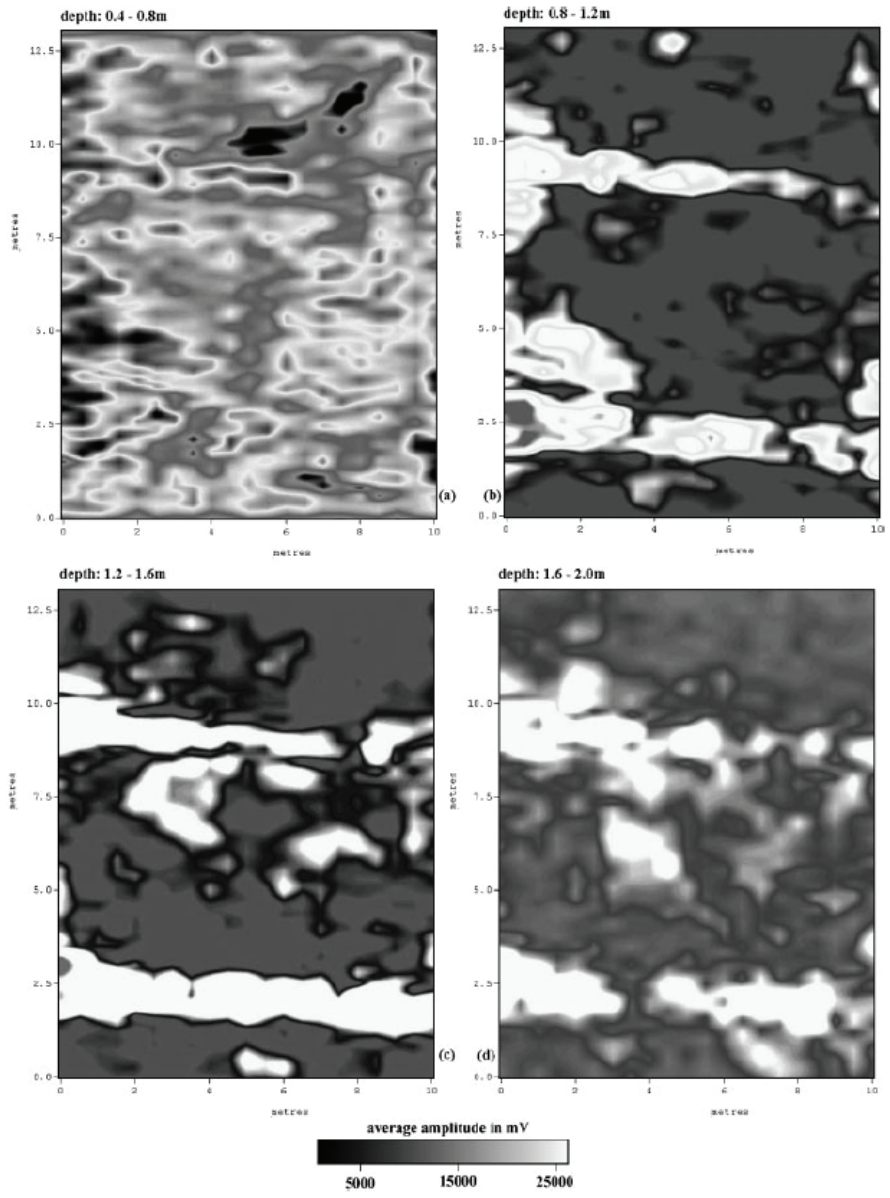


Conclusions

The geophysical investigations undertaken in this project have uncovered many anomalies which may be related to the monastic settlement at Clonard. Most of the features east of the supposed site of the abbey (area A) are indicative of field boundaries. However, a much greater diversity of geophysical signatures are located south and west of the proposed abbey site (area B). A 60 m subsquare enclosure is adjacent to a 300 m long palaeochannel. There are three areas in which anomalous magnetic readings are recorded which might indicate sites of human activity. In addition, four zones show large concentrations of high resistance readings suggesting that buildings were located in these areas. One of these (zone 1) has resistivity and ground-penetrating radar characteristics which indicate the presence of an E–W aligned building approximately 7 m wide (N–S direction) and about 15 m long (E–W).

The combined application of various geophysical techniques has maximized the amount of information acquired in the study area or strengthened the resultant interpretation. Some of the features located in area A are associated with both magnetic and resistance anomalies. Magnetic gradiometry alone would not have detected the east–west

Figure 9. Areal plot of ground-penetrating radar data for zone 1 at different depths. See Figure 5 for location of plots.



aligned building and other zones in which it is postulated that other buildings are present. The palaeochannel yields a clearly defined coherent magnetic signature whereas its resistance signature is not as pronounced and it does not appear to be a single feature on the resistance plot. The correlation of similar patterns in both the ground penetrating radar and resistivity plots over the east–west aligned building in zone 1 both support the interpretation that the anomalies represent major walls.

Acknowledgements. The authors would like to thank Lorraine O'Reilly for helping in the collection of data and The Heritage Council, the Royal Irish Academy and the Bishop of Meath for financial assistance.

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CHAPTER 18

COLONIAL SPACES AND SITES OF RESISTANCE: LANDED ESTATES IN 19TH CENTURY IRELAND

PATRICK J. DUFFY

First published in Proudfoot, L.J. and Roche, M.M. (Eds) (2005) *(Dis)Placing Empire*. Aldershot: Ashgate, pp. 15-40.

Introduction

The regional expression of rural protest, agrarian outrage and rebellion in 19th century Ireland has been periodically examined by historians and historical geographers (Bric, 1985; Kiely and Nolan, 1992). One of the contexts within which such events may be re-visited is within a framework of local resistance to colonial domination. Post-colonial perspectives offer a critique of 19th century colonial discourse in which dominant power structures frequently served to 'Other' the colonized, through processes of negative stereotyping and myths of primitive backwardness. Colonial hegemonies generated both subservience and resistance in a variety of strategies by the colonized. Colonialism in its various manifestations throughout the British Empire provides some of the most clear-cut examples of a dominant elite subordinating a colonized 'inferior' native population.

Although the colonial nature of Ireland's relationships in the British Isles and British empire is sometimes ambiguous, they displayed most of the characteristics of colonial society in the 18th and 19th centuries, especially in the role played by the landed gentry. The Irish economy which was largely controlled in the 18th and 19th centuries by the English metropole, developed as an agricultural periphery to the British heartland. The Irish landed estate, which formed the lynch-pin of this economy, lay at the core of the colonial enterprise in Ireland from the 17th century. Estates became progressively contested spaces in the later 18th and 19th centuries, with increasingly unpopular attempts by the dominant elite to reform their properties through regulation. Ironically after 1801 Ireland was part of the United Kingdom and superficially less obviously a colony, though one commentator in 1834 noted the numbers of military garrisons in county Tipperary, as 'an array of bayonets that renders it difficult to believe that Ireland is other than a recently conquered territory, throughout which an enemy's army has just distributed its encampments' (McGrath, 1985). Much of the 19th century was taken up with agitation to remove the union between Great Britain and Ireland, generally in the teeth of opposition from the landed establishment which was predominantly unionist and imperialist in its outlook. The ambivalence and inherent contradictions in Ireland's political and colonial status are captured in the manner in which it was represented in the Great Exhibition in Dublin in 1853. The discursive

logic of an exhibition that was designed to reconfigure Ireland symbolically as a modern progressive nation comfortably located in the United Kingdom and the Empire, in the end only served to emphasize its subordinate colonial status: the organizers of the Exhibition found themselves 'instructing people whom they consider as their own national lower orders in the behaviours appropriate to civilized life, by mobilizing colonial images of Ireland traditionally used to denigrate the island as a backward region of the United Kingdom' (Saris, 2000).

Many of the projects of settlement and survey which were undertaken in Ireland from the 17th century were essential components of colonial enterprise, measuring and mapping a conquered land for appropriation and domination. The construction of the landed estate system was largely a product of such a mapping enterprise. The Civil and Down Surveys in the 17th century, the Ordnance Survey and the General Valuation of the mid-19th century, for example, were all pioneering episodes which were later replicated in outreaches of the empire. Other elements of the 19th century Irish experience, such as the postal system, and the Irish Constabulary (Royal Irish Constabulary from 1867) which were crucial parts of the Irish administration, subsequently became models for colonial practice throughout the empire.

Much of the literature on postcolonialism, orientalism and the British Empire does not initially appear as overtly relevant to Ireland's case. Indeed Ireland itself, especially its landed elite, was involved in the consolidation of many imperial overseas projects. There are, however, parallels in British colonial experiments in 19th century empire and earlier colonial developments in 16th and 17th century Ireland, reflected for instance in plantations of settlers from Britain, transplantations and Cromwellian 'ethnic cleansing' of elements of the native population to the West Indies in the 1650s. Though the nature of colonial experience in Ireland was modified through the 18th century, it persisted in some of the attitudes to and treatment of the native Catholic population, with echoes of colonial domination throughout the 19th century. The Yahoos appear as an ironic satire on colonial perceptions of the native Irish in *Gulliver's Travels* (published in 1726), characteristic of many stereotyped 'others' in classic colonial discourse:

> ....the Yahoos appear to be the most unteachable of all Animals, their Capacities never reaching higher than to draw or carry Burthens ... For they are cunning, malicious, treacherous and revengeful. They are strong and hardy, but of a cowardly Spirit, and by Consequence insolent, abject, and cruel… the Red-haired of both Sexes are more libidinous and mischievous than the rest (Swift, 1953, p. 285).

Routledge talks of the 'place-specific' character of popular protest and struggles resulting from the manner in which society endows space and its associated resources with a variety of meanings (Routledge, 1997, 1997a). Land ownership and occupation as the ultimate expression of space relations is and has been the focus of tensions and the site of resistance between powerful elites and comparatively powerless landless people in many parts of the world. Ownership and control of land formed the fulcrum of colonial power in Ireland, with increasing proportions of immigrant (Protestant) landowners in the 17th and 18th centuries. The close interrelationship between the ascendancy/gentry and membership of the Anglican Church, British army garrison and Irish administration in Dublin demonstrates this. Lester has also underlined the 'critical spatial dimensions' of colonial discourse (Lester, 1998, p. 3). In Ireland estates can be seen as manifestations of such a discourse, particularly in the case of the more extensive properties of some thousands of acres. More than 95 per cent of the island's land resources were held by around 5000 landowning gentry in the 1770s, much of which incorporated comparatively large extents of territory over which one owner exercised considerable power and control. The owner of such an estate in early 19th century Ireland had 'infinitely more control over its inhabitants than the government ... having it in his power to render the little world of which he is the centre ... miserable or happy according to the principles of management pursued' (Thompson and Tierney, 1975, p. 83).

Such landed estates provide good examples of the operation and application of knowledge and power by dominant elites, reflected in networks of gentry intermarriage, visiting and correspondence within elite circuits, symbiotic linkages with the colonial administration in Dublin and London, estate agency theory and practice, all consolidated by close cultural affinities with England and its gentry elite. Lindsay Proudfoot has recently placed more emphasis on the hybrid nature of gentry identity within Ireland and less on its colonial status, suggesting that gentry/ascendancy elites were not unique to Ireland but were part of a wider European post-enlightenment age (Proudfoot, 2000; 2000a; 2001). It is impossible, however, to ignore the ultimately colonial nature of Ireland's experience within Europe, the reality of England's first colony on its western doorstep in which many of its more distant colonial endeavours were first tested, and its general perception by London as a troublesome colony throughout the 19th century. To Edmund Burke in the later 18th century, Ireland provided 'a metaphor for the world beyond Dover, affording points of comparison which helped to explain events in places as far-flung as India or the Americas' (Kiberd, 1995, p. 19). The ethnic/cultural constitution of Ireland's landed elite (who participated in the European enlightenment largely through the filter of a British gentry) adds a putative colonial dimension to its relations of power in Ireland and to its dominant-subordinate relationship with the mass of the tenant

population. By the second half of the 19th century, it was becoming more and more a discredited, displaced and dispossessed elite.

Being very close to the heart' of empire, there was an intensity and immediacy in impacts of colonial and imperial discourse on Ireland. The central role played by England in 19th century world capitalism meant that the social upheaval which all peasantries have undergone was experienced acutely by the Irish. This exacerbated the dislocations brought about by the modernization of the economy as Ireland was rapidly subsumed within the ambit of discourses of improvement and the new political economy pressuring traditional resources. Landed estates and their farms and townlands were the settings for what Scott has characterised as everyday local resistance, small expressions of dissent, disrespect and protest (Scott, 1990).

Estates as colonial spaces

In terms of origins, a great many of the landed estates were part of an overt colonial enterprize in the 16th and 17th centuries – involving confiscation, plantation and colonization of the land of Ireland by British settlers. Those whose lineages were not grounded in plantation policy (such as Anglo-Norman manors or Gaelic territories of the 16th and 17th centuries) were by the 18th century locked into a transparently colonial world to which they had largely conformed in cultural and religious terms. Whether the owners were English/British (like Devonshire, Lansdowne, Palmerston, Abercorn, Fitzwilliam, Bath or Shirley) or Irish/Anglo-Irish (such as Downshire, Leinster, Leslie, Charlemont, Fingall), they were overwhelmingly part of a class and system which reflected the consequences, and supported the project, of imperial hegemony in Ireland. Members of the ascendancy and gentry commonly sent their children to be educated in schools, universities and law schools in England or to the Anglican environment of Trinity College, Dublin (established by Elizabeth 1 in 1595), and served in the army (especially the Indian army), navy and colonial administrations overseas. 'Insecurity and the England-complex remained with them to the end' (Foster, 1988, p. 194); like many other British colonials, Anglo-Irish gentry like Elizabeth Bowen saw themselves as 'a hyphenated people, forever English in Ireland, forever Irish in England' ... 'locked in misery between Holyhead and Kingstown [Dun Laoghaire],' (Kiberd, 1995, p. 367), a Kingstown whose placenames echoed with imperial ghosts -Wellington, Windsor, Carlyle.

Centres like Bath, Cowes and Cheltenham,[1] for example, comprised a familiar nexus of socialization for them. London and Dublin were foci of social, cultural and political life -though the Castle balls in Dublin by the

[1] On what is still referred to by many in Northern Ireland today as 'the mainland'.

1850s were 'no great affair' in the lofty (English) opinion of Mrs Shirley.[2] Gentlemen's clubs, like the Carlton and Garrick in London or the Kildare Street Club in Dublin, were important components in Irish gentry networks. Many Irish landowners maintained a house in London in the 19th century: Sir Charles Powell Leslie's four daughters required 'a spring-board' in London in 1872 and Stratford House was duly leased (Dooley, 2001, p. 48). Evelyn Philip Shirley's daughter wrote to him in Monaghan from their London house in Belgrave Square in 1832 to inform him that the city was beginning 'to fill some coming to attend the Houses of Lords and Commons and others to be ready for the Levy and Drawing Room which take place this week, the Drawing Room on Friday to celebrate the Queen's Birthday'.[3] Like their British counterparts, Irish gentry went on Tours of the continent, Persia, Egypt, India, Africa, collecting arts and curios for their mansions. They married strictly within their class and creed, regularly seeking brides in England; London was 'the Mecca for matchmaking' (Leslie in Dooley, 2001, p. 67) and adhered generally to a collective view of the lower (Irish) classes, which generally represented them as 'other' to their morally and culturally superior world.

In much the same way as colonial authority elsewhere in empire was written into extravagant panoplies of landscape and architecture, the houses and landscapes of even the most modest gentry landowner in Ireland reflected a world of privileged extravagance, where the norms of 'civilization' and social order were inscribed in avenue and mansion, parkland, parterre and planted vistas – from the 'crenellated extravaganza' of Lord Gosford's castle in Armagh built during the 1820s to the Romantic landscape created by Frederick Trench at Heywood in Queen's county in the late 18th century (Thompson and Tierney, 1976, p. 8; Proudfoot, 2000a; Friel, 2000). There were also interior 'texts' in plasterwork, art collections and *de rigueur* trophies of the big game hunt: the Duke of Leinster collected speckled cows to ornament his demesne and shells from around the world for his Shell House; all aspired to fashionable Italian art collections. Here were statements in stone or plantation to reflect status and power, to impress neighbouring gentry and to instil deference and respect in the local tenantry: 'there is nothing will keep the Irish in their place like a well-appointed mansion' (Banville in Johnson, 1996, p. 556). Even small county towns managed to reflect a discourse of empire in their monuments and streetscapes, as stages for the politics of performance by landowning county society marching troops, bands, and the flags and bunting of loyalty. The Dawson memorial in Monaghan commemorates Colonel Dawson's death in Inkerman in 1854. The town also contains a monument to Lord Rossmore and in the (Anglican) Church of Ireland there are memorials to

[2] Public Research Office of Northern Ireland (hereafter PRONI) Belfast, 0353 JlC/212 Shirley papers. Mrs Shirley (Ettington Park) to Evelyn Philip Shirley, 20 April 1856. Papers quoted by kind permission of Major Shirley, Lough Fea.
[3] PRONI, Cl31114 Frances Shirley to E.J. Shirley, 20 February 1832.

the sons of gentry killed at Ferozeshah (India) in 1845 and Isandula (South Africa) in 1879 (Duffy, 2004).

These architectural and landscape statements were settings for a symbolism in day-to-day relations of power. Turlough House in Mayo for instance had the tenants step through great French doors into the Library to pay the rent, with a doffing of hats and appropriate gestures of subservience. Tenants lined the streets of Maynooth to bow to the Duke of Leinster *en route* to Sunday church. Gatelodgekeepers into the early 20th century bowed to the owners passing through (Somerville-Large, 1995). Evelyn John Shirley held annual tenant dinners in the Great Hall of his house at Carrickmacross at which lectures on frugality and industry were given to the tenants favoured with invitations. The moral and economic improvement of what was often seen as a sluggish and ill-disposed tenantry was the well-intentioned objective of the landed, reflected in one agent's remarks: 'when the beautiful variety of surface, which this country affords, is now observed bleak, dreary, and naked; and then look forward to it covered with well built cottages, well laid out farms, and thriving plantations, with contentment and its natural companions good order, peace, and prosperity reigning around, surely everyone ought to be tempted to put his hand to the work' (Blacker, 1837, p. 63, 66). Vaughan has suggested that there was more to improvements than agricultural innovation; 'They were the means by which landlords justified their existence, imposed their power on the countryside and enhanced their prestige' (Vaughan, 1994, p. 120). Foster's suggestion that they were attempting to legitimize their situation in Ireland more than a century after initial colonization has been comprehensively tested in a number of studies by Proudfoot (1993; 1997). A recent essay by Whelan emphasises the manner in which a colonial imagination is reflected in Anglo-Irish perceptions of ruins in Ireland as 'materialities of the colonized's defeat' and commemorations of the disorder of the pre-colonial world (Whelan, 2004).

Titles and patronage to accompany landed power and landscape display were eagerly sought out and highly regarded by gentry. In a gossipy letter to his son on the home estate in Warwickshire, Evelyn John Shirley reported on the attendance at a ball in his Carrickmacross mansion in 1848, paying special attention to the social status of the guests:

> Lord and Lady Farnham and two Miss Stapletons, Lord Worcester and Sir William Russell and Lt. Fraser of the 70th.... Lord and Lady Fingall, and the Lady Plunkets and Lord Killeen, Lord and Lady Louth, Col Pratt and Mr and Mrs Chaloner and the Farrells, Ld Bellingham, Mrs Napier and two sons, Mr and Mrs Singleton came in a party of 21, and brought two beauties Miss Browns with their mother, and Mr and Mrs Coddington, two beautiful daughters etc, Major and Mrs McClintock, Mr and Mrs Olpherts, H

> Mitchell and daughter, Ruxtons, Longfields, Mrs Butler, Forsters (not Sir George or his daughter), Lucas's, Archdeacon Beresford and daughters, Lambarts, Winters, Smiths, G Filigate, C Fortescue, Sir P Leslie, Mr P Nicholson, Baronet Lestrange, Hawkshawe, Wooley, Proby, Folliott, Dillon, Lyle, Tipping, Wilman, Officers Capt Stewart, Lieuts Halfield, Coade, Hutchinson and Wassenbend of the 23rd Dragoons, etc etc.[4]

School, church, military and colonial service formed a network which cemented the solidarity of the landed elite. Towards the close of the 19th century, Castletownsend in west Cork was the setting for a close-knit community of a dozen Anglo-Irish families commemorated in many of the writings of Somerville and Ross: 'all Protestants, all suspicious of strangers and all completely sure of themselves ... Ireland continued to be divided neatly between US and THEM, and the ones who mattered in it, who made the place tick over at all, were undeniably US' (Fleming, in Scott, 2003, p. I). Most of the influential personnel on larger estates, such as estate agents, agriculturists, stewards, clerks and other senior officials were usually recruited from the landed/colonial class, and commonly from Britain (Dooley, 2001). Grooms, gardeners, cooks and other 'loyal retainers' in Carton, in Kildare, for instance, were imported. The behaviour of Leslie's Irish footmen who accompanied the family to London for Queen Victoria's golden jubilee, got drunk and ran down Oxford Street shouting 'to hell with your bloody old Queen' probably confirmed the advisability of selecting employees who empathized with the world of Queen and empire! (Somerville-Large, 1995, p. 335). Cecil Frances Alexander, who married the Anglican bishop of Derry and Raphoe in 1850, was the author of the hymn 'All things bright and beautiful'. One of its verses might be seen as an important paean to imperial order, celebrated by the Established Church and its gentry adherents in the 19th century and sung throughout the empire:

> The rich man in his castle/The poor man at his gate
> God made them high and lowly/Each to his own estate.

Though there were tenurial constraints on land ownership in Ireland, especially in the 18th century, landed gentry were ultimately the centres of social, economic and political power and patronage from the 18th and into the 19th centuries. The more influential of them were frequently the objects of respectful dedication of work by authors, publishers, surveyors, architects and artists. Taylor and Skinner's map of County Louth, for instance, was presented 'with gratitude' to Jn Foster Knight of the shire of Louth. Newly published maps of Ireland, or its counties, in the late 18th century, pointedly represented the place of landlord and gentry elite in the developing Irish landscape, by marking the residences

[4] PRONI, D353/1C/2/1. E.J. Shirley to E.P. Shirley, February 1848.

and mansion houses of gentry. In 18th and 19th century Ireland, as in England, the landed estate and its mansion was regularly used as a device in literary fiction to symbolise order and stability, especially a disorderly 'colonial' world like Ireland from Edgeworth's *Castle Rackrent* at the end of the 18th century, to the works of Somerville and Ross in the late 19th century (Edgeworth, 1800; Somerville and Ross, 1920; Bowen, 1942). The society of the estate, privileged by religion and culture, continued to represent an exclusive colonial world-view in the 19th century which reluctantly gave way to the majority colonized/nationalist community in the dying years of that century. But into the early 20th century, the now dispossessed Irish landed gentry continued to hark back to an earlier world, before Elizabeth Bowen's 'golden close of the British 19th century' (Bowen in Scott, 2003, p. 26), with Lady Fingall writing that 'Irish landlords lived within their demesnes making a world of their own, with Ireland outside the gates' (Fingall in Somerville-Large, 1995, 355).

Irish landowner identities were complex and far from 'seamless' (Proudfoot, 1993). In addition, the personalities of individual landowners often emerge as a significant element in topographies of resistance at estate level different owners having different management regimes, often dictated by different lifestyles and expenditures. Vaughan talks about the 'truculent meddling of Lord Leitrim', the 'paternal despotism' of Lord Fitzwilliam, 'hesitant fussiness' of the Gosford estate, the 'conscientious benevolence' of Hamilton, 'unbending integrity' of Mr Joly (Vaughan, 1994, p. 105). Moralistic paternalism, however, would characterize the generality of the landowners and associated gentry class (agents, clergy and military elites), with a growing penchant in the 19th century for regulation and control. Regulation and stricter management of properties was more characteristic of landed estates in the post-war recessionary period from the 1820s, in sharp contrast to the more lackadaisical approach to estate management in the 18th century. William Steuart Trench, the land agent, writing for an English audience in the mid-19th century, noted that if the landlord 'ventures to interfere with old habits, old prejudices or old ways ... he must be prepared to contend with difficulties which none but those who have experienced them could have imagined' (Trench, 1868, p. vii). On the other hand, absentee landlords, like Sir William Palmer with lands in Mayo, who took little interest in their estates and the tenants, left all to agents whose main focus was to get in the rent at all costs: the result was mistrust and antipathy between owners and occupiers.

Throughout the country there were innumerable instances of the estate as the arbiter of power and privilege, and a demonstration of 'civilization' and 'superior moral order' in operation. The law of the land was mediated through the estate's representatives: resident magistrates and justices of the peace were usually landowners or their agents and most landowners had ready access to and contacts in the centre of Irish administration in Dublin Castle like Sir William Palmer who wrote (from Wales) to the

Castle in 1847 seeking the erection of a police barracks on part of his Mayo estates to assist his agent in the collection of his rent (Byrne, 1996). County Grand Juries were composed of the propertied class who administered justice and local government. Throughout the 18th and 19th centuries, political representation (either in Dublin or Westminster) was seen as the automatic entitlement of the landowning classes. Networks of patronage emanating from Dublin Castle lent authority and influence to them, as well as ensuring their support: a typical government memorandum book of 1818 recorded details of patronage in Westmeath: Lieut. Colonel the Hon. H. Pakenham Lord Longford is a Representative Peer; is Custos Rotolorum of the County; is a Trustee of the Linen Board. He is brother-in-law of the Duke of Wellington. His brother, Admiral Thomas Pakenham has £1200 compensation as Master General of the Ordnance' (Jupp, 1973, p. 166). Charles Powell Leslie (also related to the Duke of Wellington), on losing the 1826 election in Monaghan to the pro-Catholic Henry Westenra, thanked his supporters and hoped that they would 'uphold what the state of your country, as well as that of the empire demands, the Protestant ascendancy in church and state'.[5]

Networks of patronage were also replicated at local level: William George Smith, clerk in the Shirley estate office in Carrickmacross sought a 61-year lease in 1839 from the agent for some property on the estate pointing to the benefits of favouring him:

> by making this purchase, I have...secured to myself and representatives after me the means of furthering in every possible way, the interest of Mr Shirley and his political friends, ... Should Mr Shirley think it right to consider this favour to me, ... Protestants having capital may by this example be encouraged to bring it to bear on the removal of his opponents and a class of persons might thus be induced to settle on his property who ... might hold in check, not only his enemies but those of the established institutions of the country.[6]

We can talk, therefore, of an estate system that was implicated in many of the predilections of colonialism – 'order', 'improvement', 'civilization', integrity, morality, industry, loyalty, subservience. Shane Leslie, author and landlord, in his novel *Doomsland*, likened the running of the estate to an old watermill: its business proceeded routinely from season to season: 'a hundred cogs moved and clicked in their place ... Agents, clerks, land-stewards, bog-bailiffs, gardeners, gamekeepers carried out dilatory functions. Wages, jointures, salaries, tithes, taxes, pensions, mortgages were paid' (Leslie, 1923, p. 25). Brenda Yeoh (2000) has documented the manner in which colonial governance in Singapore regulated and

[5] NLI Ms 1420 quoted in A. Doyle (2001, p.37).
[6] PRONI, 03531 C/3/116. Smith to Mitchell, Oct 1839.

regimented society and space to produce a western British expression of municipal order. Landownership in Ireland saw its role in much the same way as the colonial administration in India for instance, whose duty was 'to impose linearity and order on an ungovernable society' (Chatterjee, 2000, p. 20). It was supported by an increasingly bureaucratic State system which, up until the Great Famine in the late 1840s, largely unquestioningly supported the landowning elite in Ireland, manifested through networks of patronage and political preferment.

As disturbances and resistance increased in a variety of regions in the 19th century, the police and military forces of the state were expected to support the landed establishment. This support also traditionally extended to the Anglican (and what might be characterized as the colonial) church in its collection of tithes: proctors and process servers were backed up by parties of police and militia during the 'tithe war' in 1830s. Fourteen people were killed in Bunclody in County Wexford during tithe agitation in 1831, and 11 policemen were killed in Kilkenny disturbances in 1832 (Kieley and Nolan, 1992). Evictions near Woodford in Galway in 1843 were assisted by a force of 300 of the 5th Fusiliers, a troop of 4th Royal Irish Dragoons, a troop of 10th Hussars, and 200 policemen (Clark, 1979, p. 69). Thomas Drummond, who was appointed Under-Secretary for Ireland in the late 1830s, was a reformer who began the questioning of this alliance of landed elite and state with his observation on property having duties as well as rights. Only gradually, as the 'land war' intensified after the Famine did the State contemplate withdrawing such unconditional support for Irish gentry.

Perspectives On the Colonized

Although like the landowning elite, the largely Catholic farming class was also far from being a seamless community, in general, gentry perspectives tended to simplify and collapse all into a collective colonially-inferior status, usually tinted by anti Catholic prejudice. Into the late 19th century, the gentry had a real horror of intermarriage with Catholics of any hue, reflected in the novels of Somerville and Ross. Indeed the marriage of Shirley's younger son to a Dublin Catholic in the 1850s precipitated a family crisis. Looks, accent, dress and general deportment were seen as important markers feeding into a universal representation of peasantry as other, characterized in recurring terminologies of 'ill-disposed', 'slothful', 'wild', 'wily', 'cunning', feckless etc. Trench's favourite metaphor for managing tenantry was 'harness,' to restrain a population, which he characterized as 'docile and easily led', and generally obedient to their superiors, yet 'when once assembled in masses .... they become capable of the wildest and most frenzied excitement' (Trench, 1869,70).

Even in the late-19th century, some of the writings of Somerville and Ross depicted networks of gentry houses sprinkled through landscapes which were the settings for hunts and elite outdoor pursuits and were

peopled by an array of tenantry, distinguished by subservience, humour, slyness, 'blarney' idiosyncratic 'difference' looked down on from the saddles of the Galway Blazers or the Rosscarbery Hunt (e.g. Somerville and Ross, 1901). Social distanciation helped to reduce individuals to a uniform mass, invariably seen through a coach window, from horseback, or through the colonial lens of the press. Thomas Carlyle was confirmed in all his imperial prejudices about the Irish during his Famine visit. From the upper platform of the mail boat to Ireland, he observed five or six typical degenerated 'physiognomies' one 'a lean withered slave of a creature with hairy brows, droop nose, mouth corners drooping, chin narrow, eyes full of sorrow and rage', all 'with the air of faculty misbred and gone to waste' (Carlyle from 1882 in Crowley, 2003, p. 163).[7]

Trench while agent on the Lansdowne estate was captivated by a peasant girl in terms which have many of the characterizations of 'Othering', justifying her attraction to him by separating her from his class view of the local peasantry putting her in an altogether more acceptable category:

> She had but little of the original Celt in her features. Her beauty was purely Spanish, of which I have seen many perfect specimens in Tuosist and around Kenmare: large soft eyes, with beautiful dark downy eyelashes, the mouth well formed, and cheek of classic mould ... The form which now stood before me was a beautiful specimen of this perfect Spanish type ... her hands were clasped in an attitude of wild supplication ... she was perfectly natural and simple, and ... so intelligent a girl as she was could not possibly look at her reflection in one of her own dark mountain lakes and not see that she was different from her neighbours ... She had watched my countenance with the quickness of an Irish peasant during the whole time she was speaking (Trench, 1868, pp. 76-77).

E.J. Shirley in the mid 19th century held many of these opinions of his Irish tenants. Like many others in Ireland, he was an English landowner with an estate in Warwickshire; his overcrowded and sprawling Irish property with its 20,000 population must have appeared to him as a colonial outpost, many of whose inhabitants he sometimes considered a wild and fickle rabble. On the other hand, it also had an exotic attraction which drew him every summer from the late 1820s, and he commenced to build an extravagant mock Tudor mansion in the 1830s. Like Lord Farnham of Cavan, Lord Roden in Down and many others, Shirley saw himself as superior guardian of his tenantry and the moralistic paternalism of his many utterings were regularly published on handbills and addresses for dispersal throughout his estate, reflecting an outlook

[7] Thomas Carlyle, *Reminiscences of my Irish journey* (London, 1882) quoted in John Crowley (2003). I am grateful to John Crowley for permission to refer to his doctoral thesis.

expressed by Lord Lansdowne in 1870: 'the longer I live the more firmly do I believe in blood and breeding' (Lyne, 2001, xliii). One of the law officers on the Shirley estate probably fairly represented the gentry perception of the mass of the tenantry at the height of a rent strike in 1843:

> people are still hanging back and *skulking* behind the *pretension* of danger to themselves or property if they pay their rent; ... but this feeling has its origins in the *baseness of character* so very prevalent in the *absence of right moral principle* .... [emphasis added][8]

Ignorance, sloth and cunning were common traits attributed to Irish tenants by their superiors in the 19th century and may be illustrated by excerpts from private correspondence between members of the landowning gentry, reflecting an essentially internal discourse not intended for public consumption. Writing to Lord Wilburton in 1850, in relation to the management of the neighbouring Bath estate, Shirley suggested that *'vigorous measures* to obtain rent .... are *absolutely necessary* in dealing with the "Celts of Farney", most of whom only pay by compulsion ... The people are very quick and cunning, … many of the tenants are idle and reckless and in some instances neglect all improvement.'[9] Trench in considering the offer of the Bath agency wrote about the principles which he adhered to in running estates: that he would 'place these wild and uncivilized people sufficiently under his command that he can force them by a judicious mixture of firmness and kindness with the duties and responsibilities of some approach to civilized life.'[10] He further emphasized this approach a month later, significantly manifesting some fundamentals of colonial discourse: 'nothing impresses a wild though intelligent and cunning people with more confidence in a superior, than his at once showing them that he is accurately acquainted with the whole subject in hand and nothing tends to anarchy and confusion as even the *appearance* of indecision or ignorance'.[11] Thomas Derby an English land agent in Tipperary wrote to Trench about the necessity of assisting emigration off landed estates: 'so as to strip off the *Rubbish* (may God forgive the word, but I speak only in the way of utter want of intelligence, industry and hopelessness of improvement) and preserve a sufficiency of stock of an improvable kind.'[12]

The Ordnance Survey Memoirs, written in most cases by English military officers, contain comprehensive and valuable accounts of rural economy

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[8] PRONI, 0353J1C13/5. Sudden to Trench, 5 May 1843.
[9] Longleat Library. Bath papers, Irish Box iii. Shirley to Lord Wilburton, 19 September 1850. Quoted by kind permission of the Marquess of Bath.
[10] Longleat Library. Irish Box iii. Trench to Lady Bath (encl.), 21 December 1850
[11] Longleat Library. Irish Box iii. Trench to Lady Bath, January 1851
[12] Longleat Library. Irish Box iii. Enclosed with Trench to Lady Bath, 26 February 1851.

and society in the north of Ireland in the 1830s. They often betray the external and elite background of the authors in their frequent representations of local communities as primitive and indolent, indicting them for their tendencies to abandon the harvest for a wake or a wedding or fair. 'Would that the habits of industry and the desire of accumulation, which so generally prevails in the sister kingdoms, could be imparted effectually into the minds and disposition of this wretched and deplorable peasantry' …… 'A glance at the wretched hovels, scantily covered with straw, surrounded and almost entombed in mire, which everywhere present themselves... sufficiently testify that the total absence of all activity in industry is one source of the wretchedness and misery which almost overwhelms the land' (Day and McWilliams, 1998, Parish of Laragh 44; Parish of Currin 93). Carlyle searched (Europe's) imperial outposts for landscapes analogous to what he saw in the west of Ireland: 'Claddagh as like Madagascar as England. A kind of charm in that poor savage freedom' (Crowley, 2003. p. 165). Outside observers were universally impressed with 'the laziness and idleness' of estate tenants, the 'vivacity of the Celt and a portion of ... sloth and cunning'.[13]

Shirley's annual addresses to his tenants prior to his return to his Warwickshire estate were imbued with well-meaning paternalism which advocated, for example, 'an encreased degree of *improvement, comfort and respectability*. To promote this and to encourage a love of *order, tidiness and cleanliness* is the anxious desire of my heart' and deprecated 'the scenes of drunkenness too often exhibited in market and fair days in Carrickmacross'.[14]

He was concerned with the general indolence of his tenants:

> Now it is my duty to tell you that you do not value your time... I saw numbers of the tenantry lounging and idling about, their turf still in the Bog, their Hay still uncut, and the weeds growing plentifully... Pro. ch XV, verse 19, 'The way of the slothful man is as a hedge of thorns'[15]

Like many of his peers, Shirley planned to appoint a Moral Agent (who was an English army officer) for the estate in 1839. Lord Farnham in Cavan had his estate divided into districts in 1830 to facilitate its 'moral management'. William Krause, born in the West Indies but living in England, was his Moral Agent from 1826 and 1838, whose duty it was to 'free Roman Catholics from bondage'. The lives of the tenants were closely monitored by him and illicit distilling of poitín was prohibited on pain of eviction, while bawdy ballads and vices such as swearing, gambling and dancing were forbidden. Evangelical Protestantism was

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[13] Estate agent Barbara Verschoyle to Lord Fitzwilliam, 1801, from W. Nolan and A. Simms (eds), (1998, p. 132); *Greig's Report on Gosford Estates*, p. 104.
[14] PRONI, D3531/C/3/1/7, Shirley draft address, November 1839.
[15] Handbill, November 1838, quoted in Broehl (1965), p. 44.

instinctively linked with social and economic progress, in the same way that Irish Catholic culture was associated with backwardness and inefficiency (Hill, 2002, pp. 78-79). A similar concern with moral welfare drove Trench, while agent on the Lansdowne estate in Kerry, to eject a tenant who had moved in with the daughter of a neighbour and married her a year later: as well as contravening the marriage law of the estate, they were condemned because they had 'committed fornication together'.[16]

The Marquis of Downshire kept himself well informed on his tenants' behaviour, frequently engaging in tours of inspection: 'Wilson the Master of B.macbrennan School does not do enough for his Wages ....he seems sleepy and has few Scholars, Schoolroom dirty and full of dust and very untidy.' 'Two persons named Orr live in a wretched hole with four acres .... The man came out to me without his breeches. They should not hold land' (Maguire, 1974, p. 141). In the age of Malthus and Darwin, natural science provided Downshire and others with ready metaphors for lessons on moral and economic improvement, with references to weeds and corn being suitably biblical in tone: 'Luxuriant as is the Growth of Good Crops, as well as noxious Weeds, the plant Truth is of dubious growth & its offspring, plain dealing and openness are often stifled in the Birth' (Maguire, 1974, pp. 153-54). Trench and others frequently reached for animal analogies to depict the state and character of many of their tenants 'superabundant rabbits' .... 'locusts,' whose campaign of protest against the Lansdowne estate was dampened by cold and wet weather by which they were 'daily driven into their burrows' (Lyne, 2001, p. 301).

Regulated Space

Power and authority produces and regulates space and place and its occupants, surveying and territorializing it, and imposing discipline through, for instance, controlling movement within it. Space thus becomes the setting and catalyst within which authority may be challenged or resisted. One of the great preoccupations of estate management in the 19th century, especially in the years after the end of the European war, arose from pressure on land and questions of population control, management and regulation of access to land. This formed a universal context for 19th estates as contested landscapes in 19th century Ireland. Although for a great proportion of the peasantry and small tenants, it was the larger (middleman) farmer who sublet land to them, the 19th century saw the gentry owners of the land intervening to reorganize and re-establish order in landholding relations.

From the perspective of landowners and land agents, regulations were aimed at rent control and payment, shortening leases, subdivision and subletting of farms, restrictions or control of access to other local

[16] Kenmare estate minute book, quoted in G. O'Connor, The Lansdowne estate, 1848-58: the Poor Law, emigration and estate management, unpublished MA thesis, University College Dublin, 1994, p. 121.

environmental resources (such as woodland, bogland, rivers, lakes, mountain), sale and transfer of farms, improvements in farms such as enclosures and squaring of fields, improvement in houses, as well in some cases as the education and general moral behaviour of the tenantry. At local estate level, manor courts frequently operated to implement estate rules and regulations, and fines and punishments designed to order society and landscape within its boundaries.

Most of the proactive intervention took place as early as the mid-18th century on the best land, with some belated interest in the marginal western lands in post-famine years. Estates with the most active intervention in lives and landscapes of their tenants reaped a legacy of hostility especially in post 1820s and were subsequently execrated in folk memory. Agents like Mitchell, Trench and Morant on the Shirley estate, or Lord Palmer or Lord Lucan in Mayo enforced estate rules and earned a reputation as exterminating landlords. It was Trench's somewhat exaggerated belief that the 'careless, spendthrift, good-for-nothing landlord, who hunts and shoots, and drinks and runs into debt, who ever exacts the most exorbitant rents from his tenants, provided only he does not interfere with their time-honoured customs of subdividing, squatting ... and reckless marriages, may live in peace ... in high favour with the surrounding peasantry' (Trench, 1868, p.47).

Rural population growth expanded rapidly in the poorer regions where there had been little 'colonial' interest or commercial incentive to manage properly and on less supervised spaces such as back lanes, bog edges or roadsides where squatting prevailed: on the Midleton estate in Cork in the 1840s, for example, a subtenant of 37 acres had allowed 45 cabins on the side of the road; on another 60 acre farm, the tenant had allowed 98 cabins to be 'thrown up' on the sides of the road (Donnelly, 1975, p. 13). Shirley's 26,000 acre estate in Monaghan had a population of some 20,000 in 1841 approximately 3000 tenants and 600 cottiers. Palmer's 80,000 acres in Mayo supported 23,000 in 1841. Lord Lansdowne's 96,000 acres in Kerry had a population of approximately 17,000. In these regions and places, landowners who were by inclination and politics doctrinaire Malthusians by the 1820s, were keen on relieving their properties of the burdens of excessive numbers of people.

'The tenants big and little are too much in the habit of subdividing their holdings, selling and setting, chopping and changing as their will leads them, defying me and my regulations' (Maguire, 1974, p. 142). Subdivision of farms among family members and subletting portions of farms to cottiers were prohibited outright on most landed estates. The Devon Commission of enquiry into agrarian conditions in Ireland (1843-45) was heavily preoccupied with the enforcement of rules about subdivision, which even on the most well managed estates were more honoured in the breach than the observance. Most leases had clauses prohibiting these practices on pain of eviction but until the 1820s and

1830s strict enforcement was rare:-references to 'nests' and 'swarms' of cottiers are regular occurrences in contemporary estate correspondence. But by the mid-19th century a great many landowners were unable or unwilling to provoke the hostility of the local population by intervening in cases of subdivision. The 'cold fear of provoking agrarian outrage' restrained many landlords in their regulation of tenantry (Donnelly, 1975, p. 54). In many cases it was difficult to police the enormous populations on the larger estates. Advisors like Blacker and Trench suggested that estate managers undertake thorough surveys of their properties including details on the circumstances of each tenant and the condition of their farms, houses, offices and stock, as well as the numbers and ages of their children. Regular reviews would help to 'distinguish and encourage the deserving' (Blacker, 1837, p. 4).

The links between tenant marriages, demographic growth and farm structures were well known to have repercussions on the future well-being of estates. Subdivision of farms, for instance, inevitably followed marriages of family members and many proprietors assumed rights to oversee the marriages of their tenants. Elizabeth Smith, lately arrived from Scotland, was aghast in 1839 at the careless manner in which tenants in Ireland married without reference to their landlord, frequently setting up home in outbuildings (Trant, 1997, p. 49). Shirley in the 1830s ineffectually admonished his tenants for subdividing ... 'abstain from leaving in your wills what is not yours to leave', and on both the Shirley and Bath estates marriage regulations, by which licences had to be obtained from the agent before going to the clergyman, were in place up to the 1860s. In 1842 Shirley had a handbill posted throughout his estate addressing the marriage issue in strident Malthusian terms:

> The necessity of consideration before engaging in marriage is self-evident... remember that you injure your neighbours by throwing upon them the burthen of supporting those whom you ought yourself to support.....taking employment and food from those who already have not enough...Keep animal impulses under the control of reason.[17]

Lord Palmer also enforced rules regarding marriage and families sharing houses in the post Famine period, in one case demolishing a house and confiscating crops in 1864 for contravention of the rules (Byrne, 1996, p. 61). From the Famine onwards there was growing local resentment and resistance to these interventionist policies.

The organization of surveillance and information networks on estates became increasingly repressive in the 19th century. Local informants such as 'keepers' and 'watchers' were responsible for informing the estate on

[17] PRONI, D3531/B/1. Farney Bubble Book,, printed handbill September 1842.

the progress of tenants' crops and other activities, preventing some from selling off at harvest time and absconding without paying rent, as well as searching the premises of defaulting tenants. Tenants were alert to the presence among them (in chapel congregations, for instance) of landlord-favoured tenants, employees or others such as gamekeepers and Royal Irish Constabulary men who acted as the 'eyes and ears' of the estate. The Bath tenants petitioned the agent in 1849 for the abolition of the 'odious system of placing keepers on their property'.[18] Many estates with absentee owners, however, such as Crown estates, did not have as effective a knowledge of their tenants' affairs (Scally, 1995).

Bailiffs, grippers and process servers applied the rules of the estate, driving off the livestock of defaulting tenants or making arrests. Trench, land agent at different times on the Shirley, Lansdowne and Bath estates, made it his business to become acquainted with every aspect of the estate he was on and regularly boasted in the 1850s that: 'a mouse can hardly move [or a dog cannot bark] on the estate without my knowledge.' Indeed Trench himself had earlier considered the application of some of the regulations in 1843 to be rather too rigorous on the Shirley estate, provoking a rent strike and other disturbances. He highlighted a range of penalties all aimed to keep the tenants, as he put it, 'tightly to their traces'. Decrees were taken out at the quarter sessions against defaulting tenants, and if the rent was not paid promptly, arrest and imprisonment followed, with 'ruinous expenses and loss', ensuing for the tenant.[19] This period of increasing imposition of regulations and reform on estates coincided with post-war depression, rising arrears, falling rents and Poor Law taxation increasing pressure on tenants. And it resulted in rising opposition and resistance, with sporadic and largely uncoordinated outbreaks of violence, burnings and maiming of cattle being extensive in the 1840s. Regular 'outrage reports' were made to the government by the constabulary from the counties concerned.

With the intensification of modernization processes, the century thus witnessed a collision of the small tenant farmers' 'moral economy' and its traditional and customary relations with the land, with the expanding market economy of Britain into which the landed estates were locked. Restrictions on such ancillary resources as turbary or woodland, with fines for what Trench referred to as 'misconduct and disobedience' (see also Lyne, 2001, p. 262) became common, as estates determined to extract maximum value for all aspects of the property. The attitude of management to goats, for example, regarded as an animal of the poor and marginal, sums up the clash between poverty and improvement. The capacity of goats to eat newly-planted hedges, usually given gratis by interested landowners as an encouragement to tenants to enclose newly-squared fields, led to regulations to restrict them. Lord Leitrim, Shirley

[18] Longleat Library, Irish Box iii. Kennedy to Lady Bath, 5 July 1849.
[19] PRONI, D35311S155 Shirley papers, Trench's report, reproduced in Duffy (1997).

and others, prohibited many of their tenants from keeping goats. These restrictions of marginal economic activities of tenants were regarded with hostility by tenants and Shirley was still remembered as a 'bad landlord' by schoolchildren in 1938 for this reason.[20]

Economic change which followed colonialism in southeast Asia in the early 20th century had precedents in 18th and 19th centuries Ireland, where all the resources of the land which had traditionally been part of communal ownership, commonages, wastelands, woodlands, fisheries, and in Ireland's case turbary and rundale farming in the western regions - were appropriated by landlord estates, whose property rights were enforced by the colonial state's militia and courts (Scott, 1976; Kiely and Nolan, 1992, pp. 472-474). In South East Asia, as in Ireland a century earlier, this inequality in access to land resources was exacerbated by rural population growth leading to everyday forms of resistance organised on a kinship and territorial basis – boycotting, strikes, assaults, rioting, destruction of property (Brass, 2000, p. 133; Clark and Donnelly, 1983, p. 7). Modernization of agriculture on Irish estates in the 19th century involved improvements designed to eliminate joint tenancies, rundale settlements, consolidation of tenant holdings, prevention of subletting, restriction of access to turbary, woodlands, game, generating resistance by tenants which echoed agitation and repeated the practices of earlier generations of rural protesters: 'we, levellers and avengers for the wrongs done to the poor, have unanimously assembled to raze walls and ditches that have been made to enclose commons' (Bric, 1985, p. 153).

Estate management regulations were devised to compel acquiescence by a sometimes recalcitrant tenantry and formed the context for resistance on more and more estates during the mid-19th century. Such growing resistance meant that estates had to be judicious in dealings with tenants, lest as Trench expressed it in terms of traces and harness, 'that they must needs go steadily forward, or else by some violent plunge break through all restraint' (Duffy, 1997, p. 116). By the 1870s, tenant resistance in much of the country disabled many management initiatives: on one estate in Limerick the bailiff refused to serve notices to quit in 1878 because he was afraid that the tenants 'would do away with him' (Donnelly. 1975, p. 196).

Strategies of Resistance

Most features of agitation and protest evident on Irish landed estates reflect closely the various stratagems of subordinate resistance examined by Scott (1990). The public performance of subservience, putting on a show of humility, masking true feelings or flattering to deceive as rituals of subordination are characteristic responses by the comparatively powerless, 'the colonized native who understands that because his

[20] Vaughan, *Landlords and Tenants*, p. 104; Irish Folklore Department, Schools Collection, Magheracloone parish schools.

security depends upon compliance with the system he needs to display total loyalty' (McLoughlin, 1999, p. 202). And this confirmed elite perceptions of the subordinate other/natives as innately deceitful, evasive, fickle, and cunning. In this way what was characterized as 'oriental inscrutability' made the real Burman discourse inaccessible to the British (Scott, 1990, p. 35). (Similarly the intentions and attitudes of the colonial world, as exposed in the private correspondence of the Irish landowning elite, for instance, were equally unknown to the local community.) Disguise and anonymity, therefore, are the hallmarks of subordinate protest: use of anonymous threats and intimidation in circumstances 'where any open, identified resistance to the ruling power may result in instant retaliation', means that the regulations of the powerful can most effectively be countered by the anonymous threat of violence intended, for example, to 'chill the spine of gentry, magistrates' (E.P. Thompson in Scott, 1990, pp. 148-149). Coded signals of resistance, especially in songs, ballads and folktales, where the real object of protest is mocked with irony or satire, represent another form of hidden resistance which has been used in Ireland. Universally, pressure by dominant classes on traditional rights with restrictions on local access to resources, are countered in a range of 'down-to-earth, low-profile stratagems designed to minimize appropriation' (Thompson in Scott, 1990, p. 188; see also Brass, 2000, p. 130): theft, pilfering, shirking, evasion, foot dragging, sabotage of crops and livestock, arson, flight, poaching, squatting, beating gamekeepers and other representatives of authority, for example. In the eyes of the dominant/colonial elite, many of these stratagems of resistance are not the consequences of application of arbitrary power but 'of the inborn characteristics of the subordinate group itself who are by nature lazy, lying and unreliable (Scott, 1990, p. 37).

Passive resistance in 19th century Ireland was most classically exemplified in the 'boycott', which characterised the climax of the breakdown in gentry-tenant relations during the Land League disturbances in 1880. Captain Boycott was the land agent on Lord Erne's estate in county Mayo who was ostracized by the local tenantry ('boycotted') during a rent dispute. He imported some hundreds of Orangemen from south Ulster to assist with his harvest, guarded by some 1000 troops in an ultimately futile demonstration of landlord power. 'Combinations' such as this were a flagrant challenge to the authority of the landowning establishment: 'it is always the spectre of an open rebellion by the peasantry which haunts the conscience of the dominant classes in agrarian societies and shapes their exercise of domination' (Chatterjee, 2000, p. 22).

Between 1800 and the Great Famine, the government passed 35 Coercion Acts to control lawlessness in Ireland, mostly collective violence in rural areas (Clark, 1979, pp. 66-67). In 1827 for example, magistrates in Tipperary petitioned the government on two occasions to

implement the Insurrection Act which imposed curfew from sunset to dawn (McGrath, 1985, p. 275). The estate which increasingly controlled and restricted access to land was at the coalface of these local resistance strategies. They ranged from passive non-cooperation, through anonymous night-time protests, rent strikes, intimidation of estate employees, to the murder of landlords and agents. Earlier practices of protest were resurrected cropping of horses and maiming of cattle, destroying crops, firing shots, attacking and burning houses, levelling fences, burning turf stacks, administering oaths to secret societies, as well as erecting gallows, digging open graves, and despatching threatening letters and placards.

Protests on the Shirley and Bath estates in the middle decades of the 19th century involved many of these kinds of tenant resistance to the management regime on these two extensive properties. The agents on both estates were long aware of the potential for tenant protest, as far back as 1795 warning that to guard against a 'combining disposition in the tenantry', leases should not be allowed to expire at the same time over the two estates.[21] There was a constant awareness on the part of the estate administration in the mid-19th century of the presence of a stratum of insubordinate tenantry: in 1850 Shirley's visit to the agricultural show was a measure of his (un)popularity -'some tried to give me a cheer on going into the show ground which was so poor an attempt I may say it failed. There were not enough Tenants and the *rabble* of course did not care about joining'.[22] Trench reported to Lord Bath in 1853 on the 'mob of reckless paupers' on the estate.[23]

In the 1830s, Shirley's commitment to improving the general education of the tenantry was evident in his public exhortations to improve their moral and social behaviour. With the help of the Kildare Street Society, which was actively committed to proselytism, he established a number of schools, which emphasized bible reading, on his estate:

> the word of God is important. For this end I have provided for the Protestant the authorised and for the Roman Catholic youth, the Rhemish version ... I hope the time is not distant when the native Irishman will be brought to obey the divine command to 'search the scriptures' and to consider it his right as a human being, his duty as a Christian and his *privilege* as a *British subject*.[24]

The reaction by the tenants demonstrated the effectiveness of 'combination' in protest, as well as the role of the priest as leader. The

[21] PRONI, D3531/A/4. Observations on future letting of estate by Norroan Steel, November 1795.
[22] PRONI, D3531/C/2/1. EJS to EPS, 1 September 1850.
[23] Longleat Irish papers, Bath estate annual report, 1853.
[24] PRONI, D3531/C/3/1/7. Draft address of E.J. Shirley, 14 November 1839.

Roman Catholic clergy were opposed to what was perceived as proselytism by the estate. One of the schools, held in a Catholic sacristy by the clerk of the chapel who was paid a salary by the estate agent, was abandoned by most tenants. Schoolmaster and priest brought their case to the petty sessions in Carrickmacross where both magistrates, agents of the Shirley and Bath estates, supported the continuance of the school. In consequence, the local community, in the words of the priest, 'took the law into their own hands, came at night in a body and levelled the sacristy to its foundations ... scattering to the winds all the bible and proseletyzing tracts' (Ó Mearáin, 1981, p. 409). Several other estate schools were attacked in similar fashion and their (predominantly Catholic) teachers beaten. Such demolitions were not uncommon in other parts of the country in the 19th century. In 1839 when the parish obtained a grant to establish a national school in the chapel yard, the land agent initially prohibited the supply of building materials from any part of the Shirley estate. Neighbouring parishes, however, provided assistance with a convoy of carts during the night and, in the words of the parish priest, 'on the following day as much stones, sand and lime were left on the ground as built the schoolhouse' (Ó Mearáin, 1981, p. 409). Soon after, Shirley cooperated in the granting of sites for a number of national schools on the estate.

Alexander Mitchell's agency of the Shirley estate from 1830 was accompanied by the gradual tightening up of management and control of the property. Rents were enforced by impounding the livestock of defaulters, or by putting them in gaol. Fuel rights from turf bogs were an increasing concern to Irish landowners especially where cottier populations had escalated. Bog rents were imposed on the Shirley estate in the early thirties and bog tickets had to be purchased in the estate office. Furthermore, lime rents for limestone burnt in kilns on the estate were enforced. 'Raising the coppers' was a book-keeping practice adopted by the office in which rents and other charges to the tenants were rounded up to the shilling. Both practices Trench later agreed, represented 'close shaving' by the estate to boost income, which only served to aggravate the tenants (Duffy, 1997, p. 114).

These impositions were the cause of an outbreak of protests in 1843 following Mitchell's sudden death. His death was signalled by a rash of celebratory bonfires on the hills of the estate. Bonfires were universal signals of dissent and protest in many parts of rural Ireland. A large public demonstration was arranged to meet the new agent William Steuart Trench, demanding a reduction in rent: 'down with the coppers', 'we'll stand the grippers no longer', 'we'll hang the keepers' (Trench, 1869, p. 79). In April and May of 1843 the disturbances continued on the estate with a rent strike and bog protest by the tenants. Anonymous placarding took place throughout the estate, the police informing the office that one had been posted on the chapels: 'On Tuesday the ninth of May let each person go to his Bog to cut his Turf, it is the advice of John Lattitat (sic)

-let there be a water pool ready for the bog trotter'.[25] Latitat was a legal device, bog trotter was the bog ranger. Anonymous placarding was a popular medium of protest on the Lansdowne estate in the 1850s as well as in many other estates (Lyne, 2001, pp. 294-296; Kiely and Nolan, 1992, p. 468).

The estate retaliated vigorously with notices to quit and impoundment of the cattle of defaulters. Shirley found himself the centre of national attention in defending landlord rights. On application to Dublin Castle, a troop of horse and company of infantry were despatched to Carrickmacross to support the estate. Attempts to post ejectment notices on a chapel in the estate by estate officials, accompanied by police and military, were signalled by bonfires and accompanied by jeering crowds. More troops were sent from Carrickmacross, the Riot Act was read, and soldiers opened fire killing a tenant.[26] Driving in the cattle of rent defaulters, accompanied by police, bailiffs, the agent and three or four magistrates turned into a farce, as Trench described it in his memoirs: 'Not a hoof nor a horn was left in the countryside', as all the cattle had been spirited away by the tenants, and a forlorn little heifer was all that they succeeded in driving to the pound to the 'jeers and laughter of the populace' (Trench, 1869, p. 85).

In the following months, the agitation escalated with violent attacks on bailiffs and other officials connected with the estate. Drivers were threatened in anonymous posters: 'We will dissect you alive – life is sweet'.[27] At night the Molly Maguires took to the roads compelling the support of the tenantry and intimidating bailiffs and drivers. In Trench's words, the Molly Maguires were:

> stout active young men, dressed up in women's clothing, with faces blackened; or otherwise disguised; sometimes they wore crape over their countenances, sometimes they smeared themselves in the most fantastic manner with burnt cork ... to suddenly surprise the unfortunate grippers, keepers or process-servers, and either duck them in bog-holes, or beat them in the most unmerciful manner (Trench, 1869, p. 85).

The terror imposed by such groups, often recruited from neighbouring estates, is well reflected in a plaintive letter to the estate from a tenant seeking arms for his defence against what he called the Bundoran Girls:

> I take the liberty to inform you of the dangerous state I am in. On Monday I went down to Coraghy to see Mr Shirley's house, as I was proceeding home I espied ...

[25] PRONI, D3531/C/3/5. Gibson, 8 May 1843.
[26] Based on Trench, *Realities*; Broehl, *Molly Maguires*; and PRONI. Shirley papers, C/3/5.
[27] From Farney Bubble Book, Shirley papers, cited in Broehl, *Molly Maguires*, p. 54.

> some women looking earnestly at me one of them started up the road before me ... When she came some distance, I saw a number of women standing along with her. But they were men in women's clothes. Were it not how I proceeded in haste through the country I really believe I would have been murdered for the Bundoran girls were marching through Cornenty the same day. The reason I would be beat is it is reported that I am one of your Honor's bog bailiffs.[28]

In the end, on Trench's advice, Shirley conceded most of the demands of the tenants – many of the impositions and charges were removed or reduced.

In 1849 Shirley embarked on a series of evictions which, attracted the attention of the Nation newspaper and became a *cause célèbre* in Britain and Ireland. Offers of passage to America were made to some of these tenants, but the evictions were frequently resisted by barricades and pailfuls of boiling water thrown at bailiffs from inside the houses.[29] In these post-famine years, as pressure was exerted on the tenantry by the landowners, agitation and intimidation spread throughout the region with the result that the county was proclaimed and subject to special police provisions. Disturbances spread to the neighbouring Bath estate in 1851, coinciding with the arrival of a new agent (Trench once more), who embarked on a programme of ejectments, assisted emigration and clearance of rent arrears. A handbill was posted, according to Trench, on every Catholic chapel on the estate:

> To Landlords, Agents, Bailiffs, Grippers, process-servers, and usurpers or underminers who wish to step into the evicted tenants property, and to all others concerned in Tyranny and Oppression of the poor on the Bath Estate
>
> TAKE NOTICE
>
> That you are hereby (under pain of a certain punishment which will inevitably occur) prohibited from evicting tenants, executing decrees, serving process, distraining for rent, or going into another's land, or to assist any tyrant, Landlord, Agent in his insatiable desire for depopulation.... (Trench. 1868, p. 126)[30]

Many of the Bath estate officials were in constant danger during the 1850s from unknown elements in the tenantry. Trench and his son

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[28] PRONI, D3531/P/3, undated, [c.1844).

[29] See Broehl, (1965), p. 66.

[30] Trench, 1869, p. 126. As Kevin Kenny (1998, p. 15) has suggested the text of this notice was probably edited by Trench.

usually moved about the property (as they also did in their land agency in the King's County) with 'a brace of pistols' and a police patrol; Trench was convinced of what he called a conspiracy of Ribbonmen determined to assassinate him. His *Realities of Irish Life* contains a reconstruction of his mock trial by disaffected inhabitants of the estate.

By the late 1840s the tenantry were beginning to resort to democracy in their campaign of resistance throughout the country. Lords Palmer and Londonderry issued eviction notices to tenants who had refused to vote in the 1852 election in accordance with the instructions of the estate administration (Byrne, 1996, pp. 57-59). Poor Law guardians were elected to the workhouse by rate paying tenants who increasingly ignored the estates' directions to support their candidates. The Shirley correspondence from 1850 is preoccupied with this shift in the balance of power, E.J. Shirley fulminating in August about the election of Guardians 'who can hardly write their names and who cannot read'. In January he complained indignantly about the election of a national schoolmaster as Master of the workhouse. His agent George Morant was there 'and exclaimed against this election but of course that was of no use ... as he was the only dissentient. Kennedy of course [the Bath agent until late 1850] voted with the mob, no gentleman but George was present, he now is about to write to the Commissioners to ... try to get them not to sanction the election'.[31] The hostile *Dundalk Democrat* summarized the changing balance of power, noting that Shirley,

> had no power in the workhouse of Carrickmacross, for you have deprived him of all authority. His agent, when he storms and threatens in it, is only laughed at; and it is but a few weeks since a vote of censure was passed on him for his unmannerly conduct and English insolence to those guardians whom you have returned to protect your interests.[32]

A petitioning system, introduced during Trench's agency on the Shirley estate in 1843, represents an important formal encounter between tenant and landlord and illustrates many of the elements of subaltern relations with a dominant elite. Apart from its value as a record of the extreme poverty of many of the tenantry in the 1840s, the petitions also demonstrate a degree of naive ingenuity on the part of tenants in the context of the rigour of estate regulations. One tenant sought permission in March 1845 to build a house:

> As your petitioner is now cast on the benevolence of the world without a Cabin to shelter him his cousin with your

[31] PRONI, D3531/C/2/1. See Lyne, *Lansdowne Estate*, 611-614 for similar trends in Kerry in 1858.
[32] Longleat Library, Bath papers, printed notice from editor, *Dundalk Democrat*, September 1850.

> honour's permission offers him a spot to build on. That your petitioner humbly hopes that your honour will take his distressed state into consideration and graciously please to grant permission?[33]

Most of the petitions depict universal attitudes of subordination, particularly in the frequency of 'your honour' as a form of servile address, though in some cases one suspects a mask of subservience in the certain knowledge of the espionage system which kept the estate informed of their circumstances. Palmer's recalcitrant tenants petitioned against their threatened eviction in 1852, 'humbly hoping' that 'your honour will still continue them as tenants' (Byrne, 1996, pp. 56-57). Ruth-Ann Harris has suggested that many of the women on the estate used the petitions as a means of subverting the patriarchal authority of fathers, brothers and sons by appealing to estate regulations when it suited their circumstances (Harris, 2000).

Satirical songs and ballads were part of a long tradition in Ireland and many were employed as vehicles of resistance, indicting and lampooning the landlord class. At the annual dinner in Shirley's mansion in October 1850, some of the tenants sang in Irish for the assembly: the *Dundalk Democrat*, which was hostile to Shirley and Bath, suggested that they were abusing Shirley and his officials to their faces (Broehl, 1965, p. 68). Numerous ballads and humorous verses marked popular hostility to the Trenches on the Lansdowne estate in 1858 (Lyne, 2001, pp. 297-298). Estate 'marriage laws' were particularly satirized in song, as for instance on the Bath estate in the 1860s:

> O girls of Farney is it true/That each true-hearted wench
> Before she weds must get consent/From pious Father Trench?
> O search green Erin through and through/And tell me would you find
> Match-maker and land agent too/In one small farm combined?[34]

Overarching all of these strategies of resistance universally is language and what has been significantly characterized in colonial situations as 'native cunning', both fundamental in the armoury of the powerless. This is well illustrated in a confusion of language and landscape which was associated with many landed estates and the relations between tenant and colonial elite. In describing the densely-populated rundale landscapes of the west of Ireland, Estyn Evans suggested that the 'word used to describe the confusion of innumerable scattered plots and tortuous access ways ... was 'throughother' [*trína chéile* in Irish], a word which has

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[33] PRONI. D3531/P/box 1. Tenants petitions

[34] *Dundalk Democrat* 12 June 1869. A year after Trench's death in 1872, his ornate headstone was broken under cover of darkness. A recent restoration attempt was similarly destroyed.

often been applied to other aspects of Irish life'. This confusion of landscape was exacerbated by nicknames for numerous families sharing surnames in the locality. Most landowners and agents saw 'the townland and their settlements as merely another obstinate obstacle to any rational management ... an occult device that muddled responsibilities between master and tenant, perpetuated the old listless ways, and bred conspiracy' ... 'Its very incoherence was their protection ... Their means of resistance -conspiracy, pretence, foot-dragging, and obfuscation -were the only ones available to them, 'weapons of the weak' like those employed by defeated and colonized people everywhere' (Evans, 1973, p. 60; see also Scally, 1995, pp. 12-13). These intricately occupied, named and fragmented landscapes containing elaborate federations of kin groups confused many colonial prescriptions for neatness, order and civilization, especially in situations where there was no resident landlord.

Language as the expression of cunning, especially if not the language of the colonist, was a powerful weapon, masking true intentions and feeding into the 'oriental inscrutability' of colonial discourse. Hiberno-English, and its comic or 'charming' convolutions in 'blarney,' for example, may be seen as having a subtle objective of obfuscating or subverting the language of the colonial elite. 'Lying to the landlord' is part of local folklore in many parts of the country, playing on the understanding that the landowning elite assume the same rules of 'civilized' behaviour apply to all (McLoughlin, 1999, p. 192). Mimicry, mockery and satire also fall into the same strategic use of language as a weapon of resistance. However, as estate correspondence and official colonial archives elsewhere show, many of the dominant elite were aware of such tactics. Trench knew that the tenants on the various estates he managed were, as he suggested, 'servile and fawning whilst under restraint'. As he informed Lady Bath in 1851, he had no intentions of being 'humbugged' by outward signs of welcome.

'Native cunning' is perhaps the best manifestation of the 'Other' in colonial situations, a term which has been transmitted through estate records and formal narratives of the Irish landed elite, deeply signifying many of the elements and dispositions of colonial discourse. With the authority of the [extensive) written record of the landed gentry preserved today in public and private archives, the mindset behind 'cunning' still echoes down to us as a righteous term demonstrating the rectitude of the rulers and the intransigence and deviousness of the ruled. Some researchers may unquestioningly or unconsciously appropriate the outlook of the dominant class who wrote the narrative and shaped the story. Alternative perspectives, aimed at restoring the integrity of the original insubordinate presence however, are difficult to access. There are more than a dozen Patrick Duffys in the 19th century records of the Shirley, Bath and neighbouring estates, whose voices are silent. A critical reading of the records suggests that for these weak and absent witnesses,

innate cunning was an important part of an armoury of resistance and survival in a world where the chips were generally stacked against them.

It may be argued that the system of landed estates was a fundamental component of the colonial project in Ireland from the 16th to the 19th centuries. Its owners and managers aimed for order and progress, articulated generally as 'improvement' and 'civilization' in estate landscape and society in the 18th and 19th centuries. Many of the struggles in 18th but especially 19th-century rural Ireland can be seen as a collision between the top down intentions of the powerful landowning elite for neat and ordered landscapes, neat and docile tenantry, regulation, control and asset management, and local, impoverished and untidy tenant resistance. Resistance ranged from anonymous conspiracy, assaults and murder, to a more general practice of feigned subservience and obfuscation, often characterized by the landowning class as fecklessness, wiliness or 'native cunning' the ultimate weapon of the powerless.

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CHAPTER 19

ASSESSING THE IMPACT OF CLIMATE CHANGE ON WATER SUPPLY AND FLOOD HAZARD IN IRELAND USING STATISTICAL DOWNSCALING AND HYDROLOGICAL MODELLING TECHNIQUE

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First published in *Climatic Change* (2006), 74, 475–491.

Introduction

Although Ireland is relatively well endowed with water resources, regional shortages can occur at certain times of the year, especially in the east and south east of the country. The rapid expansion of urban areas such as Dublin, Cork, and Limerick, associated with recent economic conditions, is putting an increasing strain on the water supply infrastructure. The increased demand for water comes mainly from the industrial and domestic sectors, with domestic demand increasing both as a result of population growth and rising water consumption per capita. As a result, low flows are becoming more frequent in some areas and it is likely that future climate change scenarios will exacerbate these effects. At the same time, many Irish rivers are prone to flooding, especially those in the west, with the Shannon being a prime example. Increases in winter precipitation over the western part of the island are likely to increase the magnitude and frequency of flood events, and increase the duration of seasonal flooding. The aim of this research, therefore, is to simulate patterns of runoff under baseline and future climate scenarios, at a fine spatial resolution, in order to assess annual and seasonal changes.

Most of the present water supply in Ireland comes from surface water, with between 20% and 25% coming from groundwater. In some counties the groundwater proportion is much greater, and in many rural areas that have no access to a public or group supply scheme, groundwater from wells provides the only source of water (Daly and Warren, 1998). Water availability fluctuates over time and through space and is dependent on the balance between precipitation and evapotranspiration. The runoff yield from an area, usually that of a catchment (drainage basin), over a period of time can be calculated using the water balance equation:

$$R.O. = P - AET \pm \Delta S$$

Where:
R.O. = runoff,
P = precipitation,
AET = actual evapotranspiration
ΔS = changes in storage.

The storage term includes water stored as groundwater; in lakes and reservoirs; and as soil moisture. The volume of water held in storage fluctuates through time in response to changes in the balance between rainfall inputs and evaporative and transpiration losses. Characteristics such as soil permeability, geology and topography all determine the response to precipitation, in addition to flow recession characteristics and the duration of baseflow between rainfall inputs. The baseflow contribution is particularly important in the context of climate change scenarios that indicate dryer summers because the frequency and duration of low flows are likely to increase as a result.

Climate change and water resources in Ireland

Observed linkages between climate change and hydrology

A number of studies have been carried out to examine the linkages between climate variables, especially circulation types and precipitation, and subsequent runoff. A significant correlation was found by Shorthouse and Arnell (1999), who concluded that precipitation and the resultant runoff are strongly correlated with the North Atlantic Oscillation index (NAO). Increased rainfall caused by strengthened westerlies (positive NAO) has been observed for northern and western Europe, while at the same time southern and central Europe have experienced drying. An increase in winter storminess has also been observed by a number of authors for Britain (Conway, 1998; Lovelace, 2000; Hulme and Barrow, 1997) and Ireland (Houghton and Cinneide, 1976; Sweeney, 1985; Sweeney and O'Hare, 1992). Irish studies have found changes in the synoptic patterns of Irish precipitation, identifying a reappearance of westerly circulation frequencies along the northern and western parts of Britain and Ireland during the 1980s and 1990s (Sweeney, 1997). These westerly winds, together with a decrease in anticyclonic easterlies, are thought to be responsible for the rise of autumn and winter storm events in Dublin in the latter half of the 20th century (Sweeney, 2000). Increases in annual precipitation and streamflow have been observed by Kiely (1999) who tested observations from selected sites for climatic and hydrological change. Streamflow was found to show similar trends to precipitation data, with the increase occurring after 1975 and being most noticeable in the west of the island.

Runoff under future climate change scenarios

Although a number of studies have investigated the impact of future climate scenarios on water resources for Britain (Arnell 1992, 1996; Arnell and Reynard, 1993, 1996; Boorman and Sefton, 1997; Pilling and Jones, 1999), little work has so far been carried out for Ireland. Cunnane and Regan (1994) used a hydrological model applied to the Brosna catchment (a tributary of the Shannon) to simulate runoff under four prescribed climate scenarios for the year 2030. Under these scenarios precipitation and evaporation were increased on an annual basis, or seasonally on the basis of increased winter and decreased summer

precipitation. The results indicated that although the magnitude of high and low flows would be only slightly greater than those observed within the range currently experienced, the frequency of flood and drought events would be likely to increase within that catchment.

Recent research in Britain has examined the spatial pattern of changing runoff for the whole land area of Britain (Arnell, 1992, 1996; Arnell and Reynard, 1993; Pilling and Jones, 1999). Although the grid squares used do not represent actual drainage basins, such studies allow changing spatial patterns of annual and seasonal runoff to be considered and provide a valuable starting point for further research focusing on selected drainage basins. Advances in downscaling techniques have allowed hydrological modelling to be carried out at increasingly high spatial resolutions, with the 10 x 10km resolution used by Pilling and Jones (1999) constituting the highest resolution to date. Pilling and Jones used downscaled Global Climate Model (GCM) output for 2050 (UKHI) and for 2065 (transient UKTR) to drive a hydrological model and simulate annual and seasonal effective runoff for Britain. Effective runoff is the total depth of runoff yielded by an area over a given time period e.g. annually or seasonally and is normally expressed as a depth of water in mm covering the area under consideration. Whereas this had previously been carried out using relatively simple water balance models (Arnell, 1992, 1996; Arnell and Reynard, 1993), Pilling and Jones used a physical process-based hydrological model to simulate runoff. This allowed a more detailed representation of the land surface through the use of physically realistic parameters and processes.

Since there has not been any previous attempt to model runoff for the whole land area of Ireland under future climatic scenarios, the present study is an initial investigation. A grid-based approach, based on that of Pilling and Jones, was adopted. It has been necessary to make some simplifying assumptions, and certain aspects, such as the representation of storage as groundwater, soil water, lakes etc., are somewhat crude. However, in addition to giving some indication of spatial changes in runoff for Ireland, the study also provides a useful learning experience in the application of various techniques and in assessing the validity of the approaches used.

Derivation of the climate data

Baseline climate

In order to derive the baseline climatology, monthly climate data were obtained for the Republic of Ireland from Met Éireann and, for Northern Ireland, from the British Atmospheric Data Center. This amounted to 570 stations recording precipitation and 65 for temperature. Data for global solar radiation, sunshine hours and potential evaporation were also acquired for as many stations as possible. A criterion of 70% data capture was applied to each station and those that failed to meet this were

rejected. In order to derive a climate 'surface' for each variable, the observed monthly climate variables from the recording stations were related to the position and elevation of each station on the Irish National Grid (northings and eastings). A polynomial regression technique was then used to derive a gridded baseline climatology at a scale of 1 km^2 (Goodale et al., 1998). The use of the polynomial equation appears to adequately capture many of the key spatial trends in the Irish climate with a coast-interior-coast contrast superimposed on a southwest – northeast latitudinal gradient. For example, winter temperatures in Ireland do show a coast-interior-coast contrast as the dominant spatial feature, while summer temperatures have a more overt latitudinal control apparent. Table 1 displays results, R^2 and standard errors from the polynomial regression and indicates the suitability of this method for deriving climatic 'surfaces' from Irish climate data.

Table 1: Polynomial regression statistics for maximum temperature, minimum temperature and precipitation for the baseline climatology

	Max. temp		Min. Temp		Precipitation	
Month	R^2	SE	R^2	SE	R^2	SE
Jan	0.91	0.25	0.63	0.58	0.74	26.63
Feb	0.95	0.19	0.69	0.53	0.75	18.60
Mar	0.90	0.25	0.69	0.50	0.71	20.07
Apr	0.80	0.34	0.63	0.53	0.71	11.67
May	0.70	0.41	0.62	0.54	0.69	12.81
Jun	0.78	0.40	0.66	0.46	0.71	10.97
Jul	0.85	0.38	0.67	0.43	0.73	12.04
Aug	0.83	0.34	0.57	0.54	0.69	15.66
Sep	0.86	0.28	0.62	0.54	0.74	17.69
Oct	0.92	0.18	0.57	0.52	0.77	21.70
Nov	0.91	0.23	0.66	0.58	0.76	21.48
Dec	0.91	0.24	0.61	0.58	0.75	25.10

Statistical downscaling

Over recent years there have been considerable developments in the capabilities of GCMs, brought about by advances in understanding of the atmospheric system and an increase in available computing power. However, the grid size, typically of the order of 2.5° x 3.75°, is generally at too coarse a scale to be suitable for use in most impact studies. As a result, various methods for downscaling GCM output to a finer spatial resolution have been developed. These vary in complexity from the relatively simple approach of pattern scaling, to much more sophisticated techniques, using one of two approaches: statistical downscaling or Regional Climate Models (RCMs). Pattern scaling, which assumes climate changes are the same from place to place irrespective of altitude or location within the grid, was considered unsuitable for this study because it would not allow spatial variations in runoff change under future scenarios to be considered. A statistical downscaling technique was

selected in favour of the available RCM data for Ireland from the UK Climate Impacts Programme RCM, UKCIP01, as the spatial resolution of 50km was considered too coarse for this application.

Statistical downscaling involves using an empirical statistical technique to establish linkages between surface observations and mesoscale predictor variables such as geopotential heights, vorticity and humidity, for a baseline period. These relationships are then used to downscale future climate scenarios using GCM output. The technique assumes that GCMs simulate mesoscale aspects of climate better than surface variables such as temperature and precipitation (Palutikof et al., 1997) and that the relationship will remain robust in a changing climate. In order to account for some bias which may occur within a GCM, the difference between modelled future and modelled present climate scenarios are then applied to the observed baseline.

The UK Meteorological Office coupled ocean-atmosphere model HadCM3 was selected to provide the GCM data. This has a grid resolution of 2.5° x 3.75°, providing a surface resolution of 240 x 278 km in the vicinity of Ireland. The simulation used (HadCM3GGa1) is based on historical increases in individual greenhouse gases from 1860-1990 and then partly on emission scenario IS95a. This produces global temperature increases of approximately 3.5° by 2100.

Mesoscale data for the Irish domain, from the National Center for Environmental Prediction / National Center for Atmospheric Research (NCEP/NCAR) Reanalysis Project, was re-gridded from 2.5° x 2.5° to conform with the output from the GCM. A parsimonious selection of predictors for the mesoscale data was then related to a large selection of the original stations (250 stations in the case of precipitation and 60 stations for temperature) to establish relationships between the surface observations (temperature, precipitation and radiation) and the upper air variables. The mesoscale data included the height of the 500hPa surface, the 500-850hPa thickness, specific and relative humidity and mean sea level pressure.

Validation of these relationships was performed using an independent dataset from 1991-97 (Table 2). In general, temperature verification was good, particularly for summer maxima. Minimum temperature was predicted well for all seasons by the technique. As expected, downscaling precipitation was less accurate at all times of the year, largely due to the heterogeneity inherent in precipitation data.

Once validated, these relationships were then used in the statistical downscaling of the GCM. Monthly outputs for the selected mesoscale variables from the HadCM3 simulation for the period 1961-2099 for the spatial domain around Ireland were extracted from the GCM. These data were then used to establish a control run and two future scenarios using

the empirical relationships derived between the NCEP upper air and observed surface variables. The results from the GCM control run for the period 1961-1990 were then compared to the observed climate to ensure faithful reproduction by the GCM. Climate differences between the control and modelled runs were then applied to the observed station data to provide future climate scenarios for Ireland for two future periods: 2041-70 and 2061-90. In order to assess the spatial component of change – an advantage of using statistical downscaling over pattern scaling – polynomial regressions were again used to derive the climate surfaces, but for the scenario data, at a 10 km^2 resolution.

Table 2: Validation summary using independent dataset for the period 1991-97

Climate Variable	Range Pearson's 'r' (monthly)	Mean Average Error (MAE)	Root Mean Square Error (RMSE)
Maximum Temperature	0.23-0.94	0.04°C	0.87 °C
Minimum Temperature	0.54-0.92	0.03°C	0.83 °C
Precipitation	0.36-0.85	0.29-30.02mm	24.24-48.72mm
Radiation	-0.13-0.63	0.35 MJ/day	1.12 MJ/day

There is an inherent weakness in using just one scenario run from a GCM to generate future scenarios of climate, mainly due to an inability to address uncertainties in both the forcing of the GCM parameters and future emissions. Though a more desirable approach to addressing issues of uncertainty could have been incorporated through the utilisation of ensemble runs from multiple GCMs, this was not considered feasible in an initial assessment of this nature.

Hydrological model simulations

Model Parameterisation

The hydrological simulation model, HYSIM (Manley, 1978, 1993), was selected for this study. It is a versatile model that has previously been used in a number of different applications, including climate change research such as that carried out by Pilling and Jones (1999, 2002). It is also the standard rainfall-runoff model used by the UK Environment Agency. HYSIM uses rainfall and potential evaporation data to simulate river flow, and parameters for hydrology and hydraulics that define the river basin and channels in a realistic way. The model consists of several conceptual stores between which water is transferred by means of numerical algorithms.

The 10 x 10 km grid covering the land area of Ireland that was used in downscaling was also used as the 'hydrological grid'. Soil data were

obtained from the digital 1:575 000 map of the soil associations for Ireland, produced by the Soil Survey of Ireland, together with the accompanying bulletin (Gardiner and Radford, 1980). The soil hydrologic parameters include porosity, permeability of the different soil layers and pore size distribution index; values for these parameters were assigned on the basis of the soil textural characteristic (Manley, 1993). The digital map was converted to the 10 x 10 km grid and the 44 soil associations reclassified into 11 soil textural groups (soil texture is defined by the relative proportions of sand, silt and clay particles). Where more than one textural class was dominant, texture was defined manually by considering the textural classification of the adjoining grid cells and their corresponding land use classification. Two additional hydrological classes were included to represent the extensive areas of blanket and raised peat, with parameter values assigned separately on the basis of field and laboratory observations of raised and blanket peat made by Galvin (1976) and Feehan and O'Donovan (1996). Parameters relating to vegetation and land use characteristics include the rooting depth of vegetation, impermeable areas, permeability of the soil surface and the rainfall intercepted by different types of vegetation. Standard values for these parameters were used (Manley, 1993) and were assigned according to vegetation type or land use class. These categories were determined using the digitised European land use database, CORINE (Coordination of Information on the Environment) (O'Sullivan, 1994). In parameterising HYSIM, land use was assigned on the basis of majority into one of seven classes: urban areas; arable land; pasture, forests, including shrubs and herbaceous plants; peat bogs; inland water bodies; little or no vegetation. One land use classification value, based on predominant land use, was assigned to each of the 10 x 10 km cells, although it was again necessary to reclassify some cells by hand. The assumption was made that land use and land cover parameters would remain unchanged in the future. Much of the groundwater in Ireland occurs in fissured shallow aquifers, many of which show some degree of solutional enlargement or karstification characteristic of certain limestones. (Daly and Warren, 1998). The grid-based approach used in this study presented problems for the representation of groundwater. HYSIM uses a recession coefficient determined from hydrograph analysis to integrate these aquifer characteristics. Each cell was assigned a groundwater reservoir and using an 'average' value for the recession coefficient (Manley, 1993). Although a number of the 10 x 10 km grid cells would not in reality be partly or wholly underlain by significant aquifers it was felt that assigning groundwater to all cells made fewer assumptions than allocating 'groundwater' and 'no groundwater' to different grid cells. In this study changes in effective runoff, expressed as a depth of runoff per unit area, rather than stream flow were examined and the hydraulic routines were not employed. As a result of the simplifications made the groundwater storage term effectively represented groundwater, lake and reservoir storage.

Daily precipitation and monthly potential evaporation data were required as inputs to the HYSIM model, which was run at a daily time step, and monthly precipitation values for the baseline (observed) and future climate scenarios (downscaled) were converted to daily values by distributing the monthly precipitation into mean daily values. Input files were then created in HYSIM format, each file containing two identical years of daily precipitation or monthly PE data to allow one year as a run-in period for the model before the actual simulation. Longer run-in periods were tested but did not produce a significant improvement in model performance.

Model validation

Although the grid cells did not represent actual catchments, it was possible to validate the output from the HYSIM model by comparing observed runoff for selected catchment areas with simulated runoff for the cells / parts of cells corresponding to these areas. As far as possible catchments were selected to represent the range of hydrological conditions found in Ireland. Gauging stations upstream from dams and reservoirs were selected on the basis of the quality and availability of data for the 1961-90 baseline period and naturalised flows were used. The catchments selected are shown in Figure 1 and Table 3. Mean monthly observed flows in $m^3 s^{-1}$ for the 1961-90 period were converted to annual, winter (December, January, February) and Summer (June, July, August) effective runoffs in mm and were compared to model predictions for the catchment areas over these periods.

Table 3: Predicted and observed values of annual effective runoff for the catchments used in the validation of the hydrological model HYSIM.

	Feale at Listowel	Suir at Clonmel	Slaney at Scara-walsh	Shannon at Athlone	Brosna at Ferbane	Bonet at Droma-hair
Basin area	646	2173	1036	4597	1207	294
Predicted	1058·93	617·27	566·55	645.86	475·88	950·12
Observed	1070·69	697·00	565·63	787·97	441·82	1232·20
% error	-1·1	-11·4	0·2	-18·0	7·7	-22·9

Figure 1: Rivers and upland areas in Ireland showing the locations of gauging stations used in validation.

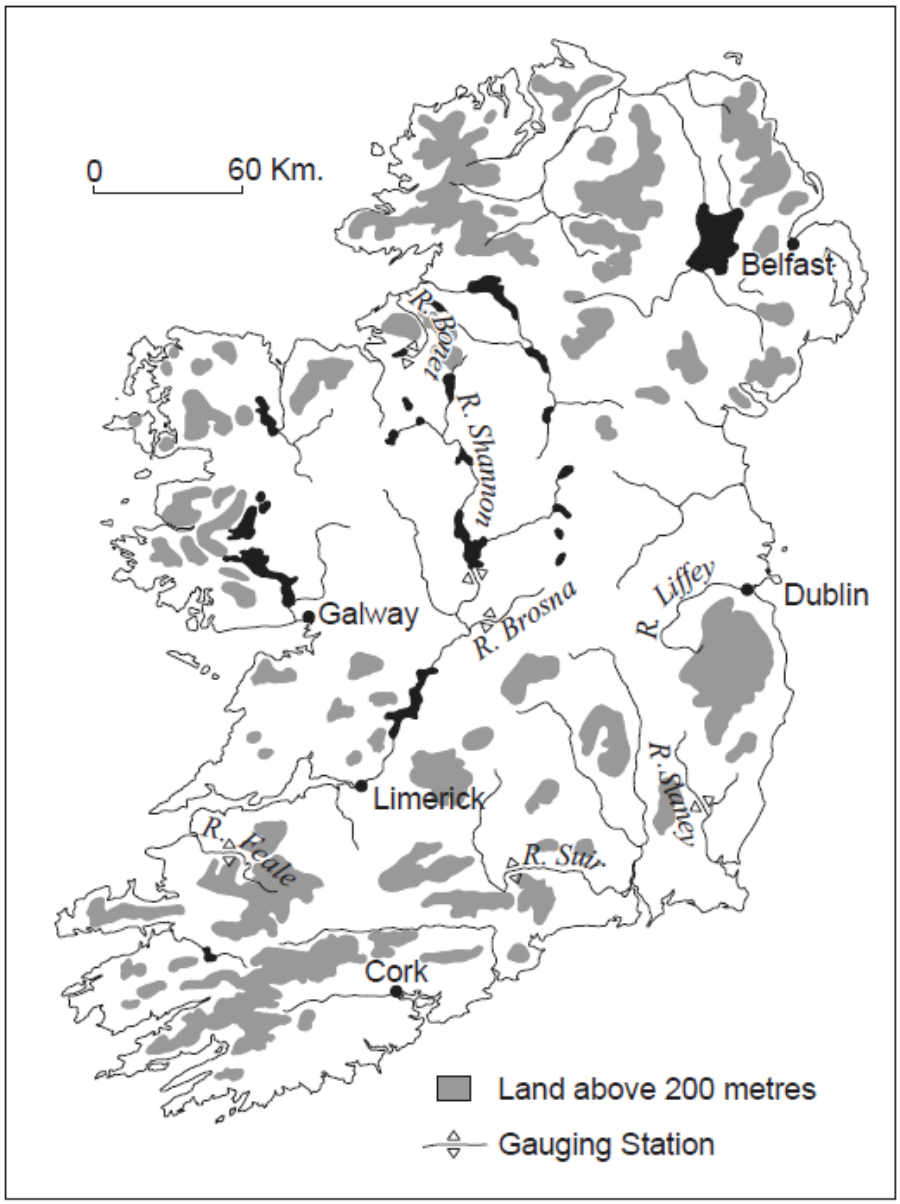


Table 3 shows the annual observed and predicted effective runoff for each of the selected catchments for the baseline period. From this it can be seen that the Feale, Slaney and Brosna all fall within ±10% of the observed values, with the percentage error for the Suir slightly over 10%. However, annual runoff was under-estimated by 18% for the Shannon and 23% for the Bonet; these catchments are discussed in more detail below. The seasonal errors for the Brosna, Feale, Slaney (winter) and Suir (winter) were all less than 10%; these last two catchments had errors of +20% and −14% respectively for the summer months. The greatest

errors in annual and seasonal runoff were for the Shannon and Bonet. The Shannon catchment, upstream from Athlone, was the largest considered in this study and has extensive areas of lakes, wetlands and peat; the channel gradient is very low and there are complex interactions with groundwater. The smaller catchment of the Bonet also includes areas of peat and wetlands. Examination of the simulated winter and summer runoff for these two catchments revealed that the Shannon was under predicted in winter (-29%) but close to the observed value in summer (-0.6%), while the runoff from the Bonet was under predicted for both summer (-28%) and winter (-20%). It is possible that some of the shortfall in simulated runoff could have been brought about by the simplified representation of storage and, with this in mind, overall changes in each of the storage reservoirs were examined for selected grid squares. However, although the storage parameters did affect the relative magnitudes of monthly and seasonal runoff totals, the small changes observed at the end of the simulated year were insufficient to account for the annual shortfall in simulated runoff for these catchments. Another possibility is that the monthly precipitation input might have been under-estimated for some upland areas. This could have come about when the digital terrain model was upscaled from the 1 x 1 km to 10 x 10 km resolution, resulting in an under-representation of any individual peaks and ridges occurring within each 10 x 10 km grid square and a consequent reduction in precipitation input. While the upper Shannon, Bonet, Feale and Suir all drain upland areas, the interpolation problem would be greatest where isolated peaks occur, as is the case for parts of the upper Shannon and Bonet, and less marked for the more continuous areas of upland drained by the Feale.

In general the results of the HYSIM validation provide some support for the techniques employed and there does not appear to be a consistent bias in runoff prediction. It is important to note however that errors greater than those reported for the six validation catchments could exist elsewhere. In common with other studies of this type, several sources of uncertainty are introduced during the modeling process described. These include the choice of downscaling technique, structure of the hydrological model structure and model parameterization, while external uncertainties relate to the choice of emissions scenario, climate model selection and model structure. The results discussed in the following section can therefore only provide a general idea of possible outcomes, particularly where the magnitude of errors in runoff prediction is greater than the percentage change observed under the selected climate scenarios.

Possible future changes in effective runoff

Changes in annual and seasonal runoff under the two climate scenarios were examined for the validation catchments; for annual runoff these were found to be greater than the validation errors for all catchments except the Shannon and Bonet. With the exception of the Bonet, changes

in summer runoff were found to be greater than the errors for five of the six catchments. Greater uncertainty was associated with winter runoff, where the observed changes were greater than the validation errors for the Slaney and Feale only.

Figure 2 shows the annual effective runoff for the baseline simulation, where observed data were used to drive the model. Seasonal effective runoff for winter (December, January, and February) and summer (June, July and August) are also shown. The spatial distribution of runoff for this period reflects precipitation patterns, with an east-west gradient across which a decrease in runoff is observed. Higher runoff from upland areas is associated with localised increases in precipitation due to orographic effects. Figures 3 and 4 show the estimated percentage decrease in runoff, relative to simulated baseline runoff, for 2041-70 and 2061-90 respectively. From these maps it can be seen that the overall reduction in runoff is greater under the 2041-70 scenario than for 2061-90. At a regional scale these runoff patterns broadly reflect those observed in downscaled precipitation for the two scenarios, though spatial variations are seen at the grid scale, reflecting differences in soils, land use and hydrological parameters between grid squares. It is during the summer months that the greatest spatial variation occurs since effective runoff for this period is more strongly influenced by variations in storage characteristics than are winter and annual flows. General observations of changes in storage were made for selected cells by examining the variations in moisture storage and transfers between different stores that occurred during each simulation period. Under the 2041-70 scenario, a slight depletion in soil moisture and groundwater storage was observed during the summer months in the west and northwest. This was accentuated in the midlands and severe in the east and southeast, where a temporal delay in recharge of up to six weeks could occur. The results suggest that under both scenarios there may be an overall decrease in annual runoff for most of the land area that is most marked in the east, an effect that is apparent both in terms of percentage and absolute changes. From Figure 5 it can be seen that an increase in annual runoff may occur over a limited part of the northwest. A greater area may be affected under the 2061-90 scenario.

As previously mentioned, winter runoff is associated with the greatest uncertainty. In addition to this, the temporal resolution of both the input data and the model output is too coarse to provide information on flood frequency and magnitude and it is thus possible only to make general observations relating to changes in flood risk. Increases in winter runoff appear to be likely over large areas under both scenarios (Figure 5) and the land area can be roughly divided into two zones along a northeast-southwest axis, suggesting an increase in winter runoff of up to approximately 12% for the western part of the island. Under the 2061-90 scenario, an increase in runoff is indicated over most of the land area, including the upland area of the Wicklow Mountains to the south of

Figure 2: Simulated effective runoff in mm for the 1961-90 baseline period showing (i) annual (ii) winter and (iii) summer effective runoff.

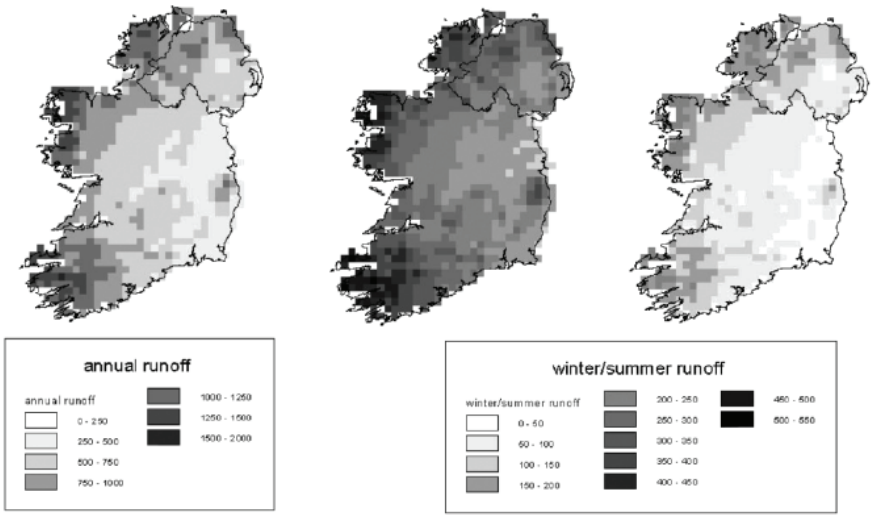


Figure 3: Percentage decreases in annual and seasonal effective runoff for the 2041-70 scenario.

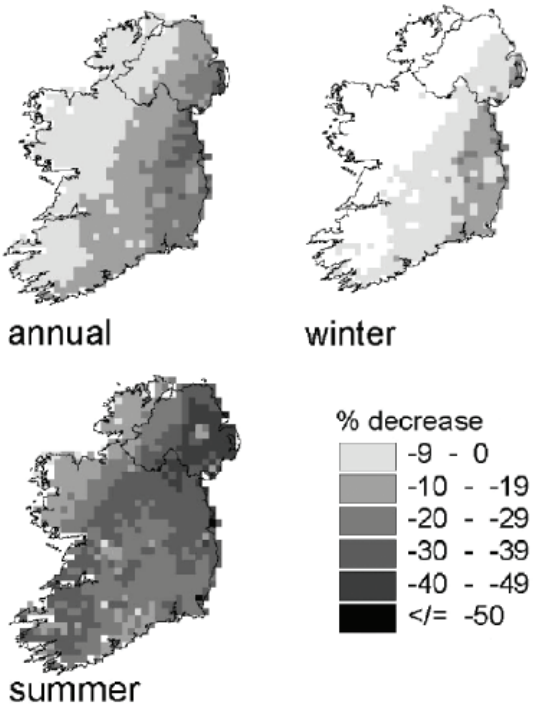


Figure 4: Percentage decreases in annual and seasonal effective runoff for the 2061-90 scenario.

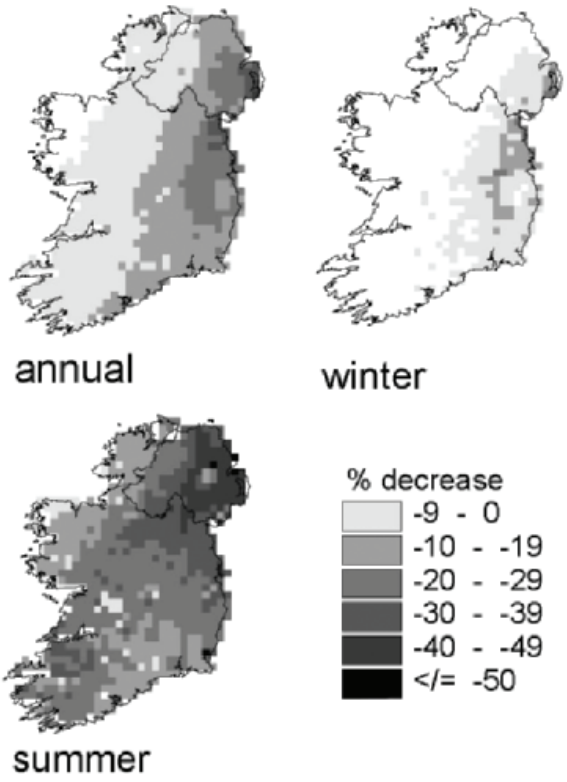
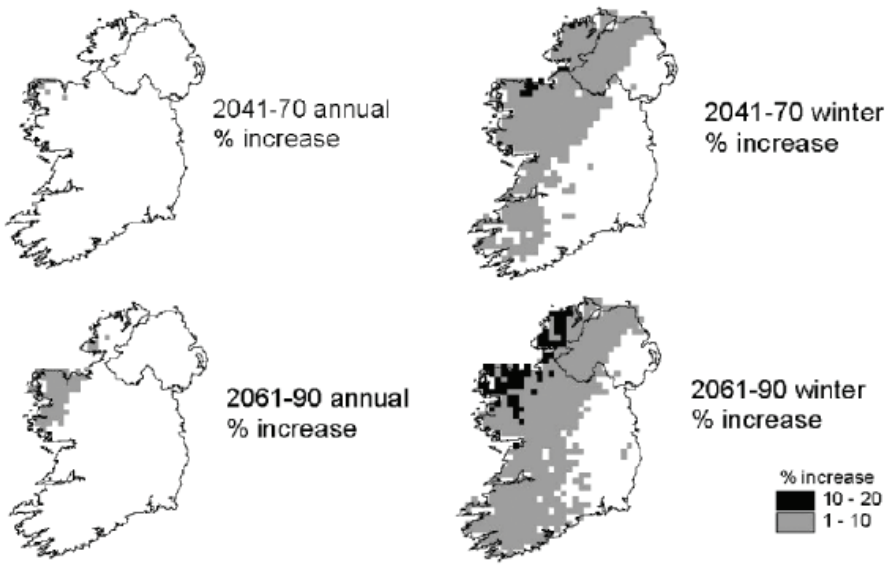


Figure 5: Percentage increases in annual and winter effective runoff for 2041-70 and 2061-90 scenarios.



Dublin. The increase in winter runoff indicated for many parts of the west, especially under the 2061-90 scenario, could lead to increases in the magnitude and frequency of flooding. Seasonal flooding affects many parts of Ireland during the winter months when soils are at or near saturation. The central lowlands have large areas of lakes and wetlands and seasonal flooding is a common occurrence for the rivers draining this area, which have shallow gradients along much of their length and a poor carrying capacity. An increase in runoff would probably increase the extent and duration of such flooding.

A degree of caution should obviously be applied to the observations made above, which can only give a general idea of changes in annual and seasonal patterns of storage under the future climate scenarios considered.

Management implications

For the climate scenarios examined, a decrease in runoff may occur during both summer and winter months in the east and southeast. It is in these areas that current demand for water is greatest and where there is likely to be the most rapid increase in demand, mainly as a result of projected population growth. This is especially true for the Greater Dublin region, where the water supply infrastructure will come under growing pressure in the near future, especially during the summer months (Department of the Environment, 1996). A widespread reduction in runoff would also lead to a number of water quality problems. Although the estimates made here are for seasonal runoff, it is not unreasonable to assume that the frequency and duration of low flows might also increase. This, combined with the projected growth of urban areas, would increase the volume of sewage to be treated and the quantity of effluent discharged into rivers, many of which would not have sufficient capacity to dilute it.

The estimated reduction in runoff is coupled with a corresponding decrease in soil moisture and a significant soil moisture deficit that develops during the summer months over most of the east of the country. This would lead to a considerable increase in demand from agriculture for irrigation water. At present approximately 10% of total water consumption in the Republic of Ireland is accounted by this sector (Gleick, 1993); this is relatively low since irrigation is only required on a limited scale in the east of the country. Holden *et al.* (2003) suggest that under future climate scenarios there could be major changes in the crops grown, their performance, and the distribution of land use; these factors could further affect patterns of water use.

Even without the superimposed effects of climate change, the projected increase in urban demand necessitates the identification and development of new water supplies. Possible options currently under investigation for the greater Dublin region include enhancing the flow of the Liffey (which

currently supplies most of Dublin's water) by pumping water from the headwaters of the Barrow, which rises in the Wicklow Mountains; or transferring water from the Shannon. The decrease in runoff indicated by this preliminary research could greatly reduce the yield and sustainability of both schemes, especially during the summer months where water demand will probably increase in response to dryer conditions. The conjunctive use of groundwater is another possibility for enhancing supply and significant groundwater resources are currently unused for water supply (Daly and Warren, 1998) could be exploited. In doing this it would be necessary to consider the climate change implications of reduced recharge to aquifers and the role of groundwater in maintaining low flows under the climate scenarios considered. The availability of groundwater in fissured and karstic aquifers, where there is a rapid throughput of water, could be significantly reduced during the drier months.

The implications of this study for increases in flood magnitude and frequency can only be discussed in very general terms because the coarse temporal resolution did not allow the estimation of changes in flood magnitude and frequency. It is possible that in much of the western half of the country there will be an increased incidence of flooding, with a greater area being at risk of flooding on a frequent basis in future. In management terms, the role of land use change in increasing the flood risk, and the encroachment of urban development onto floodplains should be considered in all aspects of planning, as this will exacerbate any climate-induced changes. This is particularly important where new areas are urbanized since impermeable surfaces, drains and sewers rapidly transfer water to river channels, resulting in a reduced response time and an increase in peak flow. Widespread flooding took place throughout the country in November 2000 and again in November 2001 and may, in some cases, have been exacerbated by floodplain development. Further research is required to allow the delimitation of risk areas, to define confidence limits and to quantify flood return periods and magnitudes to inform management decisions.

Conclusions

This is the first time that downscaled GCM predictions have been used to model effective runoff for the whole land area of Ireland under future climate scenarios. Since this was a first pass investigation it was necessary to make a number of simplifying assumptions and, in common with other studies of this type, several sources of uncertainty were introduced at different stages during the modeling process. Despite the assumptions made, the results of the model validation carried out were considered to be reasonable given the limitations of the study and generally fell within the range that might be expected. The results suggest a widespread reduction in annual runoff under both climate scenarios, which is most marked in the east and southeast of country. A slight increase in annual runoff may be observed for a limited part of the northwest. All areas

were found to experience a decrease in summer runoff, with the greatest reductions in the east of the country. It is possible that the frequency and duration of low flows could increase in many areas and long term deficits in soil moisture, aquifers, lakes and reservoirs are also likely to develop. Winter runoff was found to increase in the west of the country, especially under the 2061-90 scenario where an increase in winter runoff was simulated for over 60% of the land area. The greatest increases occurred in the northwest and the results suggest that the magnitude and frequency of individual flood events might increase in the western half of the country. In management terms the uncertainties, clearly go beyond those associated with the modeling process. Improvement in the hydrological estimation of climate change will better inform management decisions.

Given the findings presented here, future work will move away from the grid-based approach towards employing the catchment as the basic unit of investigation. In order to allow a more detailed analysis of the frequency and magnitude of extreme events under a changed climate, climate data of a monthly time step will be replaced with daily data. Given this evolution of the adopted methodology many of the limitations of the current study may be addressed in greater detail. More stringent validation requirements have been established with the model being tested both annually and seasonally and the transferability of parameter sets being examined over both wet and dry periods. Ongoing work is examining the sensitivity and stability of the HYSIM framework so that sources of uncertainty relating to model input, model structure and the parameterization and calibration processes can be highlighted and quantified, thus enabling confidence bounds to be attributed to simulated output.

Acknowledgement This research forms part of the Environmental RTDI Programme 2000-2006, developed and managed by the Environmental Protection Agency (Ireland) and funded by the National Development Plan.

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CHAPTER 20

IRISH INFORMATION SOCIETY POLICY

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First published in *Networks and Communication* (2007), 21(1-2), 209-240.

Details on the progression and implementation of Irish information society policy have been quite fragmented to date. The majority of key documents relating to policy that have been produced over the years are available but there is a shortage of papers or reports that document the overall progression and comment upon it. It is therefore worth drawing it into a coherent piece for the benefit particularly of scholars doing comparative work. However, of equal or perhaps more importance is the realisation that maybe Ireland isn't doing as well as it might and this lack of performance will also be touched upon below.

The Republic of Ireland, covering a land area of 68,895 square kilometres with a population of 4.2 million in 2006, has a relatively centralised administration. It has been noted by analysts prior to EU expansion that the Irish system of governance is one of the more centralised of any European country. However, this might be questioned if the relative size of the country is considered.

The Irish Regions

Before investigating the history of Irish information society policy, an understanding of county and regional government or management is necessary. The Republic of Ireland is divided into twenty-six counties. These are subdivisions of the ancient provinces of Ireland. The counties developed under the Christian dioceses and also the Norman and British administrations.

Given the centralised administration, the local and regional levels nevertheless have key responsibilities in a number of significant areas. Clear constitutional status was given to local government in 1999 following an amendment to the constitution.

Local government services at a county and city level are provided by local authorities. These authorities are multi-purpose bodies that have responsibility for an extensive range of services. There are thirty-four primary local authorities. This is made up of twenty-nine county councils and five city councils. There are a further eighty town authorities with a representational role at the sub-county level. Members are elected for a period of five years according to a system of proportional representation. The services for which local authorities are responsible are divided into eight categories: housing; planning; roads; water supply and sewerage; development incentives and controls; environmental protection;

recreational facilities and amenities; and agriculture, education, health and welfare (Irish Regions Office, 2006). Further to these functions, a primary remit of local government is to represent local communities. There is no specific remit for these authorities in relation to ICTs.

Eight regional authorities came into existence in 1994 under the 1991 Local Government Act. Their function is to monitor the use of EU structural funds and coordinate specific activities of the local authorities. They have specific responsibility for: reviewing the various development plans of local authorities in both their region and in adjoining regions; compiling regional planning guidelines and regional social and economic strategies; and promoting arrangements, consultation, joint actions and cooperation among local authorities and the various public bodies. Members are nominated by the local authorities in the region. The final regional divisions were established in July 1999 when the country was designated as two regions for EU structural funds purposes. The Southern and Eastern (S&E) region had a "phasing out" regime for objective one until the end of 2005 while the Border, Midland and Western (BMW) region had objective one status until 2006. Following this designation, two regional assemblies came into effect in July 1999 with the following tasks: to manage the regional operation programmes under the national development plan; to monitor the general impact of all the EU programmes under the national development plan/community support framework; and to promote coordination in the provision of public services in the assembly areas (Irish Regions Office, 2006). Further, these assemblies were the INTERREG IIIB contact points for Ireland.

Information Society Policy History / Background

The Irish Government has placed considerable emphasis on the promotion and propagation of an information economy and subsequently information society. As was the case with most states in the early to mid '90s, there was awareness that the trends in information technology will have a profound effect on practically all aspects of life. The primary – and arguably most successful – focus of government policy was on economic and educational aspects in order to maximise the country's competitiveness within the global market. In more recent years the government has made a concerted effort to build upon this foundation specifically to promote a knowledge-based society and address concerns relating to digital inclusion (eInclusion). However, the initial focus was limited to mentioning the imbalanced diffusion of the information society and the potential problems without formulating any definite policies to address them.

In 1996 the government industrial policy agency (Forfás), began to refer to societal issues in relation to economic development. The importance of the information society and equal participation for citizens is mentioned. (Forfás, 1996) However, while the requirement of policy

implementation had been identified, it was not developed any further. The main focus for the use of advanced telecommunications was on business applications. Changes in education and the development of telecommunications infrastructure to facilitate competition were suggested without any further consideration for any societal aspects or for the citizen in particular.

The Department of Enterprise and Employment (1996) developed this further within a white paper containing rhetoric increasingly being used at the time within the EU. Referring to the presence of information haves and have-nots, it acknowledged that the economic developments which were largely based on informational activity could result in the further compounding of social cleavages resulting in a two-tier information society. It also presents the inherent dangers of allowing this new age to be driven and shaped by market forces alone. The report was lacking any concrete proposals on how to combat or reverse any of these issues.

Perhaps the most comprehensive report at the time, which – unlike the others – contained more proactive suggestions and solutions, was released by Forbairt (1996) entitled 'Ireland, the Digital Age and the Internet'. This document assessed the possible impact that the digital age could have on Ireland. It was a decent appraisal of the changes that will occur. It is the most constructive report released in 1996 in that it suggests possible responses for the state in the face of this challenge. It stated that the government had become keenly aware of the need to implement the necessary structures for an information economy and political system. This reflects the primary focus at the time on economic activity while showing that there was an awareness of the potential these technologies had for improving governance. However, it also makes suggestions on how best to approach the issue of addressing the shortcomings of Ireland in terms of promoting an information society.

The following key documents, illustrating developments in Irish Information Society policy up to the current policy document, are presented in chronological order.

Information Society Steering Committee

The reports outlined above brought the presence, importance and dangers of the information society into the political limelight. This, combined with the attention being paid to it by other states, resulted in an Information Society Steering Committee being established by the Minister for Employment and Enterprise in March of 1996. The role of this committee was to advise the government on its information society policy. The committee recognised the importance that "Ireland responds with urgency to the challenges that lie ahead" as it acknowledged "the speed and scale of the revolution under way". The committee was comprised of twenty members. The corporate sector and the government

had the majority of representatives (eleven and six members respectively). The remaining positions were comprised of two academics and one trade union representative. There were no representatives from the community or voluntary sector. This can be viewed as a major flaw in the representative structure of the committee.

Information Society Ireland: Strategy for Action

The main product of the committee was a report entitled 'Information Society Ireland: Strategy for Action' (ISSC, 1996), which was published in December 1996. It examined the potential of ICTs for transforming the economy and society of Ireland in the future. It set out the vision for Ireland in the future as an economy that is committed to "securing the full benefits of the information society for its people and enterprises", that a social partnership is vital, and that the state's actions should be quick and decisive. The main body of the report identified barriers and presented a series of objectives and strategies to overcome them. A series of actions are suggested for implementation in order to achieve this. A key central suggestions of the report was: the foundation of an Information Society Commission to monitor progress and advise the government; the creation of a public interdepartmental implementation group on information society; and the formation of a development team in charge of preparing a 'framework for action' followed by an action plan. This group of seventeen members, which was chaired by the Taoiseach (i.e. Prime Minister), included members from the Central Statistics Office and all ministries.

First Information Society Commission Report

The Information Society Commission (ISC) was established in May 1997 for an initial three-year period. The Commission was an advisory body whose main function was to monitor and advise on the development of the Information Society in Ireland. It was to advise the government, conduct research and benchmarking, and promote general awareness and understanding of ICTs among the general population and businesses. Another of its most important tasks was to raise awareness among the general public and industry of the opportunities and benefits offered by the Information Society.

The 'First report of Ireland's Information Society Commission' was released in December 1997. (ISC, 1997) It outlined the main developments within Irish society and initiative implementation since the ISSC 'Strategy for Action' publication in March. Further to this, it set out goals for the short-term while areas where more urgent action was required were highlighted. A summary of the key developments were outlined under the headings awareness, infrastructure, education, enterprise, government legal issues, and government services and social inclusion.

With regard to awareness, the publication of the 'Strategy for Action'

report is considered an important development creating a focus on the information society for national debate. There had been an increase in the media coverage of information society related issues. The number of related conferences and events also increased. The Information Age Town competition was won by Ennis, Co. Clare, and the national broadcaster (RTE) launched a magazine programme to raise awareness of technology in education issues, entitled LearnNet. Recommendations for action included two suggestions. Firstly, the national broadcaster (RTÉ) should cater for the growing interest in the information society. Secondly, companies who stand to gain most from informational activities should sponsor awareness raising activities.

There were numerous developments in relation to *infrastructure*. A director of telecommunications regulation was appointed. The liberalisation of the telecommunications market had begun and was predicted to be complete by January 2000. This was to include the provision of advanced telecommunications and services beyond voice telephony by forty service providers already active in the market. A fibre optic network for every major city and town was among the investment activity. ISDN was available nationwide and the national telecommunications companies broadband backbone exceeded the 30,000 fibre kilometres. Cable networks were developing internet cable access. NTL Telecom began construction of a £30m (€39m) undersea digital synchronous hierarchy (UDH) fibre optic ring linking Ireland with the network within the UK. The Electricity Supply Board (ESB) and British Telecom began a joint venture of £130m (€165m) over ten years to enter the Irish telecommunications market. They were to utilise the ESB's digital microwave network and electricity cables and ducts. Finally, ten MECU of EU structural funds were relocated to fund a new measure for broadband telecommunications. A number of recommendations for action are outlined. These include: The use of existing cable and telecommunications networks for the large-scale deployment of cable modems and xDSL technologies should have clear timescale targets and further investment – beyond the 10 MECU redirection outlined above – would be required for sufficient infrastructural development.

Investments in *education* were numerous. An Education Technology investment fund was launched in November '97. This investment of a quarter of a billion pounds over a three-year period was the largest commitment to education and training ever undertaken by the state. The money was to be used to modernise third level institutions, promote innovation, and develop new areas of activity for emerging skills needs. The Schools IT 2000 programme was set up with the key objective of bringing "about a national partnership involving schools, parents, local communities, third level colleges, together with public and private sector organisations to meet the project's ambitious aims" (ISC, 1997, 11). A National Centre for Technology in Education was set up to manage the project while working with a national network of Education Centres

supplying regional-level support to schools. The Government's investment was £40m (€51m) with a further contribution by Telecom Eireann of £10m (€13m). Three key initiatives within the Schools IT 2000 project were launched. The first initiative, entitled the 'Technology Integration initiative' aimed to provide schools with 60,000 multimedia computers by the year end 2001. The second, called the Teaching Skills Initiative, aimed to provide ICT skills to 20,000 teachers nationally and a minimum of one teacher per school. The final initiative within this programme was the schools' support initiative. This aimed to enhance ICT use in the classroom and create a support structure via a schools network, 'Scoilnet', and a School Integration project.

Forfás launched a three year campaign aimed at encouraging young people and school leavers to take up jobs in the software, tele-services and electronics sectors. To complement this, 3,000 new places across all third level and training institutions were made available in 1997. Research in the Institutes of Technology doubled between 1996 and 1998 (Forfás, 1998). Reacting to a shortage of people with technical skills within the technology sector, a 'Task Force on the Supply of Technicians' received investment of £5m. It was hoped that this would initiate an industry / college initiative to recruit and train technicians. 'Libraries-on-Line', was a partnership between public libraries and Microsoft which provided internet access, business and educational software. The European Computer Drivers Licence (ECDL) Ireland Ltd was set up with the goal of establishing computer-use standards for educational institutions, enterprises and the general public. In realising the full potential of investment in educational institutions and including marginalised groups in internet activity / learning programmes, recommendations for the future were outlined. Every library in the country should have an ISDN connection, while all citizens should have access to email within the libraries by 2000.

Under the *enterprise* heading, there was a significant rise in the amount of inward investment by high-tech industries. This further compounded the points made in earlier reports outlining the importance of increasing the skills base and high-quality, low-cost broadband availability. A new business, education and training partnership was announced in 1997. The partnership aimed to develop high-level national strategies, to address the issues of skills needs, manpower forecasting and education for industry and business. Within this there was to be an Expert Group on Future Skills and a Business / Education Partnership forum. Recognising the challenges ahead for industries, Forfás began a feasibility study on the creation of Digital Park in Ireland. The National Competitiveness Council was established in 1997. It reports to the Taoiseach on key competitiveness issues for the Irish economy together with recommendations on policy actions required to enhance Ireland's competitive position. The council was to liaise regularly with the ISC on issues concerning both, future skills and infrastructure. In 1998,

Enterprise Ireland directly assisted over 1,300 indigenous enterprises through its R&D and technical consultancy. This helped increase their technical competence and link them to major European technology developments via EU initiatives. (Enterprise Ireland, 1998) Recommendations for the future include a final overview of all of the requirements for the digital park to be finalised, a more integrated approach to training to ensure the presence of a workforce for information intensive industries, and the National Labour Force Data should include new forms of work such as teleworking and numerous forms of contract work.

There were two main developments in relation to *government legal issues*. One was the formation of a Working Group on the Illegal and Harmful use of the Internet by the Department of Justice, Equality and Law Reform. Recommendations for this section included legislation enabling eCommunications, messages and records to be admissible in civil proceedings. The other was the compiling of a Fraud Offences Bill for offence in relation to the dishonest use of a computer.

Under *government services and social exclusion*, the Freedom of Information Act was passed to come into effect in April 1998. This act, through the use of ICTs, will oblige public organisations to publish their internal guidelines and rules. The provision of public services in an interactive way was another initiative within this section. The ISC recommend that all future government and related publications should be made available electronically. Internet services should be made available to all government departments. Interactivity and service delivery of government websites should be increased. Finally, Irish developers and those involved in government projects particularly, should adopt EU suggestions on the application of ICTs for the elderly and disabled.

Implementing the Information Society: A Framework for Action

The Inter-departmental Implementation Group on the Information Society (IIGIS) published 'Implementing the Information Society: A Framework for Action' in December 1998. (Dept of the Taoiseach, 1998) It followed the recommendations from the Information Society Steering Committee report but also followed the suggestions from a number of other reports released in 1998. These included; the Report of the Advisory Committee on Telecommunications (ACT, 1998); The National Competitiveness Councils 'Annual Competitiveness Report '98 (NCC, 1998a) and 'Statement on Telecommunications: a key factor in Electronic Commerce and Competitiveness' (NCC, 1998b); and reports from the Irish Business and Employers Confederation concerning telecommunications and governmental policies (www.ibec.ie).

The report took on, and developed further, the suggestions from the Steering Committee's report. It contained two parts. The first part presented a comprehensive strategic plan, with precise tasks within

specific timeframes, which outlined the resources that would be required while allocating responsibility. It proposed a plan of action under the headings: telecommunications infrastructure; development of eCommerce and business opportunities; enabling measures; legislative measures; ICTs and the delivery of public services; support areas where action is needed; and taking the work forward. The second part was a commentary on the proposed action plan.

Implementing the Information Society in Ireland: An Action Plan

The Government responded to the above reports, and built upon the 'A Framework for Action' report by publishing their plan of action for the future entitled 'Implementing the Information Society in Ireland: An Action Plan'. (Department of the Taoiseach, 1999) It outlined the importance of a coordinated and comprehensive approach. Findings within this were in line with sentiments from a number of reports from advisory bodies (NCC, 1998b / IBEC, 1998a / IBEC, 1998b). In order to present a comprehensive strategic plan the report covers a number of broad areas which they believed embraced all of the tasks requiring attention. These broad areas followed the same structure as the 'Framework for Action' report and the majority of measures to be implemented by the government developed suggestions from that earlier report.

The ISC second report

This report was released in April 1999. This report followed the same structure as the first. It reviewed developments since the 1997 report and identified new key policy areas where action was necessary. According to the report, many of the essential elements of the information society strategy had been established but it questioned the pace of these developments. Three dominant areas already identified were highlighted in this light namely low-cost broadband provision, intellectual property rights and the emerging skills shortage. However, some new areas requiring specific attention were identified. These were the promotion of access to ICTs for the general public and the development of Irish ebusiness opportunities. According to the report, awareness of new technologies among the general public and businesses had reached an acceptably high level. Thus the Irish information society was to move onto a new phase by utilising this awareness to facilitate ecommerce activity and the widespread adoption of ICTs.

Second report of the IIGIS Progress report of the implementation plan

This progress report traces developments since the Action Plan was published. It states that the Action Plan was received well and that it had become a credible blueprint for the job of implementing the information society in Ireland. The primary focus of the IIGIS in the months leading up to the report was to measure the resources required to execute the plan. They came up with numerous findings. They state that staff and funding resources have to be increased and assured. A major problem

identified was that target dates were not being met due to a lack of the required resources. The developments in the areas identified within the Action Plan are outlined. Under the 'New initiatives and Action Points' heading at the end of the report, some suggestions on how local government can apply new technologies to the delivery of their services are made by the Department of the Environment and Local Government. Areas identified include the development of a sectoral intranet which will facilitate a local government website offering a range of services electronically, the development of an internet-based procurement system, and two research and development projects. The first of these projects would be concerned with public participation in the planning process and eDemocracy. The second would focus on a localised framework for the delivery of broadband (using the sewer network for fibre optics is suggested). A third progress report was released in April 2000 following the same format.

IT Access for All
This report, published in March 2000, was the first publication to focus on social inclusion in the information age and the digital divide specifically. Its focus on the digital divide raised many issues regarding socio-economic standing and the connection this has to rates of adoption of technologies. It raised the question of whether existing social inequalities will be perpetuated, even exacerbated, by new technologies and that disadvantaged communities face additional obstacles to adoption. A key finding was that whether one is equipped to engage in the information society is predominantly determined by both one's access to and ability to use information technology. This report, with the suggestions being adopted by the government, had the potential to address many shortcomings in Irish IS policy. It presented various factors responsible for inhibiting ICT uptake namely: awareness; physical accessibility; usability and user friendliness; ability to use new ICTs; and the availability of the required support framework.

All of the above reports were vital in the history of building an information society policy approach for Ireland. There have been subsequent reports but the foundation for the first strategic approach document published by the government rests on the seminal reports above. It was the framework for all initiatives / developments to follow. Subsequent reports all built upon and developed these reports further.

Policy Framework
At this point an outline of the current policy framework at national and regional levels is necessary. This will include both policy areas specifically dealing with inclusion in the information society and those with relevant elements within them. Following this, an overview of the actions undertaken will be presented.

National level strategies / policies directly concerning the information society

Government Policy

The Information Society Policy Unit (ISPU) is a unit within the Department of the Taoiseach (Prime Minister). It has the general responsibility for developing, co-ordinating and driving implementation of the information society agenda. It aims "to ensure that Ireland develops as a fully participative, competitive, knowledge-based information Society, with all the benefits that entails" (Taoiseach.gov.ie). There are seven key areas with which this policy unit is concerned with. These are outlined in the Governments action plan entitled 'New Connections' (Taoiseach, 2002):

- Delivery of a robust telecommunications infrastructure;
- Promoting universal engagement and participation, in particular through eInclusion initiatives;
- Further developing the potential of eGovernment
- Furthering Irish competitiveness through the development of enhanced eBusiness capacity;
- Promoting and facilitating lifelong learning in the knowledge economy
- Stimulating research and development
- Promoting a supportive legal and regulatory environment

In addition to this role of policy coordination, development and coordination, the unit has specific functional responsibility for: developing the potential of eGovernment; the eCabinet initiative; monitoring and reporting on the implementation of eEurope in Ireland; evaluation of submissions to the Information Society Fund.

The ISPU also acts as the secretariat for a number of structures assisting the minister of State with responsibility for coordinating the information society agenda across all government departments. These structures include firstly, the Cabinet Committee on the information society. This committee drives the implementation of the information society agenda. The committee is chaired by the Taoiseach and convened by a Minister of State. It includes the Ministers for Finance; Enterprise, Trade and Employment; Communications, Marine and Natural Resources; Education and Science; Community, Rural and Gaeltacht Affairs; Social and Family Affairs; Environment and Local Government; Health and Children; Justice, Equality and Law Reform. The second structure is the eStrategy Group of Secretaries General which complements the above group in addressing national eStrategy issues. The third structure is the Assistant Secretaries eGovernment Implementation Group. Its remit is to ensure the coordinated implementation of information society policy across all government agencies and departments. The Information Society Commission was one of the structures within this grouping assisting the minister for state. Policy relating to the telecommunications

sector is a remit of The Department of Communication, Marine and Natural Resources (DCMNR). Comreg is the communications regulator.

Social Partnership Agreements

At a national level, policies relating to the information society and social partnership agreements share some common goals. The National Economic and Social Council (NESC) Strategy Report, An Investment in Quality: Services, Inclusion and Enterprise acted as a background for discussion. The parties involved in social partnership discussions included the Government, employers, trade unions, farming bodies and the community and voluntary sector. The negotiations have resulted in a series of reports entitled Sustaining Progress which is the sixth in a series of Agreements between Government and the social partners dating back to 1987. They have covered a wide range of issues considered fundamental to making the economy globally competitive, environmentally sustainable, efficient and socially acceptable. The aim of these reports is to provide a coherent and focused strategy for managing the interconnected elements of the economy and the behaviour of economic and social policies.

Social partnership agreements prior to 2003 had not given any significant focused attention to information society considerations beyond a number of objectives which touched upon the area. Within 'Sustaining Progress: Social Partnership Agreement 2003-2005' (Government of Ireland, 2003), however, there is a specific goal relating to it entitled 'Including everyone in the Information Society'. Its objective is to 'create meaningful and useful content to enable everyone to exploit technology to the highest advantage and to provide the levers for change and advancement that can help people to overcome barriers of personal and economic circumstances'. The social partnership agreement identifies the need to facilitate access and actively promote low-income and late adopter engagement, while facilitating measures designed to support an inclusive information society. The Government action plan, New Connections, provided direction for the implementation of this Initiative. The most recent partnership agreement 'Towards 2016: Ten-Year Framework Social Partnership Agreement 2006-2016' (Government of Ireland, 2006b), while having a section entitled 'Knowledge Society', does not go into any great detail on the subject. In fact there is considerably less than its predecessor. It merely states that it will follow the government's new knowledge society action plan. This is due to be produced in December 2006. It is to be in line with the EU i2010 initiative 'A European Information Society for Growth and Employment'. The report states that the continued exploitation of ICTs by all sectors will be supported. Following on with its view to stimulate further and encourage increased engagement with and participation in the knowledge society, it is to include specific actions on increasing awareness, use, access, application and exploitation of ICTs. An encouraging aspect of this publication is that it states that an 'eInclusion Stakeholders Group' was formed in early

2006. The only public information available on the Stakeholders Group is within this report. Its role is to contribute to the development of the new government 'Action Plan on the Knowledge Society', due to be released in early 2007, which will primarily focus on eInclusion. Its priorities for action are in the areas of access and connectivity, skills, awareness and content. From this "a national eInclusion strategy will be developed so that everyone has the opportunity, through encouragement, awareness, support, enablement and participation, to exploit ICTs to improve their quality of life, and the cohesiveness and well-being of their communities" (Government of Ireland, 2006b, 58). The report states that the successful implementation of this Strategy in reaching the late adopters of technology relies on the part played by intermediaries, including community and voluntary organisations. According to a member of the ISPU, the group was formed earlier this year and comprises government officials, academics, representatives of the Social Partners, and eInclusion practitioners. It is to be in line with the European i2010 initiative entitled 'a European Information Society for growth and employment' and the National Action Plan against poverty and social inclusion (NAPS/incl) programme.

The NAPS/incl

The NAPS/incl programme is a prime example of a policy mechanism currently in place within the state that has the potential to propagate an inclusive information society but had been falling short. This was recognised by the ISC in 2003 but, as they stated then: 'the information society elements within it were fragmented and not cohesive' (ISC, 2003, 33). They were referring to the 2001-2003 action plan. Ireland's plan was based on the revised National Anti-poverty Strategy entitled 'Building an Inclusive Society' (Feb 2002) and the social partnership agreement 'Sustaining Progress' (March 2003). It drew on consultation carried out by the Office for Social Inclusion (OSI) and the Combat Poverty Agency (CPA) through regional and national seminars. They also, following advertisements placed in the national media, received numerous submissions.

The 2003-2005 NAPS/incl plan (Europa, 2003) addressed the ISC criticisms. It refers to eInclusion and presents a policy task relating to it which covers excluded groups: women on home duties, retired people, tradesmen / skilled workers, workers in agriculture forestry or fishing, and the unemployed. It reports that funds were allocated to the information society fund initiatives such as: the Community Application of Information Technology Project, the development of National Disability Authority, IT Accessibility Guidelines, the Equalskills Project, and the Library Internet Access Initiative. Within the objective 2 section (to prevent the risks of social exclusion), under the heading 'E-Inclusion – exploiting the potential of the knowledge based society', it rearticulates the government's policy to raise the level of participation and access. It outlines the 'Including Everyone in the Information Society' special

initiative involving the Government and Social Partners developing 'coherent strategies to promote participation in the Information Society' for late adopters and those on low income. It states that this will include a review of the national e-inclusion strategy with the following key outputs: "Review of the Implementation Strategy: Evaluation of initiatives at local, regional and national level to date, progress achieved, existing and potential gaps; Examination of the research findings on how the digital divide issue is being tackled nationally compared to other countries and the need for further policy initiatives; Identification of the key components of a revised implementation strategy, including funding, particularly focusing on those on low incomes and late adopters; Mainstreaming of information society issues into all relevant Government policies and decision-making" (Europa, 2003, 41).

The 2006-2008 report is due for release at time of writing. It covers many concerns relating to the struggle against poverty in Ireland, and is linked to the 200 Billion Euro National Development Plan for 2007-2013. The consultation report used to gather opinion and formulate the 2006-2008 publication (OSI, 2006) seems to give information society related policies and issues less attention than the previous report. While many eInclusion issues are related to general poverty, it seems that IS policy has slipped down the priorities again within the NAPS/incl proposals for Ireland. None of the submissions focused particularly on the information society. Within the progress-made chapter, there is a similar trend. Within the Strategic approach, objectives and targets section [Objective 2 (5.3.2) – Facilitating access to rights, resources, goods and services] there is a section entitled 'E-inclusion/Tackling the Digital Divide'. It sets the target to 'Increase the broadband penetration rate to the OECD average of 10% by 2007.' The chapter relating to policy measures says that enhanced funding to support the use of IT technologies in education and training programmes is required. The only mention of eInclusion is within section 6.3 Objective 3 – Preventing the risks of exclusion. "A small number of submissions (3) called for the continuation of measures such as eInclusion' to address gaps in computer literacy and enhanced access to IT training and computer access for vulnerable groups. A number of submissions (2) from local authorities called for the role of existing public services, in promoting e-inclusion, particularly libraries, to be recognised in NAP/inclusion and for the national rollout of the 'Making Access Happen' scheme".

Regional Level Strategies

As will be outlined in the 'Actions Taken' section to follow, there is much being done at the regional level in relation to information society policy. While these policies are greatly influenced and generally funded by EU level initiatives, the regional authorities do contribute to, shape and in some cases totally fund and operate projects. The majority of the information society projects and initiatives at this level receive funding from the government, the EU or both. Regional authorities also play a

role in assisting the county councils and, in some cases, the voluntary sector and the community at local level. The importance of the community and voluntary sector in addressing social exclusion through utilising ICTs is being increasingly realised. The actions taken by them reflect this as can be seen within the relevant operational and development strategies.

National level strategies for local development

A number of national-level strategies have been developed to facilitate information society growth at the local level.

National / local Libraries

A set of strategies which originate at the national level but facilitate local level development is directly related to the national library service. An Chomhairle Leabharlanna (The Library Authority Council) is the advisory body on public libraries to national and local government in Ireland. The national library service is a key resource for all sections of society which is delivered at practically no cost to the user. The library council sees itself as over time increasingly becoming agents of social inclusion. Libraries were identified as one of the three key targets in a project to examine cultural inclusion by The National Economic and Social Forum (NESF) in February 2006. The Library Council sees libraries as a local and national space for all in both physical and virtual aspects. There has been a central focus of policy on libraries as a means to provide internet access to the public. With funding from the Information Society Fund, public libraries both facilitate access to online resources while digitising material from their own collections. There are now over 1,400 Internet access PCs available in almost 100% of public libraries. In 2004 a total of 1.6 million sessions of Internet access were provided throughout the country. (An Comhairle Leabharlanna, 2006, 17) Further, the libraries support adult, distance and lifelong learning.

LGCSB

Another national level strategy which directly affected local governance was the development of the Local Government Computer Services Board (LGCSB). Their aim is that 'through the quality, commitment and continuous development of their staff, the LGCSB will be the partner of choice for Local Government initiatives in the delivery of quality services through the optimum application of ICTs within the National Information Society framework' (LGCSB, 2003). Through providing ICT vision, advice, guidance and support, they strive to improve the roles, processes, systems and service delivery of Local Government. They identify common approaches and strategies for ICT in the delivery of Local Government business systems while acting as a strategic and operational resource. They also facilitate the role of local authorities, improve the service delivered to citizens and enhance local participation in the decision making process.

Local Governance

Traditionally, local agencies (LEADER, Area partnerships, Groups and County or City Enterprise Boards) while conducting positive work, had in many ways been working in parallel. This had the combined effect of reducing their effectiveness, which at times resulted in duplication and often overlap in aspects of their responsibilities. The Government established an Interdepartmental Task Force on the Integration of Local Government and Local Development Systems in June 1998. The intention of this action was to establish closer partnerships between local authorities and local development bodies both functioning at the local level. It also aimed to bring about an integrated approach to the delivery of both State and local development services at local level. It recommended the establishment of City/County Development Boards (CDBs) in each of the five major cities and in each of the twenty nine county councils. In 2000 the Department of the Environment and Local Government published guidelines to enable CDBs to deliver a horizontally integrated service across agencies and actors at a local level. To facilitate a more coherent method of planning and delivery of services at local level, each CDB is required to prepare and oversee the implementation of a ten year county/city Strategy for Economic, Social and Cultural Development. This provided the template guiding all public services and local development activities locally. A key guideline was that social inclusion was to be a major focus within the CDB strategy and that the boards were to follow key national public policies including information society and national anti-poverty strategies. In February 2003 the CDBs were formally recognised as the central bodies for formulating community and local development programmes. This shift in responsibility resulted in the CDBs having the potential to deliver and coordinate inclusive information society measures at the local level. "The county development boards generally, and the CDB strategies in particular, are a new approach to the challenging topic of providing more 'joined-up' government at local level in Ireland (CDB, 2003, 9). These boards have the potential to deliver an effective, and more locally based/orientated, approach to information society policies and initiatives. However, while some are doing this, many are not availing of this potential.

Actions Taken

Following the overview of the policy framework, a look at particular actions being taken at national, regional and local levels will give a clearer perspective. For national level actions, a synopsis of the key developments within the government action plan from progress reports will be provided. For regional initiatives, as reviewing all regions would be beyond the scope of this paper, a number of regions will be covered acting as case studies. A similar approach will be taken for local level initiatives within the counties.

Government Strategy

As outlined above, the government's strategy and actions for the information society, are presented in their publication 'New Connections: A Strategy to realise the potential of the Information Society'. This was originally published in March 2002 and there have been three progress reports since. These reports are quite comprehensive, outlining overall actions and containing updates on the relevant developments. For the purpose of synopsizing key policy areas and developments, a quite general account of actions taken within each section will be presented. There are three subsections within the 'key infrastructures' section and four within the 'frameworks necessary to support and strengthen Information Society development' section.

Key Infrastructures Necessary for Progress as an Information Society

Telecommunications Infrastructure:

An indicative €200 million from the 'e-commerce and telecommunications measures' within the National Development Plan (NDP) (2000-2006) had been put aside for broadband infrastructure projects. This was partly funded by the ERDF. The finances were used to identify gaps in infrastructure, maximise the utility of shared information, and drive demand for new services and activities. The measures were being taken to facilitate the even spread of the digital economy and to 'contribute to economic and social cohesion in the information society'.

The government launched the broadband action plan in 2003. It allocated €140 million of exchequer funding to be invested up to 2007. There are five key elements of the action plan:

- Connect more than 90 towns with populations exceeding 1,500 to broadband with Community Broadband Exchanges and strategic fibre;
- Through the Group Broadband Scheme, promote the rollout of broadband to communities where the market is not meeting demand. This scheme, with government financial support of up to 55%, facilitated these communities to pool broadband demands and obtain high-speed connectivity from service providers;
- Tougher fines for those infringing communications laws;
- New policy directions for the Communications Regulator which focus on facilitating the delivery of competitive broadband pricing;
- A website (www.broadband.gov.ie) which promotes broadband and its benefits, outlines where it is available and allows consumers to compare prices from different service providers.

The regional broadband programme aimed to supply smaller towns with broadband. Within this programme there have been two phases of Metropolitan Area Network (MAN) rollout. Both had €80 million set

aside for them. The first phase set up networks in 27 towns, while the second is to supply MANs to 90 towns with populations in excess of 1,500 that had no existing DSL broadband. Connectivity framework deals with the backbone networks, carried out by the Department of Communications, Marine and Natural Resources (DCMNR), reduced the price of back-haul (connection of a local area network to the WWW via Dublin) to one eighth of what it had been prior to 2004. Co-investment with private sector partners to upgrade and expand the backbone infrastructure also took place within the NDP (00-06). Initiatives included the construction of a new national fibre backbone by ESB Telecom (the national Electricity Supply Board), the development of regional e-commerce centres, the extension of the EsatBT regional backbone network and the acceleration of its DSL locations. The national incumbent Eircom also received funding for its DSL programme. The 'Broadband for Schools' initiative was jointly funded by the Department of Education and Science, the DCMNR and the Telecommunications and Internet Federation. It had a fund of €18 million and initially aimed to have 4,100 primary and post-primary schools supplied with broadband connectivity by the start of the 2005 academic year. The latest progress report states that Public Private Partnerships (PPP) has resulted in Ireland being one of the cheapest locations worldwide for international leased lines. A €50 million project, also funded by the NDP 00-06, was allocated to experiment with using the ESBs network to deliver broadband.

Legal and Regulatory Environment:
Numerous initiatives were implemented under this heading. Some of key initiatives will be outlined. A review of the code of practice and ethics concerning illegal and harmful use of the internet was undertaken. Legislative provisions enabling Ireland to ratify the Cybercrime Convention were included in the criminal justice bill. Work was undertaken by the Department of Enterprise, Trade and Employment to restructure, consolidate, simplify and modernise company law in Ireland. The Copyright and Related Rights Act 2000 was brought into line with EC copyright Directives. A national network security awareness campaign, with a dedicated website (www.netsecure.ie), was launched in July 2003. Further telecommunications regulation that includes the regulation of the .ie domain registry and the creation of indictable offences for breaches of enforcement measures imposed by the Commission for Communications Regulation.

e-Government:
Initiatives within this section, which is by far the largest one, are grouped within nine subheadings. These are: Public Service Broker; Flagship Services to Citizens; Flagship Services to Businesses; GIS Strategy Prioritised Service; eHealth; eCabinet Project; ePayments Strategy; eLegislation; and Additional eGovernment Projects. The public service broker is a platform to 'support integrated access to all services of central

and local government through a single point of contact and through multiple access channels. The portal website went live in 2004 (www.reachservices.ie). The website, www.basis.ie, provides business access to state information and services. Thirty two services are outlined under flagship services to citizens. These include: a site within which motor tax can be paid; the e-Plan facility within which planning applications can be monitered and processed; bringing national museums, libraries / library services, archives and art galleries online; a consumer protection and small claims portal; and eEnabling public services. Twenty two projects fall within the services to businesses section. These include a number of services being offered by the revenue commissioners such as online vehicle registration tax. Other services are: import/export licenses online; online tendering for public procurement; and online work permits. The eHealth initiative has online services such as appointments for hospital services, medical cost reimbursement, access to laboratory results and integrated health services. Online filing and payment of taxes is one of the twenty two projects outlined within the additional eGovernmnet projects section.

Frameworks Necessary to Support and Strengthen Information Society Development

eBusiness:
A project to develop a new national eBusiness strategy was developed by the Department of Enterprise, Trade and Employment to promote non-ICT sector Small to Medium Enterprises (SMEs) and micro-enterprises to use ICTs to maximise their competitive advantage. An acceleration fund was established by Enterprise Ireland to fast-track projects of a significant scale designed to integrate ICTs into the business process. Building on this was an initiative supplying ebusiness and IT advice which aimed to have an effect on a larger number of companies. ITS 2007 is another Enterprise Ireland project designed to develop high value-added knowledge intensive industries and to assist them in achieving fast growth. A number of eProcurement projects were also designed and implemented by the Chambers of Commerce and Enterprise Ireland. Campaigns were run dealing with and promoting e-work, e-work awareness and training.

The government's e-business development strategy focused on five target sectors: mobile commerce; e-marketplaces; netsourcing; voice technology and digital content development. Flagship digital content projects were established. The Digital Hub was established in Dublin as an International centre of excellence in digital content development. It has 28 firms working in collaboration with education & research institutions to develop digital content capabilities. Media Lab Europe, an offshoot of Media Lab at Massachusetts Institute of Technology (MIT) was set up for cutting edge IT research (development and application). Both aimed to promote research and development, help spin-off

enterprises/commercial activity while also being used to showcase Irish expertise and, in turn, attract foreign e-business investment. This project has since experienced serious / terminal difficulties. (See Lillington, 2005)

Research & Development (R&D):
Enterprise Ireland has developed programmes which aim to: build the R&D capacity of firms to a continuous and significant level and to initiate significant R&D development; encourage and support high-risk, high-quality R&D projects; encourage company participation in collaborative R&D projects at both national and international levels and to develop their management ability to control the R&D process. €2.5 billion from the NDP 2000-06 was allocated to research, innovation and technical development. Numerous initiatives were developed to support the development of the pervasive technologies of ICT and biotechnology. Regional development strategies were also developed. Strategies to increase the quantity and quality of collaboration between third level intuitions and companies were developed to establish a world class research environment in state agencies and higher education institutions.

Science Foundation Ireland was set up in 2003 to: embed existing firms within the economy and facilitate their re-positioning higher up the value chain; attract the R&D activities of foreign investment projects; foster the start-up of high potential technology firms. The Irish Research Council for Science, Engineering and Technology (IRCSET) was launched in 2002 to establish schemes of support for researchers within its relevant disciplines and to provide research funding. Numerous post-graduate and post-doctoral fellowship schemes were also set up. The Higher Education Authority, with the support of the Department of Science and Education, increased the capacity of its national backbone (HEAnet).

Lifelong Learning:
As part of the Blueprint for the Future of ICT in Primary and Secondary Level Education initiative, almost €40 million was made available to schools between 1998 and 2004 in order to realise the government's vision of preparing all students for the information age. In 2003 the National Council for Curriculum and Assessment (NCCA) developed a plan to integrate ICTs into education at first and second level. Following negotiations between the DCMNR, the Department of Science and Education and the telecommunications industry, an €18million fund was established in 2003 to fund broadband services to schools over a three year period. Additional exchequer funding was added for the supply of equipment and services. An IT industry advisory group was established to formalise links between the IT industry and schools at national level in the implementation and development of innovative IT projects which would, through the use of ICTs, also expand the boundaries of

traditional education. A number ICT training initiatives for adults were developed to provide both basic ICT training and part-time flexible options in further education. The National Adult Literacy Agency was given funding to develop a website (www.literacytools.ie) to develop distance learning ICT literacy programmes to be used in homes, workplaces, libraries and within training and education centres. In 2002 €12 million (plus a further €3 million in 2003 and 2004) was given to the Information Technology Skills Fund to ensure the supply of skilled graduates in emerging market needs areas. In 2002 a Taskforce on Lifelong Learning established a strategic framework for lifelong learning. (Government of Ireland, 2002)

eInclusion:
Following the outcomes of many initiatives and policy implementation plus the suggestions made by reports on eInclusion, including the ISC (2003) report outlined above, the governments e-Inclusion implementation strategy was reviewed. Five areas of importance were outlined by the review committee: ICT Access, Learning and Skills; Building the ICT capacity of the community and Voluntary Sector; Measuring Inclusive Information Society Development; Awareness Raising, including Content Development and; Mainstreaming Information Society Issues. ICT literacy is being developed within the context of Lifelong Learning and within the government's commitment under the e-Europe 2005 action plan in order to produce a national lifelong learning strategy. The key goal is to incorporate ICT literacy within all education, training and 'second chance' programmes for disadvantaged groups. Three programmes were developed which target the community and voluntary sector. The first aims to provide structured support for building and enhancing the ICT capacity for the sector. The second is run by the LGCSB in coordination with the relevant government departments and agencies and funded by the information society fund, is the Mobhaile Community and Voluntary Services project (www.mobhaile.ie). Through the provision of an online presence, hosted intranets, secure emails and SMS gateways, the demands of the sector can be met through gaining the ability to communicate with members, other interested parties and individual citizens. This project also syndicated services and an online office within which the retrieval and storage of forms and documents in private areas for the members. The third programme was to research the ICT needs of the sector. This was undertaken by the Computer Science and Anthropology departments at the National University of Ireland in Maynooth (NUIM).

Another initiative, which was successful, was the Community Application of Information Technology (CAIT). Details of this are outlined within the community level actions section below. In the areas of research and measuring, the extent of the digital divide in Ireland was highlighted. The above mentioned ISC (2003) publication which was carried out by iTech Research, was used to measure imbalances and provide international

comparisons. Further, the Central Statistics Office (CSO) have publicised and are to continue to publish, annual statistical reports detailing ICT use among businesses and households. To raise awareness and provide local content the LGCSB are using the Mobhaile project which will make local authority information easily accessible, relevant and useful. As was mentioned above, the 'Sustaining Progress' and NAPs/incl reports have included sections concerning e-inclusion in order to mainstream information society issues.

Two projects were launched, under the heading, accessibility. The first was the development of guidelines for electronically delivered services. This was launched by the National Disability Authority (NDA) in 2002 and the website (www.accessit.nda.ie) was subsequently used for a number of IT publications. The second project aimed to identify and provide examples of methods or tools that could be followed in order to assist in determination of compliance with the accessibility guidelines. These projects more recently resulted in the production of a draft set of guidelines on accessibility in the physical environment, ICT and quality customer services for public service bodies.

Regional Authorities

Two regional authorities stand out as a result of their activities in relation to addressing issues concerning information society strategies and initiatives. Initiatives have been developed in line with EU regional development policy and are largely supported by EU funds. While some initiatives received funds from the Information Society Development Fund, they are considered to be fairly independent of both national and local authority strategies.

South East Regional authority

The South East region accounts for 13.5% of the country. It consists of five counties and has a population of 423,589. The economy has historically been primarily based upon agriculture, manufacturing, tourism, fishing and services. The South East Information Society Strategy (SEISS) was formally considered and adopted by the authority in September 2001. It was one of the first strategies of its kind. A key vision for the initiative was to address the relative disadvantage of the region in terms of technology availability and use. It also aimed to place the region in a strong position to develop an ICT sector. The goal of the programme was the "creation of a cohesive set of regional relationships for the delivery of ongoing practical ICT initiatives relevant to companies, communities and Local Authorities in each county in the region" (SEISS, 2004, 1). The SEISS programme was responsible for the attraction of over €19.2m of project funding to the South East region. A number of key projects were funded by SEISS.

CARP (Connection and Access for Rural People), funded by INTERREG IIIA, dealt with the provision of local community

information content and broadband access for pilot communities in Ireland. A project entitled Connected Communities was a regional approach to the encouragement of local community content creation and internet usage. EPROC (INTERREG IIIB) was a project concerned with eProcurement and the effect it has on small to medium enterprises (SMEs). Also funded by the INTERREG IIIB Atlantic Programme, SENSITIC was a benchmarking project to which sought to gauge the impact of the Information Society in seven regions of Europe including South-East Ireland. SERPANT was a flagship project with a budget of €18 million which financed six municipal area broadband networks (MANs). The SERPANT project fell within the national county and group broadband scheme. The project was grant-aided at the rate of 90% by the Department of Communications, Marine & Natural Resources (DCMNR) with match funding of 10% provided by local authorities, was completed at a total cost of €18 million. Having brought broadband to key towns, the regional authority moved its focus to the provision of broadband to rural towns and communities (the government's group broadband scheme).

The CAPTIE (Co-ordinated Advanced Teleworking Pilots in Europe) project was funded by INTERREG IIC. The South East Regional Authority was the lead partner and co-ordinator of it. The aim of the project was to promote teleworking and promote the associated benefits. The E-BYGOV project aimed to examine methods, utilising ICTs, to make government services more responsive, accessible to citizens and easier to use. It was partially funded by both the EC and INTERREG IIIB. The local authorities, assisted by the LGCSB, developed an eReciepts. Online payment services were developed in areas such as housing rents and loans, water charges, traffic fines and fire charges. The SERB-II broadband project was run in coordination with the relevant county councils. It constructed nine further networks in addition to those mentioned above. This fell within the second phase of the Government's regional broadband programme. Similarly to the previous phase, five of the towns had MANs installed. However, the remaining four utilised wireless technology to deliver broadband connections.

Midwest Regional Authority

This region contains three counties, has a population of 339,591, and is 8,248.64 square kilometres in area. The principal economic activity is in agriculture, professional services and manufacturing. The Ennis Information Age Town Project was carried out within this region. (http://www.eiat.ie/index.php)

The Shannon Informational Society Regional Partnership Programme (ShIPP) provided a coherent approach for all agencies, companies, organisations and general users within the Shannon region, that they might be direct and guide the information society proactively. This was seen as a method to raise the quality of life and economic productivity of

the region. The Shannon Regional Innovation Strategy (SRIS) ran parallel to the ShIPP project and was financed by the European Regional Development Fund (ERDF) but focussed solely on the development and promotion of innovation in the region. The Analysis of Spatial Planning and Emerging Communications Technologies (ASPECT) was a project investigating both the potential and actual impacts on spatial planning and development made by ICTs. The Tactical Integration of Telematics Applications Across Intelligent Networks (TITAN) aimed to provide personalised internet access to public services within the region. It was a project falling within the EU Integrated Applications Digital Sites (IADS) programme. The PRELUDE (Promoting European Regional and Local Sustainability in the Digital Economy) project was also carried out within the Midwest region. The RuralTech project, funded by INTERREG IIIB Atlantic Area Programme, ran in the region until December 2005 and was concerned with promoting the information society in rural areas. Finally, the Citizen First project, also funded by INTERREG IIIB, was headed by the Midwest Regional Authority as a lead partner and aimed to empower citizen interaction through the improvement of public service delivery.

County Level

In the publication entitled 'Review of County/City Development Board Strategies' (CDB, 2003) it is stated that ICTs are seen as one of the more significant opportunities for all of the counties/cities. This report also shows concern about the shortcomings generally in terms of the development of the telecommunications network. When mentioning the development of ICTs, reports from the CDBs are concerned primarily with broadband investment and development. There is very little being done in terms of the profiling of ICT development within the individual counties and cities. While social inclusion is identified as a priority within all of the CDB reports, very few look at it in terms of social exclusion from the information society or how ICTs can be used to address the problem generally. In a table outlining the number of actions targeted at social inclusion only one out of 1,225 focuses on telecommunications. (CBD, 2003, 49) This report includes information technology among the issues which the CBDs feel should be addressed at regional level.

While the majority of County councils and CDB strategies merely refer to ICTs as an infrastructural issue, some do address social information society issues such as einclusion. The Information Society Commission (ISC, 2003) presents a list of Counties that have produced strategy documents which include social inclusion and ICT issues. These include South Dublin, Meath, Kilkenny, Offaly, Donegal, Longford, Galway, North Tipperary, Kildare and Dublin City. A number of these counties action plan sections dealing with ICTs will be presented at this point to illustrate the range and types of actions which appear in county development plans.

Within its infrastructure section of the CDB plan Longford identifies ICTs as a key issue. It states that they wish to ensure that appropriate structures are in place to encourage the expansion and development of the county. Two objectives to facilitate this are associated with information society development. The first, relating to infrastructure, is to have an affordable high-speed telecommunications infrastructure. The second is more concerned with inclusion as this objective is to provide access to ICTs to those most marginalised within the county.

Kildare County Council is an example of another county level development plan that addresses e-inclusion as well as ICTs as an infrastructure. In comparison to Longford, Kildare is an example of a county going into slightly more detail. As one of its goals it has stated that it wishes to establish Kildare as a leader in ICTs. There are two sides to this goal. The first is to develop the county as a high-tech location, while the second key development is to provide publicly accessible ICT. The action to be taken to achieve this goal is to develop and implement an ICT strategy to achieve the following: Firstly, to investigate the future potential of broadband infrastructure in the county; secondly, to resolve training and skills gaps; and, finally, to co-ordinate and streamline ICT initiatives in the county.

A shortcoming of both the Longford and Kildare CDB plans is that they fail to provide sufficient detail on the initiatives and how they will be implemented is left vague. A number of county strategy documents stand out as being good examples of all encompassing ICTs strategies in that they include infrastructural, economic and social concerns and detail how shortcomings in these areas are be addressed. The Meath and Offaly strategies, while outlining the potential of ICTs, mentioned concerns and initiatives relating to the digital divide. They presented awareness campaigns with the goal of disseminating general public information and information relating to the importance, dangers and potential of ICTs and the promotion of lifelong learning. They also formulated and implemented initiatives to develop e-democracy and tackle social exclusion. Wexford county development board has developed an information society strategy following the establishment of an information society taskforce. It aimed to use existing structures to develop ICT training for marginalised groups. It has carried out appraisals of ICT training and facilities and formulated an approach as to how best to meet this objective.

One county strategy will be sufficient to illustrate a proactive county approach to information society development. This is the North Tipperary County Development Board strategy. (North Tipperary CDB, 2002). Within this plan, numerous strategies concerning the use of ICTs for economic development are presented with the aim of developing small to medium enterprises (SMEs) and making the county a suitable location for IT industries. An example of one action taken in this area is

an objective which aims to provide services and technical supports to sustain and develop existing SMEs through examining methods of ICT capacity building and the development of a programme to implement these methods. Coinciding with these are initiatives aimed at rural development and the creation of sustainable rural communities that include ICT elements, such as reviewing I.T. and e-commerce training needs of farming families. On the cultural development side, they see ICTs as being an ideal means of promoting and marketing cultural events through the development of a county culture website with links to local media and relevant information sources. (http://www.tipperarynorth.ie/services/arts.htm)

In terms of the promotion and development of the information society in the county, the section entitled 'Information and Communication Technologies' is a prime example of a well informed and wide ranging approach to addressing issues relating to the information society. The section, following an overview of the positives associated with ICTs, presents a general account of the digital divide and why it is dangerous to society. This section presents six visions within which objectives are identified and actions outlined to achieve these.

The first vision is that all people in the county are aware of ICTs. Objectives within this state that everybody, despite their geographical location, age, and education will be aware of ICTs and existing ICT facilities. Actions to reach these objectives include financing research into which social groups require special attention, an audit of ICTs within the education system and available to the general public, and projects to develop the capacity of people to evaluate and understand the ICT supports which are available. Vision two aims to ensure that ICT training and advisory supports are available to all people in the county. Objectives within this include one which aims to ensure that each individual and organisation has a level of training appropriate to their needs. Numerous actions are outlined to achieve this such as identifying specific barriers to ICT use and addressing them. Many actions within this vision focus on evaluating and developing ICT training at different educational levels. Vision three, which also outlines numerous objectives and actions, aims to ensure that organisations, groups and individuals are aware of the financial supports available to them for ICT development. Vision six is perhaps the most detailed and ambitious of the six visions. It aims to ensure that the county will have a telecommunications infrastructure that provides equal access for all at an affordable cost. Objectives include: the provision of high-speed access to all individuals, businesses, public institutions; ensuring that provision for the installation of local digital exchange is made through the planning process in every community that has a library, school, post office or church; support for national initiatives such as PIAPS in libraries and the national LLU process and; ensuring that the required infrastructure is put in place for low density population rural areas. Numerous actions are suggested to reach these

goals and timescales are outlined.

Community Level
Local authorities working within the counties have developed initiatives specifically aimed at addressing inclusion in the information society through the generation of relevant content. A number of these are also outlined within the eInclusion publication produced by the ISC. (ISC, 2003, ch6). These projects vary in terms of whether they are funded / approached at the national level, developed by county councils or individual local groups or authorities. An example of content generation from the top-down would be the Eircom funded Information Age town projects. Ennis, Kilkenny, Castlebar and Kilarney are among the towns included in this initiative. They received funding to develop community portals and promote the use of ICTs among businesses and the community. At a regional level, local content development is also being approached by the regional authorities. The SEISS project, mentioned above, contains an example of one of these initiatives. Clann Eire is a project aimed at developing a content management platform for communities within the South East region. It was funded by the EU and initially generated local content across five counties and subsequently set the foundation for potentially delivering e-government services at the local level. As outlined above, many county councils, through their websites, have been achieving local content delivery. In terms of locally based community promotion, one programme stands out as being a huge success. The Community Exchange Programme, which was established in 1999, provides a communication channel for individuals and groups with some involvement or interest in community and voluntary work or organisations. It was the first online forum for the delivery and exchange of information and news relating to the Irish voluntary sector. It has developed from being a monthly email bulletin service to become an environment for anybody both to share information and actively to contribute to the websites content.

The CAIT initiative, while being funded by the government, is the best example of initiatives being developed to target local communities and groups at the local level. The introduction of the CAIT (Community Application of Information Technology) initiative in 2000 aimed to address the digital divide following suggestions made within the Information Society Commissions report entitled IT Access to All (ISC, 2000). Within this report were suggestions to promote social inclusion through actions taken by the community and voluntary sector organisations. It suggested that these organisations should be funded to facilitate their ability to reach three key objectives. These objectives were: to encourage late adopters to engage with information and communication technologies in a beneficial way; to empower communities to harness the benefits of the new technologies; to employ information and communications technologies to overcome particular socio-economic barriers which exist for some communities. In order to

do this initial funding amounting to just over €5 million was allocated to 71 projects nationwide. These projects came into being in June 2001 and were initially to run until December 2002. There have been other phases since (Duggan et al, 2003, 5). An example of a successful initiative that took place which was shaped and organised by national, regional and community inputs is the group broadband scheme. The county and Group Broadband Scheme (CGBS) was co-funded by the e-commerce and communications measures of the Border, Midlands and Western (BMW) and Southern and Eastern (SE) Regional Operational Programmes of the National Development Plan 2000-2006. The regional coordinators acted in an advisory capacity for the communities and service providers, while matching suitable communities and providers to each other. These regional advisors also encouraged larger Group Broadband Schemes by promoting aggregated or combined projects that cover many communities within counties or across a region. The key objective of the programme was to promote the rollout of broadband access by establishing, through local/regional authority coordination and community driven initiatives, sustainable services in rural hinterlands, towns, villages and underserved areas. To be eligible for this scheme the community could not have more than 1,500 residents. It facilitated the community to deal with the telecommunications operator of their choice, or to draw up and implement their own broadband plan, in order to supply broadband to local businesses and residents. Over 125 projects were approved under the second phase of this initiative which ran until 28th April 2005. This scheme has since ended with no definite substitute put in place. (Kyle, 2007)

Statistical Indicators

The ISC produced two key statistical reports in April 2003. (ISC, 2003b) One is a general public survey and the other a business survey. The Central Statistics Office (CSO) has produced numerous reports on information society statistics which are becoming both increasingly detailed and broad in scope. This reflects both the policy shift towards increasing the analysis of the information society and the more comprehensive understanding of the key concerns that has been built up over time. A quite detailed account of the Information Society and Telecommunications sector was released in January 2006 analysing 2005 figures (CSO, 2006a), while an update on the information society statistics for 2006 was released in November (CSO, 2006b) with a full report due in December. Another source of statistical analysis, which builds upon ISC and CSO figures, is from the Economic and Social Research Institute (ESRI, 2004). These statistical reports inform a number of generalisations.

ICT Sector

The ICT sector accounted for 20% of the total turnover for Irish industries and services. There are 80,100 people in employment within the sector which accounts for 36% of the total value added in industry

and services. Of these enterprises 10% are foreign owned which account for 56% of total employment and 85% of total turnover for the sector. The Irish ICT sector has one of the highest shares of business sector value added in the EU and OECD countries.

Use of ICTs by Enterprises
Figures for enterprises were taken for those with ten or more in employment. In 2006 97% of all Irish enterprises use computers, which is a similar figure to the previous two years. 94% of all enterprises are connected to the internet. The most common type of connection is broadband (61%), then ISDN (31%). 35% connect using a modem while 14% use wireless technology to connect. Sales, which significantly overshadow total purchases, using e-commerce accounted for just over one quarter of the total manufacturing revenue. In terms of ICT strategies, a mere 18% of enterprises have written one. Irish enterprises are far more likely to sell online in comparison to their EU counterparts. They are, however, less likely to have a broadband connection.

Use of ICTs by Households
Figures for 2006 show that 58.5% of Irish households (867,300) have a home computer. This is up from 54.9% in 2005 and 46.2% in 2004. In 2006 48.7% of all houses are connected to the internet. This is increasing slightly as the corresponding figures for 2005 were 45.1% while for 2004, they were 38.2%. The figures for houses with home computers that are connected to the internet are 83.3% in 2006, 82.1% in 2005 and 82.7% in 2004. Of people aged 16 – 74, it is estimated that 54% have used a computer at some time, while 44.5% have used the internet. The three highest responses, when asked why they don't have internet access at home were: the internet is not needed; the internet is not wanted due to content being harmful or not being useful; and a lack of skills. Cost of equipment and access also appear as reasons.

Broadband
Ireland has a noteworthy international capacity existing to support current and future enterprise activity, which is served by a variety of routes and carriers. International leased line costs are the lowest in the OECD. Strong competition and competitive prices are a result of high levels of diversity and capacity. National leased line costs place the country in third place within the EU behind Denmark and Luxembourg. There has been undoubted success in relation to the ICT sector and the use of broadband among enterprises. Much progress has been made concerning the rollout and promotion of ICTs and broadband as Ireland has experienced rapid DSL growth coinciding with a reduction in cost.

Thus, the policy implementation, projects and initiatives outlined above are undoubtedly having a positive effect. However, to reveal the extent of their effectiveness and the rate of progress, Ireland's performance as an information society must be compared to other member states. The

above results warrant a specific analysis of broadband rollout among households, as they represent a flaw in the relative performance of Ireland within the EU.

While Ireland is a leading EU country in terms of the ICT sector, various aspects of ecommerce and familiarity and use of some ICTs among the general public, the country as a whole performs very poorly when it comes to households connected to the internet and the rollout of broadband generally. The OECD (2006) placed Ireland in twenty-fourth place out of thirty in terms of broadband subscribers per 100 inhabitants in June 2006. As this is a worse position than the previous year, the country is falling further behind many OECD countries. Irish households are less likely to have internet access and are among the lowest users of broadband within the EU. 16% of Irish households with an internet connection in 2005 used broadband. A low figure when compared to the EU average of 48% for the same year. In addition to this, a regional disparity exists in that households within the Southern and Eastern region are more that twice as likely to have a broadband connection than those within the Boarder and Midlands region. It was reported by Comreg (2006a) that a large percentage (around 40%) of dial-up users failed to get broadband throughout all of the regions and that the gap between the rest of the country and Dublin, in terms of availability and use of broadband, is increasing. Thus the digital divide within Ireland is widening while Ireland's position within the European digital divide is worsening.

While numerous commentators and analysts might disagree, the following points are made in the most recent review of broadband demand produced by the Irish Government (DCMNR, 2006). Ireland has a relatively low number of broadband subscribers due to the full scale launch of broadband services taking place 18-24 months after other countries which resulted in a 'take-up lag time' of roughly two years. They attribute this take-up lag time to a number of factors. Competitively priced DSL was launched relatively late by the incumbent telecom operator. Due to financial difficulties, the cable TV networks didn't emerge as significant infrastructure-based competitors. It should be noted that cable TV, partly due to receiving British television, has a long history in Ireland which means that many systems are old and in need of expensive renewal. Moreover, the scope for additional investment required to launch broadband services was curtailed by the deterioration in share values of telecoms companies.

A key issue to consider is whether this relative disparity is being reduced or is getting worse. While there are many positive considerations, Ireland continues to compare poorly for overall broadband take-up and is in fact slipping further behind other member states. Further, many of the new member states are out performing Ireland now in this area. It has been stated that Ireland was in a better relative position ten years ago. Two key

reasons for Ireland's slippage and poor relative performance in relation to overall broadband take-up are presented by Forfás (2004). Firstly, the lack of real growth in competing technologies, such as cable, which is strong in other countries is key. The second reason presented is the lack of competition and innovation within the DSL market.

Considerations In Closing

The industrial development driven Information Society policy has been undoubtedly highly successful. Public policy focusing on general education and skills to raise the country's human capital could only be viewed as a success. The required infrastructure has been put in place in various locations and most cities to attract foreign investment. Coinciding with this are the efforts of the Industrial Development Agency (IDA) to promote and attract these companies. eCommerce and call centres are thriving as foreign firms are experiencing no difficulty in accessing high quality telecommunications infrastructure. The key problem lies in the fact that at the local level provision and/or promotion of quality low cost services is flawed. A comprehensive discussion of the flaws and the criticisms they have attracted, would be beyond the scope of this paper. However, some key ones deserve mention. At the most basic level many key recommendations from the Information Society Commission and related reports were not put into action at all or were realised as being important years after their first presentation. A result of this was that many policy requirements or initiatives were either ignored completely or put in place far later than they should have been. The pace of developments was questioned at the time within publications and was not adequately addressed. The problem has been exacerbated over time.

The Government were very late in realising that simple provision of infrastructure would not suffice. While the infrastructure was becoming increasingly available, where it was available many were unaware of it. Examples of this can be seen in the Ennis information age town project (of which Eircom was given total control) and the use of ICTs in schools. The Information Age Town Projects are certainly worthwhile initiatives and produced results. In Ennis there were indeed many positive outcomes. However, despite the uniform availability of quality infrastructure and services, many people did not avail of the numerous initiatives / incentives. These people tended to be from socio-economic groupings which would exhibit slow take-up anyway. The initiatives for providing ICTs to schools in terms of hardware availability and, in most cases, high speed connections were a huge success. However, in terms of the full utilisation of these provisions, the approach was flawed. Many computers are not being used to the extent they should be. The curriculum and teacher training has not been adapted to suit. There seems to be a lack of detailed planning. Deficiencies in terms of coordination have been blamed. Examples given are that there was no single supplier and that technicians at any level were lacking.

The privatisation of the state operator (Eircom) could not be viewed as a success. Government policy has been criticised for being insufficiently critical of Eircom's market policies. Lack of competition continued for far too long. Following privatisation the company was broken up and sold off to US venture capitalists that had no interest in long-term investment decisions. (Kenna, 2003) The most profitable and useful assets were stripped and sold off. The Eircom network, which runs into almost all houses and businesses, was not opened up equally which resulted in 'bottlenecks in the market' (Smyth, 2005). Prior to the arrival of real competition Eircom was criticised for not moving beyond the more profitable dial up connections at a sufficient pace and local loop unbundling (LLU) was very slow. LLU has continued to be unsuccessful to date. (Comreg, 2006b) While the monopoly on service provision has been broken, Eircom have been heavily criticised for dragging their feet on last-mile availability. The communications regulator (Comreg), having being given increased powers, has addressed many of these criticisms and Eircom have improved significantly but the delay, it is argued, is a key factor in Ireland's relatively poor performance within the EU. There has been talk within the media of re-nationalising Eircom in order to force much needed investment. Regardless of what is done in relation to this problem, Comreg and the government need to adopt an increased sense or urgency in addressing Ireland's broadband shortcomings. This could perhaps be reached through an overhaul of telecommunications policy / regulation in place at present, which is unlikely.

Further, two significant changes to the government's approach are required. Firstly, there must be a coordinated follow through on policies and secondly the problems associated with the centralised nature of Ireland's governance must be addressed. An example of where coherence is required is in the area of education. The government needs both to pay more attention to the more recent ISC recommendations and to revisit the recommendations made in the earlier publications. A problem with the centralised nature of the state is that there is a lack of communication between various agencies. A powerful agency should be established or a minister with increased influence is required both to develop a coordinated and effective policy and to get people / bodies to act on it. There is a lack of a central driving champion. The difficulty with Ireland's centralised structure is that the question of 'Who is responsible?' still remains. Too many state agencies are involved. There is a lack of coordination at a local level. Regional and local authorities need to be given more authority (over schools and their application of ICTs for example). If the present centralised control is a problem, the solution cannot be a central authority or champion. The problem is a paradox. Centralised control is spread across too many agencies. A central champion or czar could ensure local coordination and delegate effective authority to regional and local administration.

The administration of information society policy has to be driven from the top by an agency or minister with increased powers who can coordinate and boost the effectiveness of policies. The remit would also include getting other public bodies and organisations to act on policies and to maximise the returns for investments made whether this be from the EU or national funding. While, and through doing this, an increased level of communication from top-down, bottom-up and across all actors can be reached. With a powerful and well informed body in operation, policies that reflect the real needs of all sectors can be implemented and driven, while general communication of key issues and concerns will be increased. This change in the representation of concerns, focused through the formation of a central champion, would have the effect of making existing policy more effective and future policy more representative. Thus the shortcomings of Irelands information society policy could be addressed resulting in a high relative performance across all of the indicators rather than just a number of them.

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