Beo and Raja's BioBus Adventure
Guidance Notes and Learning Activities

UCD DUBLIN

Maynooth University
National University of Ireland Maynooth

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SUMMER PROGRAMME FOR UNDERGRADUATE RESEARCH
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biOrbic

Taighde Éireann
Research Ireland

Title	**Beo and Raja's BioBus Adventure Guidance Notes and Learning Activities**
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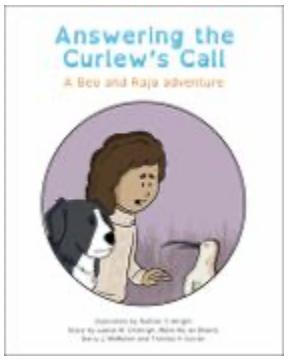
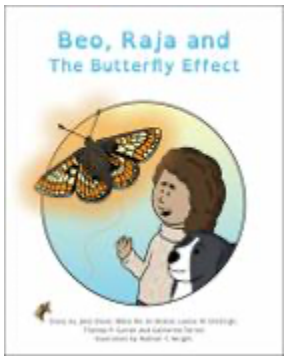
Introduction

Finding Beo

Back to the Future with Beo and Raja: A Tale from the Early Bioeconomy



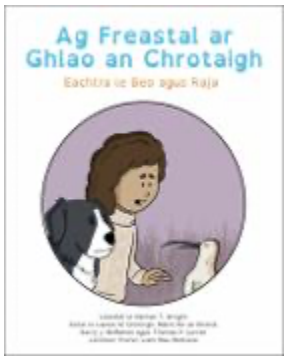
Answering the Curlew's Call: A Beo and Raja adventure



Beo, Raja and The Butterfly Effect

Tóraíocht Bheo

Ar Ais chuig an Am atá le Teacht le Beo agus Raja: Scéal ón mBithgheilleagar Fadó



Ag Freastal ar Ghlao an Chrotaigh: Eachtra Le Beo agus Raja

This is the eighth comic in the Beo and Raja series created from an original concept by Maynooth University and University College Dublin. This publication is created with the support of BiOrbic - Ireland's National Bioeconomy Research Centre.
This guidance document accompanies the 'Beo & Raja's BioBus Adventure' comic. Join Beo, Raja and their classmates as they travel across Ireland in the BioBus, discovering the science, culture and innovation behind the bioeconomy on a school tour. From the wild peatlands to a bustling town market, they meet local experts tackling real-world challenges and learn how we can all play a part in creating a more sustainable future.

These guidance notes are for everyone, teachers, youth leaders, community groups and families, who want to explore the bioeconomy in a fun, accessible way. You'll find

panel-by-panel explanations, discussion questions and activities that connect the story to real science and Irish heritage.

What is BiOrbic?

BiOrbic is Ireland's national bioeconomy research centre focused on the development of a sustainable, circular bioeconomy. BiOrbic brings bioeconomy researchers, industry professionals, policymakers and communities together to solve grand societal challenges.

'Sustainable, Circular, Bioeconomy'

The slogan *"Sustainable, Circular, Bioeconomy"* appears on the BiOrbic website and captures BiOrbic's mission to build a sustainable society that supports a circular bioeconomy. BiOrbic aims to restore our natural ecosystems, harvest biological resources sustainably, develop alternatives to fossil products and repurpose waste. Ultimately BiOrbic is supporting Ireland to emerge as a leader in the global bioeconomy.

BiOrbic has set out 15 key challenges to help Ireland transition to a sustainable, circular bioeconomy. These are:

Pillar	Challenge	Explanation
Healthy Ecosystems	Recovering Biodiversity	Restoring biodiversity and exploring its links to the bioeconomy.
Harvesting Sustainably	Animal Agriculture	Climate neutral animal farming that supports biodiversity.
Harvesting Sustainably	Marine	Unlocking the potential of coastal ecosystems for climate change mitigation.
Harvesting Sustainably	Forestry	Developing novel high-value products from forest resources.
Harvesting Sustainably	Cropping	Diversifying indigenous sustainably sourced cropping systems.
Valorising Waste	Plastic	Reducing plastic waste and developing bioplastics.
Valorising Waste	Food Waste	Reducing and repurposing

		food waste.
Valorising Waste	Carbon Dioxide	Reducing and repurposing excess carbon dioxide.
Bioeconomy Systems	Digitalising	Leveraging digital technology to support the bioeconomy.
Bioeconomy Systems	Powering	A sustainable energy supply for the bioeconomy.
Bioeconomy Systems	Circular Design	Ensuring our overarching systems are truly circular.
Enabling Actions	Economic, Social and Policy	Working with key decision makers to support the bioeconomy.
Enabling Actions	Sustainability Assessment	Applying a toolbox of techniques to assess the sustainability of products and processes.
Enabling Actions	Scaling the Bioeconomy	Scaling up technologies from the lab to pilot scale.
Enabling Actions	Education and Public Engagement	Educating and engaging the public with the bioeconomy.
Enabling Actions	Future Leaders	Supporting young talent into bioeconomy careers.

One of BiOrbic's objectives is to bring the bioeconomy concept to all communities. A key project was the BioBus which inspired this comic. This national project was to help teach and illustrate to children, teenagers and adults how we can use plant-based alternatives to petroleum products and the importance of searching for new ways to become more sustainable and eco-friendly in our daily lives!

This comic explores all 15 BiOrbic challenges through the lens of *BioCultúr.* At its heart, *BioCultúr* connects bioeconomy with Ireland's culture, language and heritage. It shows how our traditional stories, songs, and local knowledge can guide us in protecting nature and living sustainably. Instead of seeing the bioeconomy only as "science and technology," *BioCultúr* reminds us that caring for the land also means valuing our past and community traditions. *BioCultúr* is a project led by BiOrbic's Education and Public Engagement team, who make the bioeconomy easier to understand across Ireland with fun initiatives like comics, songs, social media and school programmes. To access the BiOrbic Website to explore their collection of research & projects, click the link below:

https://biorbic.com/

To access the BioBus Website to explore the work carried out by BiOrbic researchers, click the link below:

https://biorbic.com/biobus/#about

What is the Bioeconomy?

The bioeconomy is about making the most of what nature provides, using renewable resources like plants, animals and microorganisms to create food, materials and energy, while protecting our planet. Instead of relying on fossil fuels or single-use plastics, the bioeconomy turns natural resources into sustainable products.

BiOrbic Public Definition:

The bioeconomy is about getting the things society needs from living things; plants, animals and microbes.

BiOrbic Technical Definition:

The bioeconomy is the part of the economy which uses renewable resources from agriculture, forestry and the marine to produce food, feed, materials and energy, while reducing waste, in support of achieving a sustainable and climate neutral society.

BioBeo Definition:

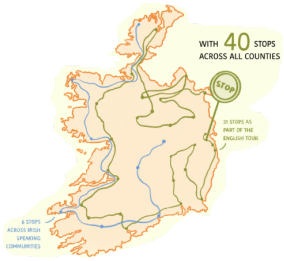
Bioeconomy is a systems-based approach that seeks to replace fossil resources in a sustainable manner with renewable biological resources from terrestrial and marine ecosystems – such as forests, crops, animals, fish, microorganisms, organic waste, and agricultural side streams, to produce food, feed, fibres, energy, bio-based products, and services within a circular economy framework designed to optimise resource use based on a cascading hierarchy of utilisation options. A sustainable and circular bioeconomy requires the application of education and training programmes, scientific research, technology, and innovation with the aim of not only creating economic

value, but also regenerating and expanding ecosystems and biodiversity as well as improving the health and the well-being of society. By addressing these systemic changes in the economy, environment, and society, the bioeconomy contributes to achieving a better and more sustainable future where no one is left behind.

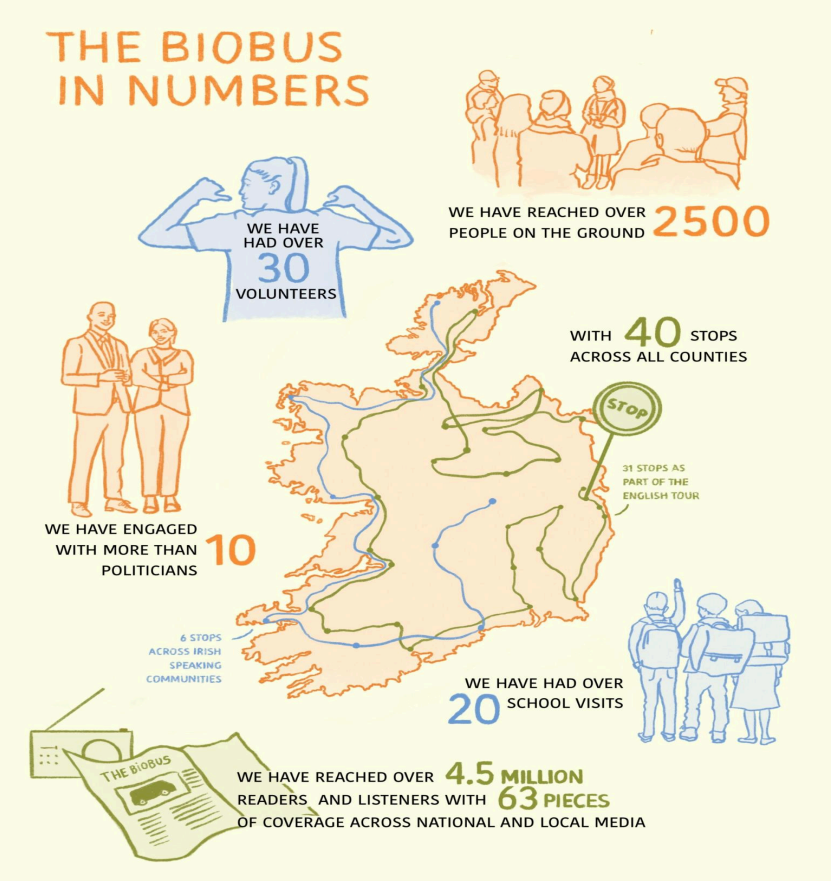
Why it matters:
The bioeconomy helps us tackle climate change, protect biodiversity and build resilient communities. It's not just science, it's farming, forestry, fishing and even how we design buildings, make clothes and package food.

What was the BioBus Project?

- The BioBus was a mobile exhibit that travelled across the country discussing and showing people what a bioeconomy consists of and how we can contribute to a bioeconomy within our local communities.



- On the 'BioBus' website, which is linked below, every county they visited is highlighted, which included 40 stops around the country including 6 Irish speaking communities.
- The BioBus illustrated how fossil fuels such as crude oil, petroleum, etc are everywhere in our lives through exhibiting an average Irish household on the bus.
- The bus showcased the alternatives that we could use to help reduce our dependence on fossil fuels.



The comic explores the deep connection between communities and land in a bioeconomy context. By understanding this interconnectedness, we foster a stronger bond with our natural lands, our environment and our communities. Through love, knowledge and a collective will to protect our land and all living things, we can inspire communities to embrace a bioeconomy.

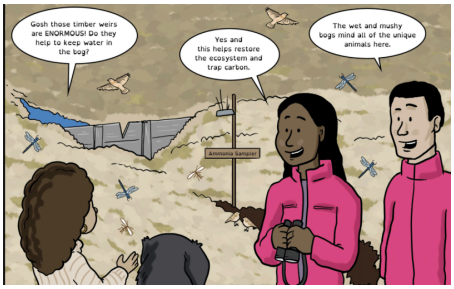
Fun Fact:

Did you know that peatlands store twice as much carbon as all the world's forests combined? Or that adding seaweed to a cow's diet can cut its methane emissions? These are just some of the real-life innovations you'll find in Beo & Raja's BioBus adventure.

Comic Page 1: Peatlands - Fearann na Móna

Beo, Raja, and their classmates arrive at Ireland's boglands. They meet local conservationists watching curlews, rare wading birds that nest here. They learn that bogs store huge amounts of carbon and are home to unique plants and animals.

The peatlands are a type of wet raised or low land that has many unique and distinctive habitats within the peatlands such as curlews, bog spiders and mosses such as sphagnum and lichen. These lands are very valuable culturally to us as they provide us with areas to walk, converse and give us an unique insight into the history of these lands.



For centuries, families cut turf together for fuel, making bogs part of rural community life and identity. Bogs also act as time capsules, preserving ancient trackways, 'bog butter' and even Iron Age bog bodies that tell us about Ireland's distant past. In folklore, bogs were seen as mysterious places, linked to stories of spirits and hidden treasures, while Irish poets like Seamus Heaney used them as symbols of memory and history. In *Bogland* he describes the land as "kind, black butter" and "bottomless," suggesting that bogs hold endless layers of the past. Heaney also refers to the bog in many more of his poems including *Kinship, The Tollund Man, and Punishment.*

Many Irish placenames still carry the word *móin/móna* (peat), showing how strongly peatlands are tied to language and landscape. These include: Móin an Mhíl; Móin an Draghin; Móin Fhiontain; Achadh na Móna; Móin Alúine; Móin Deimhis; Móin an Bhoscaigh; Móin an Bhráca; Baile Móna. Today, as we protect bogs for their role in storing carbon and supporting biodiversity, we are also protecting a living archive of Irish heritage, stories and identity.

The comic begins with the BioBus Tour Guide staging that they have arrived in the peatlands called Fearann na Móna, located at An tInbhear Mór, i gCill Mhantáin**.** Beo and Raja step onto the peatlands and explore how the ground is wet and can trap carbon dioxide within the bogland soil. They spot a man and woman curlew watching.

Beo notices the large timber weirs stretching across the peatlands and wonders what they are for. Beo and Raja soon learn that these structures help raise the water level closer to the surface, which is vital for restoring bog ecosystems and locking in carbon. There are also

ammonia samplers seen in the illustration, carefully placed to monitor ammonia levels in the air, helping researchers track pollution and protect the delicate balance of peatland habitats.

Turner et al., (2022) highlight that Traditional Ecological Knowledge integrates spiritual, cultural, and ecological values, seeing landscapes like bogs as living archives of history. For centuries, Irish communities understood bogs not only as fuel sources but also as places of lore, biodiversity and memory. By presenting peatlands as both carbon stores and cultural landscapes, the comic reinforces that sustainability is not only about ecological science but also about heritage, identity, and place.

Key Facts:

- Over 80% of Ireland's sensitive habitats like these are degraded because sensitive plants like lichen, moss and sphagnum when ammonia concentration is too high. (Kelleghan et al, 2020).

- Peatlands are also able to store huge amounts of carbon dioxide from the atmosphere with an article stating how Peatlands "store almost a third of the world's carbon - double the amount sequestered in all the world's forests" (Masteron & North, 2025).

- An article which is linked below explores how peatlands are at risk of drying out due to peat being extracted to be used as fuel and with global temperatures rising also. The article further explores the measures that countries with peatlands are doing to help protect and restore peatlands with the 'Global Peatland Assessment' created by the UNEP (United Nations Environment Programme) is keeping track of peatlands in terms of degradation and guiding countries on 'how to treat peatlands as a potent nature-based solution for climate change, biodiversity loss and local communities' (Masteron & North. 2025).

To learn more about the effect of ammonia on habitats visit the comic *There's something about ammonia:*

https://researchrepository.ucd.ie/entities/publication/5bbd9ab0-34bc-4277-a8c7-01d20580a03d

For more information on curlews and mosses such as sphagnum, please check out the Irish Peatland Conservation Council (IPPC) Website dedicated page and read another comic in the Beo and Raja series all about curlews and their ecological plight:

https://www.ipcc.ie/a-to-z-peatlands/peatland-species/sphagnum-moss-the-bog-builder/

https://researchrepository.ucd.ie/entities/publication/1c321794-2108-4e9c-9c52-9348df6d8d15

To learn more about peatlands and the efforts being made to restore and conserve them, please see a World Economic Forum article written by Victoria Masterson & Madeline North:

https://www.weforum.org/stories/2025/02/peatlands-store-carbon-climate-change/

Comic Page 2: Coast - Trá an Dóilín

Raja and Beo arrive at Trá an Dóilín, where locals are busy harvesting seaweed along the shore. This is a special beach as it is one of Ireland's rare coral beaches, made of tiny fragments of maerl, and it lies in the heart of the Gaeltacht area of An Cheathrú Rua. Here, Beo and Raja and their teacher greet the community and join in conversation 'as Gaeilge', ensuring the Irish language is a natural part of the experience. This section emphasises the Irish language, celebrating the living connection between land, language and community especially in a Gaeltacht area. The term 'Gaeltacht' is used to describe the regions in Ireland in which the Irish language is the primary spoken language of the community.

The locals are wearing full body waders to avoid getting wet and to move easily at the water's edge. The hook-like tool used to harvest and cut seaweed from the coastline rocks is called a sickle. The local discusses the benefits of harvesting and using seaweed for products as 'alginates in seaweed are used in toothpaste and wound dressings' with Beo. The 'Ours to Protect' podcast discussed the EU's Blue Economy Partnership Programme and the positive impacts that this programme will have in order to help coastal communities in Ireland and in other parts of the world. Dr Tom Ryan discusses how coastal communities in Ireland are on the front lines and the Blue Economy Programme aims to 'investigate the alternatives there might be for those areas' (00:57, episode 42).

Key Facts:

- The sickle used by the locals has been used for many centuries with it having various names such as 'seaweed hook' or 'scian mhór' (National Museum of Ireland).
- The EU Blue Economy Partnership Programme is a climate change research project that aims to find a way forward that both supports and protects Ireland's fishing and marine communities.
- The Wild Atlantic Way route unfolds the wonders of nature, the power of the ocean and its imprint on the west coast of Ireland, and the stunning countryside in all its diversity.

- Alginates refers to linear copolymers of β-D-mannuronic acid and a- L-guluronic acid units. This simply means that parts of the acids from the brown seaweed are extracted and processed for projects such as wound-dressing, gels and toothpaste.

To further access more information on seaweed harvesting visit the websites below:

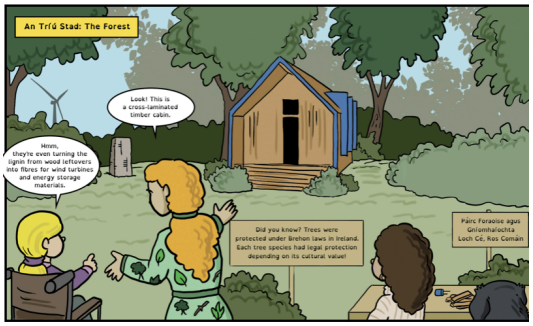
https://www.ouririshheritage.org/content/new-contributions/seaweed-harvesting-the-tools-of-the-trade

https://www.arramara.ie/irish-seaweed-resource-management/seaweed-harvesting-methods/

To listen to all of the episodes of the 'Ours to Protect' please visit their spotify page linked below:

https://open.spotify.com/show/3fC8gmOcu1jfT4jgrXVs5O?si=d8167521ca73445c

Comic Page 3: The Forest



The forest panel is set at Páirc Foraoise agus Gníomhaíochta, Loch Cé, i Ros Comáin. The teacher explains that this cabin is not made from just any timber, but from cross-laminated wood created from sustainable forestry.

Ogham stones stand proudly among the trees. Ogham writing is an ancient Irish alphabet made up of lines and notches carved into stones or wood. Ogham is very important for Irish heritage because it is the oldest form of writing in Ireland, used over 1,500 years ago. Ogham is closely connected to nature, especially trees, because many of its letters are named after different types of trees like oak, ash, and birch. This shows how much the early Irish people respected trees and nature in their daily lives and culture.

These cultural markers remind us that trees were never only resources, but living beings with legal, cultural, and spiritual importance. This is intrinsically connected to the research of *BioCultúr*. A nearby sign reads: *'Did you know? Under the ancient Brehon Laws, trees were protected by law, with each species ranked according to its cultural and ecological value.'* These laws helped ensure the survival of many native trees across Ireland.

This panel seeks to connect Ireland's biological diversity with its cultural heritage. By linking cross-laminated timber, a modern sustainable solution, with Ogham inscriptions and a Brehon reference, the comic shows how past wisdom and present innovation can work together to inspire a truly sustainable bioeconomy.

Key Facts:

- Lignin can also be used in battery storage. Could our future be powered by lignin?
- Cross-laminated timber is a strong, plant-based building material that replaces cement and steel in eco-homes.

Check out this article for fun and interesting information on some of the earlier writing in Ireland:

https://www.rte.ie/brainstorm/2020/0818/1159766-ogham-stones-ireland-inscriptions-writing-language/

For outdoor activities for all ages and abilities, with a specific activity regarding ogham, see Draíocht Dara:

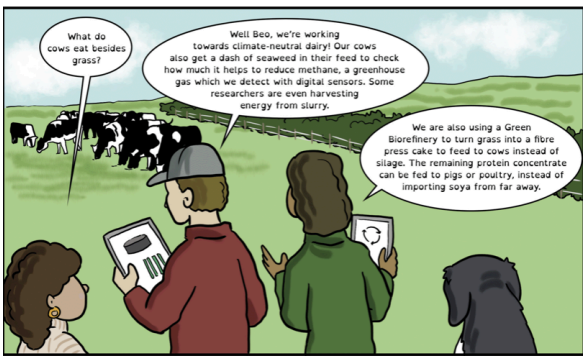
https://mural.maynoothuniversity.ie/id/eprint/16684/1/MaireNicAnBhairdDra%C3%ADocht%20Dara2021.pdf

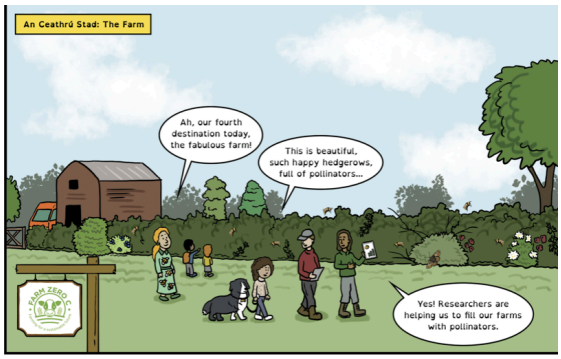
To learn more about the ancient laws of Ireland, the 'Brehon Laws' , check out Library Ireland:

https://www.libraryireland.com/JoyceHistory/Brehon.php

Comic Page 4: The Farm

Beo and Raja continue their BioBus adventure at Farm Zero C, a BiOrbic-supported research project at Shinagh Farm, i gCorcaigh. This farm pioneers sustainable dairy practices including:





				
Soil and Grassland Management	**Animal Diet and Breeding**	**Biodiversity**	**Life-cycle Analysis**	**Renewable Energy**
Capturing carbon within the soil by planting multi-species swards. This allows reduction of fertiliser and produces more resilient grass.	Trialling different types of diet that change animal digestion, reducing the amount of methane emitted by cows.	Maintaining and improving biodiversity on the farm and leveraging the natural ecosystem to reduce the reliance on pesticides and fertiliser.	Analysing the total environmental inputs and outputs on the farm to understand overall carbon emissions and where savings can be made.	Sourcing renewable energy where possible to reduce the farm's reliance on carbon-emitting fossil fuels.

The illustrations showcase Ireland's rich native hedgerows, bursting with life and colour. Far more than simple field boundaries, these hedgerows are thriving ecosystems, alive with plants and animals. They provide food for birds and insects, shelter for small mammals, and safe corridors for pollinators like bees, butterflies, and hoverflies to move across the landscape.

Curious about the farm's innovations, Beo asks the farmer about the technology used. The farmer explains how BiOrbic researchers at Farm Zero C employ tools. These are tools such as Life-Cycle Assessment (LCA) and the Habitat Mapping Tool, which help measure emissions, track biodiversity, and support decision-making for more sustainable farming. As Beo and Raja look closer, the hedgerows are brought to life in the artwork, nesting birds, wild blackberries for animals, and native wildflowers attracting pollinators.

Ollerton's research found that "3/4 of the world's top food crops are dependent on animal pollination" (Ollerton et al., 2017). This makes restoring pollinators to farmlands not just an ecological concern, but a matter of food security.

The farmer shows Beo and Raja the cows' diet. Many assume cows eat only grass, but farmers are increasingly supplementing with hay, and now even seaweed, which has been shown to reduce methane emissions from enteric fermentation. Enteric fermentation is a natural part of the digestive process in ruminant animals such as cattle, sheep, goats, and buffalo. Microbes in

the digestive tract decompose and ferment food, producing methane as a by-product. This small dietary change represents a big climate win.

One of the farmer's devices shows a symbol for circularity, introducing the concept of circular farming, a key BiOrbic mission delivered at Farm Zero C. Circularity means turning waste into something useful, for example, using slurry to grow protein-rich algae, which can then replace imported soy as animal feed. Through new diets, new technologies, and careful monitoring, Farm Zero C is working toward climate-neutral dairy that supports both farmers and ecosystems.

This panel connects with Traditional Ecological Knowledge (TEK). Turner (2022) describes TEK as knowledge developed through generations of interaction with specific landscapes, rooted in balance, reciprocity, and care. Traditional Irish farming reflects these principles: hedgerows as living boundaries, seasonal grazing, and practices that valued coexistence with nature rather than exploitation.

By focusing on pollinators and biodiversity, the comic shows how TEK values are alive in modern research farms, where farmers caring for pollinators are not only sustaining a cultural legacy but also advancing bioeconomy goals of biodiversity protection and climate neutrality.

Key Facts:

- Farm Zero C is a collaboration between BiOrbic, Carbery and others to address the challenge of carbon neutral farming. The project takes a holistic approach, combining a range of technologies and practices to reduce greenhouse gas emissions and increase the productivity and resilience of the farm.

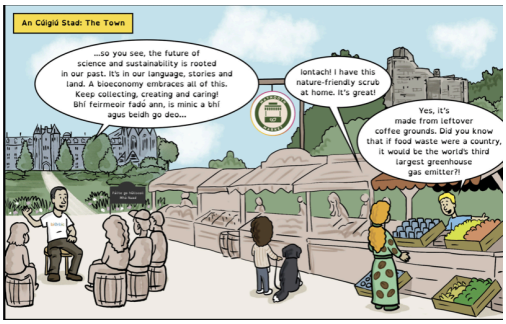
- Life Cycle Assessment is a tool used to quantify total carbon emission and analyses the total environmental inputs and outputs.

- A habitat map shows the geographic distribution of different habitats within a particular area.

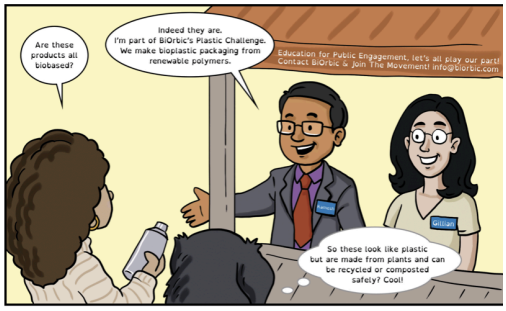
Comic Page 5: The Town

Beo and Raja's story continues when they enter Maigh Nuad, i gCill Dara. A local market is taking place, or as one of Beo's classmates described it as an old Irish 'Aonach'. The Irish Aonach was a fair or market that would showcase the community's crafts and stories. These markets were often held to buy and sell livestock, oats and butter. Locals would converse with each other to share news and stories. One of the most famous traditional Irish songs, *Beidh Aonach Amárach,* is based on a young girl arguing with her mother as she seeks permission to attend the local fair.

These markets were important for trade and creating a sense of community within small rural towns. The markets today are very similar to those of our ancestors.



Beo, Raja and their teacher explore the market and encounter local vendors selling nature-friendly body scrubs made from upcycled used coffee grounds.



Beo and Raja meet Ramesh and Gillian, two BiOrbic researchers. Ramesh explains how, as part of BiOrbic's Plastic Challenge, they make bioplastics. Bioplastics look like plastic, but they are made from plants, meaning they can be recycled and composted safely.

Maynooth Castle is illustrated in the background of the panel. This stone castle was founded in the early thirteenth century. It became the seat of power for the FitzGeralds, the earls of Kildare, as they emerged as one of the most powerful families in Ireland. The castle reminds us that our heritage is all around us.

A storyteller or *Seanchaí* sits in the marketplace and states, "so you see, the future of science and sustainability is rooted in our past. It's in our language, stories and land. A bioeconomy embraces all of this. Keep collecting, creating and caring! Bhí feirmeoir fadó ann, is minic a bhí agus beidh go deo". This links directly to Traditional Ecological Knowledge. As Turner (2022), explores, TEK is not just practical ecological knowledge but also embedded in cultural narratives, proverbs, and oral traditions that connect people to land and community.

The Irish Aonach markets historically carried this dual role: they were spaces for buying and selling, but also for exchanging stories, proverbs, and communal news. Embedding such cultural narratives in bioeconomy education and public engagement helps people see the bioeconomy not simply as a technical or scientific concept, but as something rooted in heritage and local tradition. The marketplace becomes a symbol of how language, stories, and land are essential to community well-being, echoing the way TEK links ecological practice with cultural continuity.

Cosán na Gealaí – An Crann Feasa, written by Máire Nic Bháird, is a wonderful resource for exploring Ireland's culture, heritage, and language in a creative way. Additionally, the Tairseach Tree Trail in Maynooth offers another opportunity to connect with nature. Designed for the whole community, this trail encourages people to engage with the rich biodiversity of the Maynooth University campus. Its activity booklet is full of fun, hands-on tasks that help learners of all ages discover and appreciate the native trees that grow there, making science and heritage come alive through outdoor learning.

Key Facts:

- The castle in Maynooth town was built around 1203 and was home to the Fitzgerald clan, once the most powerful family in Ireland.

- The castle and clan were very influential as Thomas Fitzmaurice, son of John and seventh Earl of Kildare, was appointed Lord Deputy which ruled Ireland in the name of the King of England making Maynooth the center for politics and culture during the medieval times (Maynooth Castle Website).

Check out the Our Irish Heritage Website to learn more about the oldest tree in Ireland:

https://www.ouririshheritage.org/content/knowyour5k/the-oldest-tree-in-ireland

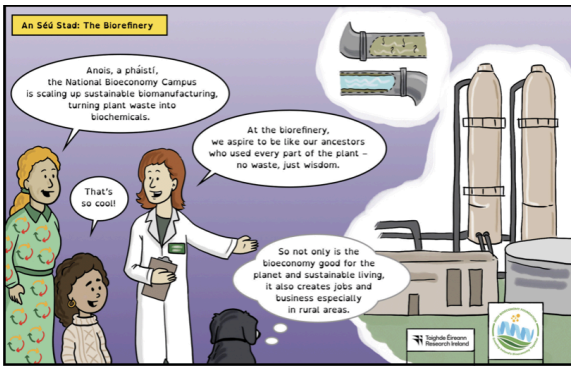
To find out more information on Maynooth Castle and its history throughout medieval times, check out the official Maynooth Castle Website below:

https://www.castlesofeireann.ie/maynooth.html#

For Irish language learners and enthusiasts, see links below, for more little readers imbued with sustainability, nature and rich Irish language phrasing and cultural connections:
https://mushop.ie
https://mulibrarydiscovery.maynoothuniversity.ie/discovery/search?vid=353MAY_INST:Vu1&tab=Every…
https://www.siopaleabhar.com/en/tairgi/cosan-na-gealai-rang-1-set-of-8-leabhar-fics/
https://www.maynoothbookshop.com
https://librariesireland.spydus.ie/cgi-bin/spydus.exe/ENQ/WPAC/BIBENQ?ENTRY=Cosán+na+Gealaí&ENT…

Comic Page 6: The Biorefinery

Beo and Raja continue their adventure at the National Bioeconomy Campus i Lisín, Tiobraid Árann. This is a place where nature and science come together to create new sustainable solutions.



At first glance, readers will notice the towering cylindrical tanks. Inside these tanks, plant materials and waste products are transformed into valuable resources such as biofuels, biochemicals, bioenergy and other biomaterials.

Beside the tanks sits a small wooden cabin, which is the hub for researchers who monitor and manage the whole process. It represents the teamwork and constant observation that are essential in cutting-edge bioeconomy research.

Beo and Raja meet an early career researcher. Finding young people who are interested in the bioeconomy is a key objective of the Future Leaders Challenge. The intern eagerly explains how the biorefinery works and how the researchers at the biorefinery seek to be like their ancestors who used every part of the plant rather than wasting part of it.

Beo also realises that the biorefinery has an important part to play in society by creating jobs and business, especially in rural areas.

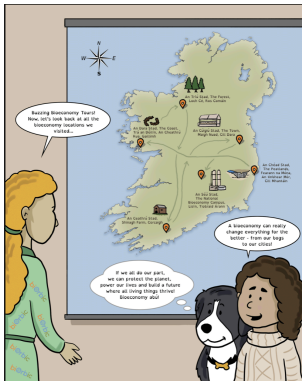
For Beo and Raja, the biorefinery is not just a place of science, but a symbol of hope and possibility. It shows how Irish research is leading the way in creating a future where waste is reused and innovation builds a healthier planet.

Key Facts:

- The National Bioeconomy Campus in Lisheen, Co. Tipperary is Ireland's flagship biorefinery and the first of its kind in the country. The 455-hectare property (that's about as big as 637 football pitches!) is a converted mining site and boasts an impressive infrastructure including roads, electrical substation, wind turbines and weighbridges.
- The conversion of the National Bioeconomy Campus from a mining site means that the jobs which the biorefinery creates are more sustainable than the mining jobs were.
- Researchers at The National Bioeconomy Campus are working on cutting-edge methods such as photocatalysis, which uses light to help capture and convert CO_2 into useful products like methanol (a fuel and chemical building block).
- Microorganisms such as *Clostridium* also play a role, breaking down agricultural residues into bioethanol, platform chemicals, and clean water.
- The campus supports Ireland's Climate Action Plan by developing circular, low-carbon industries and reducing reliance on fossil fuels.

Closing Panel

The comic concludes with a map of Ireland, showing all the places that Beo and Raja visited on their BioBus Adventure. This final scene is both a summary and a reflection, inviting readers to look back at what has been learned and to imagine what comes next.



Beo and Raja remind us that the bioeconomy can be positive for all, no matter where you live in Ireland. But they also stress an important truth: a bioeconomy works only if everyone plays their part. When we all join in, we can protect the planet, power our homes, and build a future where people, animals, and nature thrive together.

As Arrivabene et al. (2024) caution, bioeconomy strategies risk becoming too focused on technology and economics unless they also embrace heritage, culture, and language. These human dimensions make science more trustworthy, locally relevant, and meaningful in everyday life. That is why Beo and Raja's journey is not just about scientific innovations, it is also about Irish traditions, from the Aonach marketplace to ogham stones to Gaeltacht conversations.

Here, TEK becomes essential. TEK shows that knowledge about nature is not only passed down in tools and farming techniques, but also in stories, sayings, and songs that connect people to the land and community. Just as Beo and her classmates learned at the Aonach about trade, crafts, and storytelling, children today can learn how old practices, like planting hedgerows, rotating crops with the seasons, or following weather proverbs can inspire new sustainable solutions.

For Educators and Community Leaders:
This reflection page is a powerful moment to spark conversation:

- How can the stories of our grandparents or the history of our local place inspire scientific solutions today?
- What does it mean to care for both the environment and our cultural heritage at the same time?

By ending with these questions, the closing scene ties together the scientific discoveries of the BioBus journey with the cultural and linguistic threads of Irish communities. It reinforces the idea that the bioeconomy is not only about new technologies, but also about old wisdom in new ways, ensuring that Ireland's future is both innovative and deeply rooted in tradition.

Key Facts:

The map of Ireland at the end of the comic shows all the places visited by Beo, Raja, and their classmates on their BioBus journey:

- An Chéad Stad: The Peatlands, Fearann na Móna, An tInbhear Mór, Cill Mhantáin.
- An Dara Stad: The Coast, Trá an Dóilín, An Cheathrú Rua, Gaillimh.
- An Triú Stad: The Forest, Loch Cé, Ros Comáin.
- An Ceathrú Stad: The Farm, Shinagh Farm, Corcaigh.
- An Cúigiú Stad: The Town, Maigh Nuad, Cill Dara.
- An Séú Stad: The Biorefinery, The National Bioeconomy Campus.

Each stop represents a different part of the Irish bioeconomy, highlighting how land, sea, and communities are all interconnected. The map also symbolises how culture, heritage, and language travel with us. The Irish Aonach (traditional marketplace), ogham stones, Brehon laws, and Gaeltacht language exchanges remind us that a sustainable future must also include TEK and community wisdom. This closing reflection shows that the bioeconomy is not just about

science and technology, but about creating a future that is both innovative and deeply rooted in Irish culture and heritage.

See the Galway City Museum's 'Keepers of the Gael Exhibition' on their website to learn more about how our ancestors managed the many lands within Ireland:

https://galwaycitymuseum.ie/exhibition/keepers-of-the-gael/

BiOrbic have created an bioeconomy interactive map that can be accessed here: https://irishbioeconomy.ucd.ie/bioeconomy-map/. This interactive map allows viewers to see and discuss many different areas within Ireland that can and are contributing to a bioeconomy. The map can be used within geography to discover and learn about Ireland's natural resources and how they are being used to further ourselves in a sustainable way.

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Kelleghan, D. B., Hayes, E. T., Everard, M., & Curran, T.P. (2020) Assessment of the Impact of Ammonia Emissions from Intensive Agriculture Installations on Special Areas of Conservation and Special Protection Areas. Environmental Protection Agency. Johnstown Castle, Wexford. https://researchrepository.ucd.ie/handle/10197/11627

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Activities for Learning Communities

These activities blend many methodologies to engage people of all ages in the themes culture, language, heritage and bioeconomy. Communities are encouraged to act, raise awareness and foster a deeper understanding and appreciation for the world around them. The complex nature of a bioeconomy is playfully introduced through a lens of interconnection and equity for all life.

Introduction

This range of activities is for everyone to enjoy, each linking to the themes of the comic. If you live within travelling distance of the places featured, we encourage you to visit them carefully and responsibly, taking the opportunity to see these special environments firsthand. Where possible, organising a trip to one of these destinations, such as a guided tour with the Irish Peatland Conservation Council, before or after engaging with the comic will greatly enrich teaching and learning.

Broad Learning Outcomes:

The following broad learning outcomes aim to nurture a holistic understanding of culture, heritage, language and bioeconomy.

The participants will be enabled to:

- Enhance cultural and environmental understanding by exploring the interconnectedness of land, nature, communities and making decisions that will help our environment. A deeper awareness will develop of how we can protect and appreciate the various landscapes within Ireland. These elements will impact how we view nature and communities being interconnected.

- Explore how we can as communities come together to appreciate and explore the natural landscapes that are in Ireland.

- Recognise heritage, language, and social change as intrinsic elements in shaping societal values and identity when exploring the areas that are in the comic with an appreciative view for how communities and nature are interconnected.

1: Create your own BioBus tour map (Visual Art, Geography)

Objectives: To create a BioBus Tour Map inspired by the comic, showing different landscapes across Ireland. Learners will illustrate how these areas connect to the bioeconomy by including examples of sustainable practices, resources, or traditions from the places they choose.

To Do:

- Provide art materials such as paper, paints, pencils, and pastels.
- Download and read the *Beo and Raja* comic series to help find landscapes and areas of cultural heritage around Ireland.
- Participants design their own poster map of Ireland by adding new stops for the BioBus Tour.

Each poster map should include:

1. A labelled outline of Ireland (with counties or regions marked).
2. New places to visit – draw or mark at least 2–3 locations on the map.
3. A short description for each place, explaining what makes it special.
4. A link to the bioeconomy – for every place, describe how it connects to the bioeconomy. For example: A farm that uses hedgerows to protect pollinators, a forest where sustainable timber is grown, a coastline where seaweed is harvested, a community that keeps old traditions alive in new sustainable ways.

Discuss & Reflect:

- Why did you choose these areas for people to visit when learning about the bioeconomy?
- Which areas best describe what a bioeconomy is and what aspects of the area are used to best describe a bioeconomy?
- Why did you design your BioBus Tour Map this way and what materials were used to illustrate your BioBus Tour Map?
- If you were to recreate your BioBus Tour Map, would you add any other places to it and why would you add those places?

Time Estimate: 60 minutes

Skills: Drawing, Writing, Researching, Imagination, Creativity.

2. How much carbon dioxide is stored? (Science, Maths)

Objective(s): Compare and contrast how different environments such as forests, boglands, etc store different levels of carbon dioxide. Predict and discuss which natural environments might store the most amount of carbon dioxide.

To Do:
Start by asking learners: What is carbon dioxide (CO_2)? Watch this video from TED Talks explaining CO_2 and the Carbon Cycle :
https://youtu.be/A4cPmHGegKI?si=VRQ0E0z6TxWg5AyA

- Explain simply: CO_2 is a gas in the air. Too much of it warms our planet, but nature can also store CO_2 in special places like forests, peatlands, and oceans.

Give learners pictures of different landscapes (e.g., the Amazon Rainforest, Irish Peatlands, the Ocean Bed, Rocky Landscapes).

- Ask: *Which of these places do you think can store the most carbon dioxide?*
- Encourage them to compare (e.g., Peatlands vs. the Amazon Rainforest).

Next, let learners estimate how much CO_2 is stored by using a simple rule:

- Each tree they draw on their whiteboard = 22 kilograms of CO_2 stored in one year.
- Example: If a learner draws 4 trees for the ocean, this means they are showing the ocean can store 88 kilograms of CO_2 in one year.

Discuss & Reflect:

- Why do you think peatlands are able to store so much carbon dioxide compared to other places?
- Why is carbon storage good for the planet?
- Why do you think it's important to protect peatlands?
- What might happen if people dig up or drain peatlands? How could that affect the air or the planet?

Time Estimate: 30- 35 minutes

3: Mindfulness colouring (Visual Art & SPHE)

Objective: To enjoy and participate in a mindfulness activity in the outdoors using nature's palette.

Check out *Draíocht Dara* pg 29 for an Irish language meditation, to relax and to familiarise yourself with the natural world you are observing through the senses:

https://mural.maynoothuniversity.ie/id/eprint/16684/

To Do: Provide art materials i.e., colouring pencils, markers, pastels. Download and print the Beo and Raja comic in black and white. When sitting in a comfortable spot, use inspiration from the colours of nature around you to fill the comic in your own unique style. This is a calming and mindful activity for all involved.

Discuss & Reflect:

- Why did you choose to use these colours for the different panels within the comic?
- Did you see different shades of the same colour around you?
- Which was your favourite page to colour and complete from the comic?
- Did you add any more details to the page when colouring, such as more leaves, people, etc?

Time Estimate: 40 minutes

Skills: Artistry, mindfulness, bioeconomy innovation.

4: Bog in a jar (Science, Geography)

Objective: To enhance their understanding of how peat soil holds water and doesn't drain quickly or easily.

To Do: Provide participants with a small mason jar with a sponge and soil to mimic peat soil. If in a classroom setting, invite each child to bring in a clean, empty jam or marmalade jar in advance of this activity! Begin to assemble the peat soil into the jar and compress the soil. Afterwards, give small amounts of water to pour over the soil and watch how the soil begins to soak and hold the water and not drain.

Discuss & Reflect:

- Did you think that the peat soil would soak up as much water? Why/why not?
- I wonder why the peat soil holds more water than the soils from our garden?

- I wonder just how much water is stored within peat soils that are across Ireland?
- Which did you think would hold more water and why did you think that?

Time Estimate: 60 minutes

Skills: Experimentation, awareness of soil.

5: Design your own biobased product! (Research, Visual Art & Science)

Objectives: To understand and research on the various natural materials that could be used to create biobased products.

To Do: Provide examples of biobased products from the comic (paints, timber, glue, etc). Give the children time to research what biobased products they want to create and design. Discuss as a group what each person will create. Provide art materials for the projects and let them begin to design their bio-based paint buckets, paint brushes, and more examples can be found on the BioBeo website.

Discuss & Reflect:

- Why did you decide to create this biobased project?
- What materials are used within the product to make it sustainable and biobased?
- What was the most challenging part of creating your biobased project?
- Why was this the hardest part of creating your biobased product?
- How would you tell people about your biobased product?

Time Estimate: 60-70 minutes

Skills: Research, Art design.

6: Debate: Should we dig up peatlands? (English, Drama)

Objectives: To discuss and debate the environmental impact of humans on peatlands and the importance of conserving and protecting peatlands or using them for commercial uses - tourism, turf, etc.

To Do: Provide examples of people objecting to digging up peatlands in Ireland. Split the participants into different groups of people (farmers, activists, scientists, etc) whereby some are for or against digging up the peatlands in their local area. Everyone will debate their opinions on the topic and can discuss the advantages and disadvantages through research they have collected for their area of the debate.

Discuss & Reflect:

- How did you come up with your arguments for this debate?
- Were the arguments from other groups good when debating the topic?
- What made their arguments good or bad when they were explaining them during the debate?
- What arguments would you add or take away if you were to debate the topic again?

Time Estimate: 45 minutes

Skills: Debating.

7: Create soundscapes of the landscapes of Ireland (Music)

Objective: Create a soundscape using a variety of human-made and instrumental sounds for the different landscapes that Beo and Raja visit within the comic.

To Do: Discuss as a group what soundscapes can be represented using visuals to illustrate what sounds are being used within the soundscape. Explore and identify what sounds could be included for each of the different landscapes within the comic and how these sounds could be created i.e., using body percussion, musical instruments or objects such as pencils, etc. Create small groups (minimum 3, maximum 5) and allow the groups to choose which landscape from the comic they will use to create their soundscape. Provide a variety of resources such as musical instruments - shakers, drums, triangle etc or objects such as pencils, pens, whistles, coins, etc when they are creating their soundscape for the landscape that they have chosen from the comic.

Discuss & Reflect:

- Which instruments did you use to create the sounds in your soundscape?
- What was the easiest sound to create using the instruments for your soundscape?
- Why did you choose these sounds for your soundscape?
- Was it challenging to come up with sounds for your landscape inspired soundscape?

Time Estimate: 45 minutes

Skills: Musical composition, Environmental awareness, Listening

8: Food webs (Discussion, Writing, Visual Art)

Objective: To create food webs of different animals that live within the different regions in the comic i.e., Peatlands, Coast, Forest, etc.

To Do: Download the Beo and Raja comic. In groups, invite the children to make a list of the living things they see in the comic. Discuss as a whole group, ensuring all of the animals are identified and as many living things as possible. Provide art materials such as pencils, colours, markers, etc for the children. Begin to create and research how their animals, insects, people, trees, etc are linked to that area and each other through the food web.

Discuss & Reflect:

- Were many of the animals connected to each other through their food webs?
- Do any animals not connect to the food web? Why do you think they don't connect to the food web?
- Which animals were easiest to connect to each other on the food web?
- What is challenging about researching the animals that are in the food webs?

Time Estimate: 45 minutes

Skills: Research, Writing, Being scientific.

9: History of seaweed tools in Ireland timeline (History, Research, Writing)

Objective: To understand and explore the history of seaweed harvesting tools in Ireland through creating a timeline.

To Do: Download the Beo and Raja comic and examine the tools used by the local people when they are harvesting seaweed. Discuss as a whole group about how these tools have changed over time and allow everyone to research what these tools would have looked like and how they may have been used differently in the past. Provide materials such as tablets, art materials and pens when partaking in the activity.

Visit the Our Irish Heritage (National Museum of Ireland) website when discussing the history of seaweed tools:

https://www.ouririshheritage.org/content/new-contributions/seaweed-harvesting-the-tools-of-the-trade

Discuss & Reflect:

- When researching seaweed tools, which tool did you find the most interesting?

- What surprised you about the history of seaweed harvesting tools when creating your timeline?
- Was it challenging to timeline some of the seaweed harvesting tools? Why/Why not?
- How have the seaweed harvesting tools changed over time based on the timeline that you have created?

Time Estimate: 60 minutes

Skills: Researching, Writing.

10: Happy hedgerows activity (Research/Design)

Objective: Research how farming can be supportive of sustainability and nature-friendly.

To Do: Read the farm scene in the comic. Ask participants why researchers and farmers are working together, encouraging pollinators in hedgerows? Ask what is a pollinator? Research in pairs. Plan a pollinator patch for the school or community. Research in pairs, the native flora and fauna of Ireland that you need to encourage into your patch.
Design the pollinator patch in small groups. Following this, locate the relevant plants. The design that the children create can be used for activity 15 'Plant a flower garden' where the children will plant the flowers and hedgerows.

Discuss & Reflect:

- Why do you think hedgerows are important on farms and in the community?
- Are there native hedgerows near where you live?

Time Estimate: 60 minutes

Skills: Research, sustainability education, bioeconomy innovation.

11: Puppet show using the landscapes from the comic (Performing Arts)

Objectives: Create a puppet show using one of the areas that Beo and Raja explored on the BioBus Adventure or create a puppet show following the comic storyline.

To Do: Provide art materials such as paper (plain & coloured), wooden sticks, markers, pencils, etc. Discuss as a group what a puppet show looks like using BioBeo's puppet show illustrating the comic 'Answering the Curlew's Call'. Next, discuss what is in the video of the puppet show from the BioBeo website and what can be included within their puppet show i.e., characters, backgrounds, animals, etc. Next, everyone begins to create their own based on the landscape

they picked. They can create dialogue about the importance of protecting the land, wildlife or the cultural heritage of the land but remind them of a hopeful tone!

Check out the link below for the puppet show ‘Answering the Curlew’s Call’ from the BioBeo’s YouTube page:

https://youtu.be/x-YpUFJYH8I?si=mlkfp6ZVtxKS36YJ

Discuss & Reflect:

- How did you design your puppet shows to be able to include your chosen landscape?
- Why did you choose to include these characters/sounds/places within your puppet show?
- How could your puppet show help people understand and learn more about the world around them?

Time Estimate: 60 minutes

Skills: Teamwork, storytelling, environmental awareness, bioeconomy innovation.

12: Carving our names in ogham (Visual Art, Discussion & History)

Objective: Discuss how our ancestors used the ogham language to write onto stone and carve their own name into clay.

To Do: Discuss and show examples of what the ogham alphabet looks like and how our ancestors used to carve ‘ogham’ into stones and wood. Invite the participants to find ogham in the comic. Can they guess what is written on the stones in the comic? Provide art materials such as clay, toothpicks, paint and paint brushes. Begin to shape and sculpt the clay and use the toothpicks to carve out their names onto the clay. Once complete, the painting process can begin and make sure to use bright colours to better show the carved lines.

Visit the National Museum of Ireland’s workshop on ogham:

https://www.museum.ie/en-IE/Museums/Archaeology/Events/2025/Q3/Drop-In-An-Etch-in-Time!-Ogham-Craft-Workshop.

Discuss & Reflect:

- What was the most surprising thing about carving using Ogham
- Can you think of other ways people in history left messages for the future
- Do you know any other alphabets you could tell us about? Let's do some research!

Time Estimate: 60 minutes

Skills: Carving, sculpting.

14. Build your cabin modelled on the biocabin (Construction, Art)

Objective: Create a cabin using recycled materials which is modelled off of the biocabin form the comic.

To Do: Use LEGO, lollipop sticks, cardboard, or real wood offcuts to make a mini cabin. Allow everyone to design and discuss how they will create their own cabin modelled from the comic's biocabin. Use the images from the comic to discuss the structure of a cabin. Talk about how this is different from a concrete building i.e., appearance, structure, setting, etc. Begin to create the biocabins and ask questions about each of the biocabins that the children are designing and creating.

Discuss & Reflect:

- Why is it important to use natural resources carefully?
- What's the difference between renewable and non-renewable building materials?
- Lego promised to create more sustainable materials. Have they done it yet? Let's do some research!

Time Estimate: 45 minutes

Skills: Construction, sustainability awareness & environmental awareness.

15. Plant a flower garden! (Outdoor Learning, Geography, Biology)

Objectives: Plant a flower garden using wild native flowers and hedgerows over a long period of time. Discuss and observe how we manage and maintain the flowers and how the flowers allow for pollinators to pollinate and create a natural environment for more insects, bugs, etc.

To Do: Prepare a flower bed area using fertile soil and wooden planks in a small section of the school grounds or home garden prior to this activity. Discuss with the children the importance of the hedgerows and having nature be a part of our environment by exploring how the farmer from the comic embraced having the hedgerows as fencing. The designs from their pollinator patch activity (activity 10 'Happy Hedgerows') can be used for when the children are planting the garden.

As a whole group discuss the importance of designing and planning a pollinator patch and how it could benefit them when planting the flower garden. Invite the group to predict what the wild flowers will look like and the living things they will attract. Make lists and drawings. Explain how they will be planting wild flowers in the flower bed. During the planting of the seeds, talk with the children about the processes included when they are planning the flowers. Over the course of weeks, months, etc continue to ask the children to water the flowers.

Discuss & Reflect:

- What types of flowers have we planted in our flower garden?
- Why did we plant these types of flowers in the flower garden?
- How will we keep the flowers alive throughout the year?
- Why must we plant the seeds deep into the ground?
- Let's research the living things who will visit the flower garden.

Time Estimate: 60-70 minutes

Skills: Planting, environmental awareness & protection.

16. Create your own medieval castle! (History, Art, Research)

Objectives: Design and create a medieval castle inspired by Maynooth Castle from the comic using a variety of materials.

To Do: Use images of the castle from the comic to begin the discussion with the children about the culture and heritage of Maynooth town and Ireland during the medieval times. *The Cosán na Gealaí - An Crann Feasa* book can be used to discuss with the children about the local landscape and the importance of nature.

Use images of the castle from the comic and images from the Maynooth Castle website to begin the discussion with the children about the culture and heritage of Maynooth town and Ireland during the medieval times. Begin to create the medieval castles by providing materials such as paint, glue, recycled materials - household items, cardboard.

Discuss & Reflect:

- Why did you create your medieval castle to have windows up high/stairs/etc?
- Is your castle built well enough to withstand attacks similar to the Maynooth Castle invasion?
- What is the best feature of your castle?
- Let's research other castles in Ireland … are there any in your locality?

Time Estimate: 60-65 minutes.

Skills: Construction, awareness of man-made structures within the natural environment.

17. Water filtration experiment

Objectives: Experiment and discuss the importance of filtering water in small groups when wanting to drink water or use water for cooking, cleaning, etc.

To Do: Prior to beginning the experiment, have the materials of; glass containers, paper, mesh lining, baking sieve, sand, dirt, rocks, etc. Give the children containers filled with dirty water and allow them to choose which item they think will best separate the dirt (sand, rocks,etc) from the water.
Allow the children to conduct the experiment with their chosen method, ask the children why they chose this tool/method. Children can swap and test each other's methods/tools on their dirty water to determine which tool works best to give us clean water.

Discuss & Reflect:

- What was the best method to filter the dirty water into clean water?
- Why did this method/tool work best to clean the dirt from the water?

Time Estimate: 40 minutes

Skills: Hypothesising, water awareness & environmental awareness.

18. Logainmneacha research

Objectives: Research and identify deich logainm (10 placenames) using the logainm.ie website with the word Móin/Móna within the logainm.

To Do: Download the comic and invite the children to discuss and identify the logainmneacha that can be seen throughout the comic. Allow the children to discuss the similarities and differences between the different placenames ‘as Gaeilge’ from the comic. Look at the loganim.ie website. Research different logainmneacha. Try to find deich logainm with ‘Móin/Móna’ within the name.

Discuss & Reflect:

- What surprised you about the names when looking them up?
- Would you be able to guess where the place is based on the logainm?

Time Estimate: 30 minutes

Skills: Dictionary work, research, translating, language awareness.

Cuspóirí: Taighde a dhéanamh agus deich logainm a shainaithint ag baint úsáide as suíomh www.logainm.ie
Treoracha: Íoslódáil an greannán. Aimsigh na logainmneacha sa ghreannán. Scríobh amach na logainmneacha. Féach ar shuíomh www.loganim.ie Aimsigh deich logainm ina bhfuil na focail 'móin/móna'.
Pléigh & Machnamh: ● Cad a chuir iontas ort faoi na logainmneacha nuair a d'fhéach tú orthu? ● An bhfuil logainmneacha i do cheantar? Scríobh síos iad! ● Cruthaigh logainmneacha nua atá bunaithe ar an scéal nó leabhar pictiúr is fearr leat!
Nóiméad: Tríocha nóiméad
Scileanna: Feasacht teanga, taighde, obair foclóra

Useful websites

https://biorbic.com/
https://www.biobeo.eu/
https://www.logainm.ie/en/
https://www.ipcc.ie
https://www.curlewaction.org/
https://www.weforum.org/stories/2025/02/peatlands-store-carbon-climate-change/
https://www.arramara.ie/irish-seaweed-resource-management/seaweed-harvesting-methods/
https://farmzerocproject.ie/approach/
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https://biorbic.com/biobus/
https://www.rte.ie/brainstorm/2020/0818/1159766-ogham-stones-ireland-inscriptions-writing-language/
https://www.ria.ie/blog/brehon-law-manuscripts-reunited-for-galway-2020-european-capital-of-culture/
https://www.castlesofeireann.ie/maynooth.html#
https://www.thewildatlanticway.com/
https://ellenhutchins.com/

https://onetreeplanted.org/blogs/stories/how-much-co2-does-tree-absorb

Glossary

Ammonia: It is a colourless gas with a distinctive pungent smell that can be found in the peatlands and leads to moss and linen dying out when there is a high concentration within the bogland air.

Aglinates: Refers to parts of the acids from the brown seaweed that are extracted and processed for projects such as wound-dressing, gels and toothpaste.

Biobased: Made from living things such as plants, animals or microbes.

Cross-Laminated Wood: It is a subcategory of engineered wood panel product made from gluing together at least three layers of solid-sawn lumber at angles to each other

Curlew: Is a type of large, wading bird characterised by a long, slender, down-curved bill.

Fossil Fuels: The decayed matter of old creatures, found in the ground, that we use for energy and materials.

Timber Weirs: They are wooden beam structures that are put into the ground in the peatlands and their main use being to help increase water supply to the surface of peatlands**.**

Peatland: A type of wet raised or low land that has many unique and distinctive habitats within the peatlands such as curlews, bog spiders and mosses such as sphagnum, lichen.

Coast: An area of land that divides the mainland and the sea where many aquatic animals live.

Farm: A place where human and natural labour come together to harvest crops, raise livestock and provide goods to others.

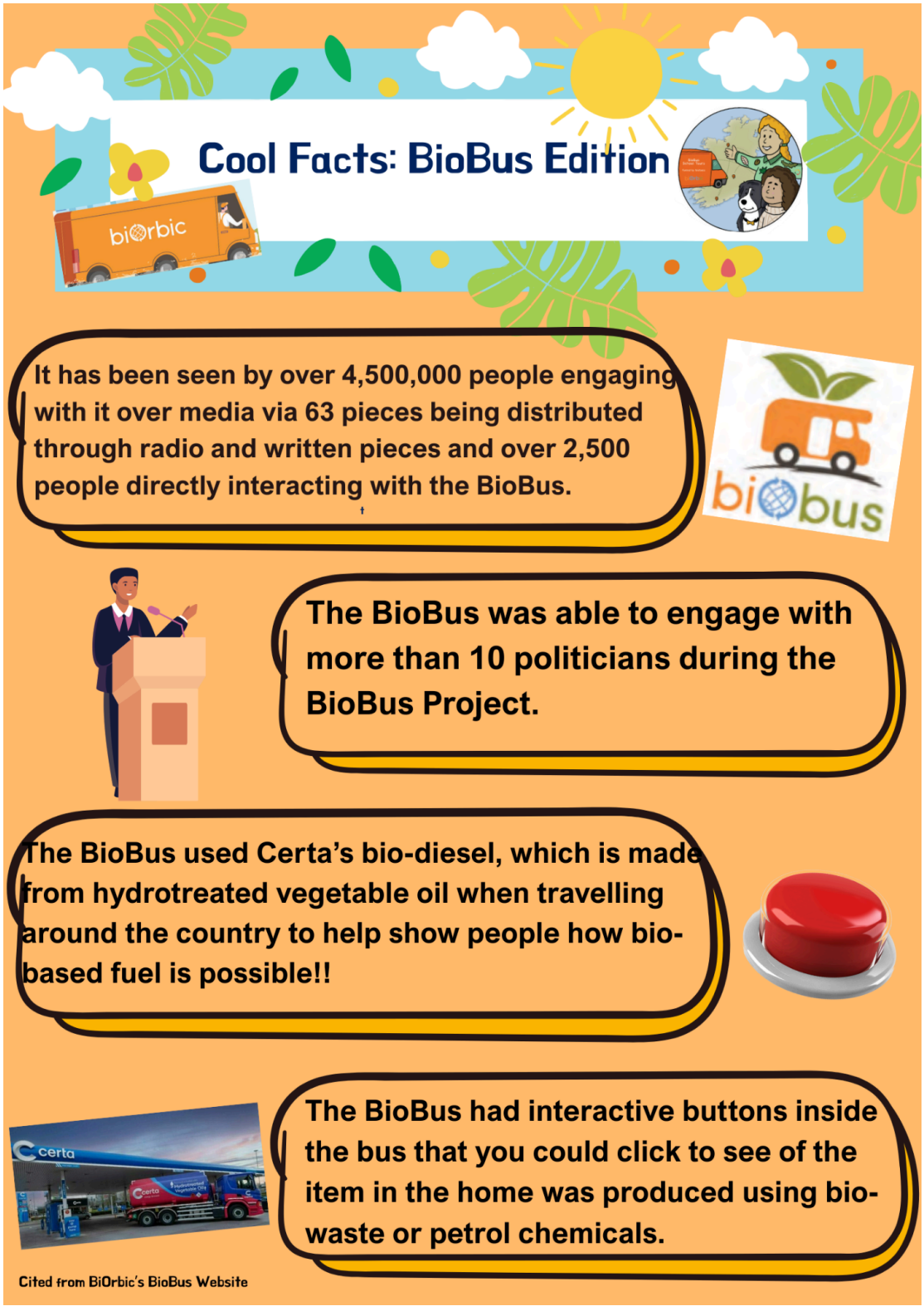
Forest: An area of land that has an intricate ecosystem that contains trees, animals, scrubs and inspects.

Market: A place where people from the local community come together to sell and trade their goods to others i.e., fresh produce, utensils, crafts, etc.

Maerl: Is the collective name for non-geniculate coralline red algae with a certain growth habit.

Biorefinery: A building where plant and food waste (biomass) is processed and converted into valuable products such as bio-gas, fresh water and electricity.

BioBus Cool Facts Poster



Acknowledgements

The authors would like to thank the following for support:

- MU SPUR Summer Programme for Undergraduate Research
- BiOrbic Research Ireland Centre for Bioeconomy
- UCD School of Biosystems and Food Engineering
- Froebel Department of Primary and Early Childhood Education, Maynooth University