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No.34 January 2026

Identifying Integrated Responses to Climate Adaptation, Climate Mitigation, Biodiversity and Water Quality

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RESEARCH PAPER

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Executive Summary

Ireland faces growing environmental challenges from climate change, biodiversity loss, and declining water quality, which increasingly threaten ecosystems, communities, and the economy. The National Climate Change Risk Assessment identified 115 climate-related risks in Ireland, with 43 deemed significant, including extreme wind, flooding, storm surges, coastal erosion, and heatwaves. Recent storms such as Darragh and Éowyn have demonstrated the severe impacts on infrastructure, homes, livelihoods, and community resilience. Concurrently, 90 per cent of habitats under the Habitats Directive are in unfavourable status, 52 per cent of rivers are in moderate to bad condition, and key species' populations are in decline.

These interlinked pressures highlight the urgent need for an integrated approach across climate adaptation, mitigation, biodiversity, and water management (the "nexus"). Siloed policies risk creating maladaptation and trade-offs, for example, non-native afforestation aimed at carbon sequestration can harm water quality and local biodiversity. An integrated approach ensures that interventions such as habitat restoration, sustainable agriculture, and urban greening deliver multiple benefits: reducing emissions, increasing resilience to extreme weather, enhancing biodiversity, and improving water quality. This report identifies the benefits, examples, and policy enablers for such integrated responses in Ireland.

Key findings:

- Fragmented governance limits effectiveness: Climate, biodiversity, and water policies in Ireland often operate in isolation, resulting in inefficiencies and counterproductive outcomes. For example, agricultural expansion and nutrient runoff have contributed to the degradation of rivers and biodiversity.
- Institutional and political barriers constrain integration: Fragmented departmental responsibilities, limited resources, unclear mandates, and short-term political cycles reduce coordinated action.
- Integrated solutions provide multiple co-benefits: Nature-based solutions such as peatland restoration, agroforestry, urban greening, integrated constructed wetlands, and riparian buffer zones simultaneously deliver climate mitigation, adaptation, biodiversity enhancement, and water quality improvements. These interventions reduce flood risk, sequester carbon, enhance ecosystem resilience, and support human well-being.
- Local and sectoral integration shows promise: Schemes like the Agri-Climate Rural Environment Scheme (ACRES), the Forestry Programme 2023–2027, and EU directives (e.g., Nature Restoration Regulation) demonstrate the potential for place-based, coordinated, multi-benefit approaches.

Enablers and recommendations for an integrated approach:

- Data sharing

    - Develop shared definitions and interoperable datasets across climate, water and biodiversity policy domains.
    - Institutionalise shared data repositories and spatial datasets to support cross-departmental analysis, integrated spatial planning and land-use decision-making, including biodiversity protection and restoration.
    - Establish cross-departmental data platforms supported by political leadership and designated integration staff.
    - Embed natural capital accounting within national and local decision-making and integrate it into national accounting systems.
    - Use natural capital accounting to inform spatial planning, nature restoration and nature-based solutions, considering biodiversity, water and climate objectives together.
    - Mainstream monitoring and evaluation of nature-based solutions to generate evidence on effectiveness, trade-offs and long-term climate resilience.
- Capacity
    - Prepare national strategies and plans through coordinated, consultative processes involving all relevant departments and stakeholders.
    - Implement an integrated national policy position on the environment.
    - Identify and address policy synergies and misalignments across climate, water and biodiversity objectives.
    - Build institutional capacity for integrated working by systematically assessing and addressing resourcing gaps across departments and local authorities.
    - Support cross-departmental collaboration through dedicated staff, training programmes, advisory spaces and statutory timelines.
    - Strengthen political leadership and governance arrangements to sustain whole-of-government approaches to nexus integration.
    - Engage communities to implement locally led integrated approaches to nexus challenges.
- Financing
    - Target public investment toward interventions delivering multiple co-benefits, including nature-based solutions, sustainable farming, active travel and nature restoration.
    - Engage finance ministers in nexus governance through clear strategies, monitoring systems and robust, integrated project pipelines.
    - Adopt whole-of-government approaches to funding by coordinating existing financial resources and aligning sectoral budgets, even where dedicated nexus funding is absent.
    - Reform harmful subsidies (e.g. fossil fuels and fertilisers) that undermine climate, biodiversity and water objectives.
    - Apply taxes and charges to environmentally damaging practices to incentivise sustainable land and water use.

- Promote dietary shifts toward planetary health diets to reduce pressure from resource-intensive livestock production.
- Reduce fertiliser use through improved agricultural practices (e.g. multi-species swards and soil management), lowering emissions, nutrient runoff and water pollution.

Ireland faces escalating risks from extreme weather, biodiversity decline, and water pollution. Integrated approaches offer a way to address these challenges holistically, maximising synergies, reducing trade-offs, and enhancing resilience. By combining nature-based solutions, strengthened institutional capacity, and coordinated finance and data systems, Ireland can build a climate-resilient, biodiverse, and water-secure future while meeting legal obligations and supporting sustainable communities.

Introduction

The dual crises of climate change and biodiversity loss represent defining environmental challenges of the 21st century (Pörtner et al., 2023). These crises are deeply interconnected (IPBES et al., 2021; IPCC, 2023; Murphy et al., 2023; Pörtner et al., 2021), driven by overlapping anthropogenic pressures (IPCC, 2023) that simultaneously alter the Earth's physical and biological systems. Climate change intensifies species extinction risks through rising temperatures, shifting precipitation patterns, and increasing frequency of extreme weather events (de' Donato and Michelozzi, 2014; Habibullah et al., 2022), biodiversity loss reduces the resilience[1] of ecosystems to buffer and adapt to climatic disturbances (Ekka et al., 2023). Further, negative impacts of climate change on ecosystem condition (Bellard et al., 2012; Nunez et al., 2019; Pacifici et al., 2015), can undermine ecosystems' natural capacity to sequester carbon. Understanding and addressing these interdependencies is essential for developing effective and lasting solutions to the planetary crisis. Integrated solutions to tackle both climate change mitigation[2] to reduce emissions, and climate change adaptation[3] to increase adaptive capacity against future climatic impacts are required. Through a desk-based review, this paper sought to identify the benefits and examples of integrated solutions for the nexus between climate-biodiversity-water (hereafter "the nexus") (Figure 1.). The aim of this work was to demonstrate the benefits of implementing integrated responses to tackle the nexus, highlighting the multiple benefits they can provide through existing examples. In Ireland, the case for action for the nexus has not been fully made and the benefits are not yet clear. This paper helps to address that gap.

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[1]The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (IPCC, 2012).
[2] "changing how we live, move, consume and manufacture so as to reduce and/or eliminate the production of harmful greenhouse gases: and it includes how we best use our land" (EPA, 2021)
[3] "dealing with the expected impacts of climate change and involves taking practical actions to manage risks, protect communities and strengthen the resilience of the economy" (EPA, 2021)

In this document, we identify synergies and benefits of integrated responses to the challenges of climate adaptation and mitigation, while improving biodiversity and water quality. We identify existing integrated responses within Ireland and abroad, reviewing the national policy landscape to identify where policies in Ireland are siloed, and where there is the potential to address multiple nexus elements, highlighting barriers and enablers to an integrated approach. By identifying these integrated approaches, decision-makers can design policies that enhance synergies and manage trade-offs across sectors. This increases policy coherence, improves cost-effectiveness, and ensures that resources deliver multiple benefits such as reduced emissions, strengthened resilience to future climate change, and enhanced human wellbeing. Integrated approaches also promote innovation and cross-sector collaboration by aligning environmental, social, and economic goals.

Integrated approaches, e.g. sustainable consumption (IPBES, 2024), include planning and designing approaches that aim to tackle the nexus. They require a holistic outlook on the many challenges we are facing, and aim to solve multiple objectives. Conversely, a siloed approach, e.g. monoculture afforestation for reducing emissions, does not holistically look at the nexus, and can cause negative impacts on biodiversity and water if there is no integrated planning. Integrated approaches will require collaboration across governmental departments and sectors, combined with policies supporting integrated approaches.

In Ireland, the National Climate Change Risk Assessment identified 115 risks due to projected changes in climate conditions, with 43 significant risks identified (EPA, 2025a). Risks were categorised into nine systems, including: biodiversity and ecosystems, marine and coastal ecosystems, and water security. Actions to enhance resilience were identified to address the priority risks of extreme wind, coastal erosion and flooding, increased precipitation and extreme heat. This assessment states that identified risks within one system have the potential for cascading impacts on other systems, highlighting the need for an integrated approach to climate mitigation and adaptation across the nexus in order to avoid or adapt to these risks.

The identified risks put an onus on us to increase resilience through adaptation as we face the increasing impacts of climate change. Increases in climate-related losses are projected in Ireland as the impacts of climate change, including sea-level rise, storm surges and extreme wind, increase in frequency and severity, with potential detrimental consequences for employment, health, productivity and food security (CCAC, 2025a). Recent storms Darragh and Éowyn have demonstrated the significant detrimental impacts increasing severe storms can have on our infrastructure, homes, and livelihoods, exposing the weaknesses in our resilience and preparedness for extreme weather events (CCAC, 2025a). At the same time, we must reduce emissions to achieve our legally binding carbon budget[4] and agreed EU emissions targets (EU, 2021). So far, Ireland has failed to achieve emission reductions targets during the first carbon budget period (2021-2025) (CCAC, 2025b). As well as increasing climate related threats, 90 per

[4]A carbon budget represents the total amount of greenhouse gas emissions that may be released during an agreed period (CCAC, 2021).

cent of habitats designated under the Habitats Directive are in unfavourable status with 51 per cent of habitats demonstrating ongoing decline (NPWS, 2025), populations of birds, bees and butterflies have declined (NPWS, 2024) and over half of our native plant species have declined in range and/or abundance (Stroh et al., 2023). 52 per cent of rivers are in moderate to bad condition, along with 32 per cent of lakes in moderate or worse condition (EPA, 2025b). Synergising climate adaptation and climate mitigation approaches in particular are essential for achieving a resilient, net zero, and biodiverse society. Integrating these approaches can provide multiple benefits, including achieving climate and biodiversity policy ambitions, increasing cost-effectiveness of measures implemented, and reducing trade-offs and maladaptive actions.

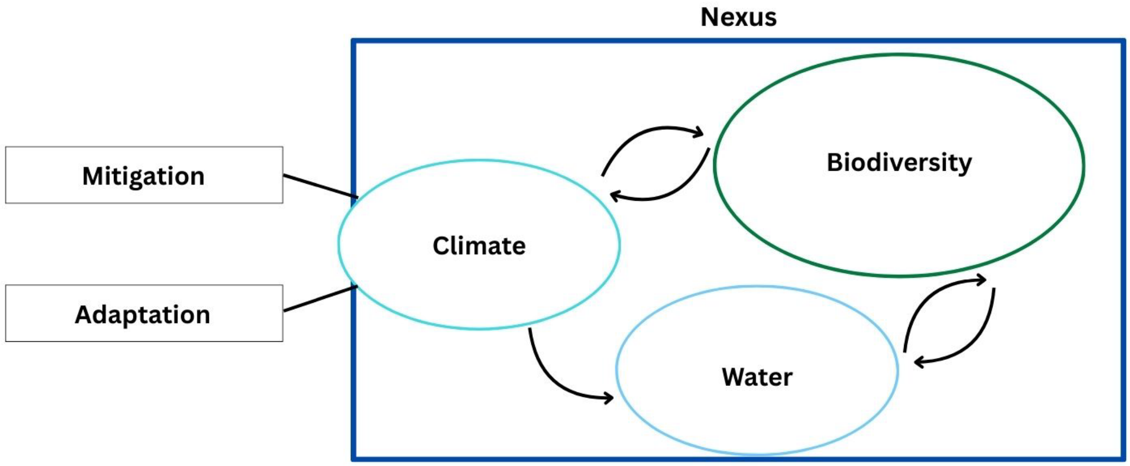

Figure 1. Conceptual diagram illustrating the nexus. Mitigation and adaptation feed into the climate system, signifying how mitigation and adaptation influence climate and therefore biodiversity and water. Mutual interaction arrows highlight the dynamic feedback among the nexus elements, highlighting their interconnectedness. The diagram emphasises that changes in one domain can propagate through the others, underlining the importance of integrated management approaches within the nexus framework.

The principal drivers of the climate and biodiversity crises, along with water quality decline, are well recognised and often shared across sectors. Land-use change remains one of the strongest pressures on biodiversity while also releasing vast amounts of stored carbon (Houghton et al., 2012). As the primary land use globally and in Ireland, agricultural and it’s intensification not only threatens species richness but also contributes to greenhouse gas (GHG) emissions (Madden et al., 2022), water contamination (Adams and Johnston, 2024), and soil degradation (EPA, 2024a). Overexploitation through deforestation and overfishing further erodes ecosystem integrity (Lampert, 2019). Meanwhile, pollution in its various forms of nutrient loading, plastic waste, and air pollutants, has pervasive impacts on terrestrial, freshwater, and marine biodiversity, while simultaneously degrading air and water quality (Pereira et al., 2012). Together, these drivers create a complex web of interactions that span the biodiversity-climate-water nexus, amplifying risks across environmental, economic, and social systems (Jaureguiberry et al., 2022).

Historically, policy frameworks have attempted to address these crises in isolation (IPBES et al., 2021). Climate policy has largely focused on emission reductions and adaptation measures, without consideration of potential impacts on biodiversity, e.g. carbon sequestration through non-native afforestation which can negatively impact local biodiversity and water quality, while biodiversity policy has prioritised conservation and ecosystem restoration irrespective of emissions, e.g. expansion of protected areas driven by EU Birds and Habitats Directives for habitat and species recovery with no focus on carbon sequestration capabilities (ten Brink et al., 2011). Similarly, agricultural, water, and pollution control policies have often evolved as sector-specific responses, designed around distinct mandates, departmental arrangements, and funding mechanisms. This siloed approach has led to fragmented governance, inefficiencies, and at times, counterproductive outcomes, for example, renewable energy developments that encroach on carbon sink habitats.

In recent years, however, there has been growing recognition of the need for more integrated and systemic responses. International frameworks such as the Paris Agreement (United Nations, 2015) tackling climate change and global emissions, the Kunming–Montreal Global Biodiversity Framework aiming to halt biodiversity loss (CBD, 2023), and the Sustainable Development Goals which aim to end poverty while tackling climate change and biodiversity loss (UN, 2022), emphasise the interdependence of climate, biodiversity, water, and human well-being. At the national and regional levels, nature-based solutions and integrated land-water-climate governance are gaining traction (EPA, 2024b). These integrated policy efforts seek to harness synergies across environmental objectives, for example enhancing carbon sequestration through ecosystem restoration and promoting biodiversity and water friendly agricultural practices (DAFM, 2023).

Methodology

To achieve the research brief:

"identifying the synergies and benefits of taking integrated responses to the challenges associated with:

- *climate change adaptation and mitigation e.g. increasing resilience to the impacts of climate change at the same time as pursuing emission reductions in areas such as energy, transport, and agriculture and land use; and*
- *climate action with biodiversity, air and water quality, e.g. where there are opportunities for synergies for multiple benefits arising from 'nature-based solutions' and other synergies across the nexus of different policy areas"*

the following steps were undertaken (Figure 2.). Published literature refers to literature from scientific journals, whereas grey literature refers to policy documents and non-scientific literature.

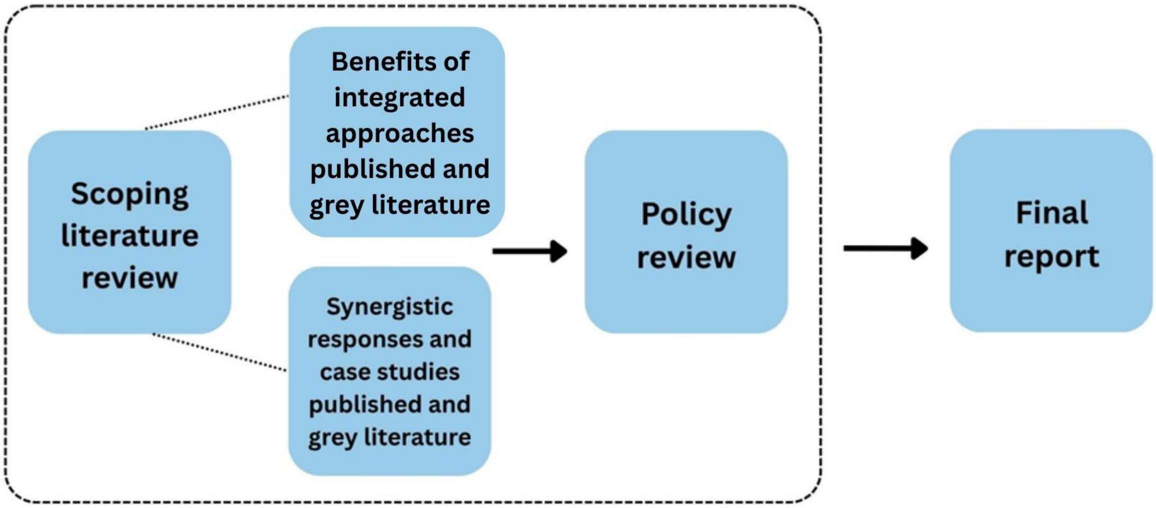

Figure 2. Outline of steps to identify the benefits and response options of integrated approaches to the nexus.

Integrated approaches

It is important to note that integrated approaches may not target the entire climate-biodiversity-water nexus, and this document aims to identify approaches and their benefits where some or all of the nexus aspects are targeted.

An integrated approach to tackling the nexus offers multiple benefits by recognising the interconnected nature of these systems. It ensures that actions in one area support, rather than undermine, progress in others, leading to more resilient ecosystems and sustainable resource use. Holistic strategies maximise co-benefits, reduce trade-offs, and promote long-term environmental, social, and economic resilience.

Benefits of integrated approaches

Flexibility

Implementing integrated approaches with co-benefits for the nexus elements can allow for flexible responses, leveraging nature's capacity to contribute to climate change mitigation and adaptation (Smith et al., 2022). Integrated approaches, such as organic farming, can simultaneously reduce GHG emissions, enhance biodiversity and water quality, and improve food security, offering multiple pathways to achieve positive outcomes for the nexus. This optionality provides flexibility under uncertain future scenarios.

Integrated planning and design further provide flexibility, allowing policies and interventions to adapt to different contexts and respond to emerging challenges across sectors. Climate change influences uncertainty around rainfall patterns, temperatures, and ecosystem responses.

Integrated planning and design allow for adjustments as conditions change, “learning-by-doing” across sectors, and policy recalibration.

Integrated approaches encourage coordination across sectors and governmental departments, along with community participation. This coordination can allow for faster responses and flexibility to emerging challenges compared to siloed approaches.

Cost effectiveness

Integrated responses, such as nature-based solutions, can tackle the nexus at a relatively low cost in comparison to siloed engineered solutions (Seddon et al., 2020). The UN Development Programme has made significant efforts to develop and deliver on the nexus agenda, and states that the alignment of biodiversity and climate finance not only presents immense opportunity to address the planetary crises, it also makes economic and financial sense (Neto, 2025). The Global Water Partnership also note that the lack of integration between water and climate action “leaves the risk of duplication and gaps in spending in support of overlapping objectives, reducing value for money” (GWP, 2019). This highlights that not only are integrated responses effective for holistically tackling the nexus for climate neutral, resilient, and biodiverse communities, they are also cost-effective.

Resilience

Integrated approaches strengthen resilience of communities, sectors, and ecosystems as they enhance the ability of natural and built environments to adapt to and recover from increasing extreme weather events. Integrated approaches to the nexus can increase resilience (Smith et al., 2022; Zhao et al., 2024) through diversifying ecosystem functions and reducing reliance on single solutions or technologies.

By addressing the nexus challenges together, actions reinforce one another. For example, restoring and protecting wetlands not only conserves biodiversity, but also stores carbon and buffers against floods and droughts. This interconnected resilience reduces long-term vulnerability, stabilises ecosystem services, and supports food and water security for communities.

Examples of approaches and their benefits to addressing nexus issues

The IPBES (2024) “thematic assessment of the interlinkages among biodiversity, water, food and health (nexus assessment)” addresses the interconnected elements of the crises and their challenges. It states that nexus approaches are crucial, and that decisions to approach them in isolation can result in misalignment, unplanned trade-offs and unintended consequences. Nexus approaches mentioned in the assessment include:

- Recognition of the dynamic interdependence among sociocultural systems, biodiversity, food, water, health and climate change as complex social-ecological systems.
- Utilisation of appropriate spatial planning approaches to ensure that predominantly natural as well as predominantly working landscapes and seascapes are considered in a complementary fashion.

- Addressing the problem of policy incoherence through the use of integrative approaches, from decision-making and implementation to monitoring and evaluation. This will enhance synergies, reduce trade-offs, and consider possible negative effects that could arise through interactions with various sectors.
- The promotion of collaboration across social, ecological and physical sciences, including engineering.

These highlight the various management approaches to the nexus that are recommended within this assessment, describing a more integrative, inclusive, equitable, coordinated and adaptive nexus governance approach.

The Organisation for Economic Co-operation and Development (OECD) produced a report using Ireland, among other countries, as a case study, with recommendations for aligning biodiversity, climate and food policies for sustainable land use. In this report (OECD, 2020), the OECD state that land use is central to the nexus crises, with GHG emissions from the agricultural and land use sectors accounting for 23 per cent of anthropogenic emissions, with terrestrial ecosystem loss and degradation threatening 25 per cent of animal and plant species with extinction. Alongside this, food production will need to increase significantly as the global population is expected to reach 10 billion people by 2050. This report used Ireland, among other countries, as it has relatively large agricultural and forestry sectors with associated GHG emissions. It examines opportunities and challenges in three areas: coherence across relevant national strategies and plans, institutional coordination, and policy instruments relevant to the land use nexus. Several recommendations were identified across these three areas.

- Coherence across relevant national strategies and plans:
    - Prepare national strategies and plans in a consultative and coordinated way, engaging all relevant departments and key stakeholders. This is essential to identify potential synergies and misalignments in the overarching objectives. The report specifically mentions Ireland's National Planning Framework as a good example of this, the creation of which included a cross-departmental steering group and a national consultation process.
    - Ensure strategies and plans have targets that are specific, measurable, actionable, realistic, and time-bound (SMART). Developing indicators to monitor progress towards targets would enhance transparency and accountability.
- Institutional coordination and coherence:
    - Strengthen coordination between different departments responsible for land use issues related to climate, biodiversity, and food, both at a national level and between different levels of government. Leadership from the top is crucial in developing coordinated policies for sustainable land use.
    - Improve policy coordination mechanisms. Setting up a cross-cutting body e.g. Ireland's Sustainable Development Goals (SDGs) Senior Officials Group with ministers from each governmental department, long-term low emission development strategies, or institutionalising coordination processes can improve coherence.
- Policy instruments relevant to the land use nexus:

    - Integrate spatial data into land use decisions better. Ireland is lacking data in this area, and this recommendation signals a need for improvements in land use data which would include biodiversity conservation actions such as protection and restoration as specified land uses in the National Land Use Review along with a National Land Use Map (Molloy et al., 2024b). Up to date spatial information is required in relation to land cover, land use, and infrastructure.
    - Apply taxes and charges more broadly to environmentally damaging practices. This can provide incentives to stakeholders to invest in more sustainable practices.
    - Regularly and consistently monitor and enforce regulations. Without this, land-use policies risk becoming ineffective and prior environmental gains may be undone.

The EU Green Deal (European Commission, 2021) has been shaped as an integrated growth strategy, aiming to achieve climate neutrality while protecting and restoring biodiversity. Paleari (2024) investigated whether the ambition of a more integrated approach has been embedded in the policy design of the EU Green Deal strategic framework, and explored whether or how they the approaches take into account synergies and trade-offs between climate change, biodiversity, and the circular economy.

- Approaches with synergies for climate change and biodiversity included:
    - Carbon removals (by forests, soil, etc.) and carbon stock (wood)
    - Reducing methane emissions in agriculture and livestock
    - Reducing the use of fertiliser
    - Trade-offs included biomass exploitation to produce renewable energy and exploiting the potential of farmed seafood as an alternative source of protein
- Approaches with synergies for climate change, biodiversity and the circular economy:
    - Reducing resource extraction and processing
    - Improving water efficiency
    - Producing renewable energy/biofuel from biowaste and agriculture residues

Paleari (2024) found that the EU Green Deal makes a significant effort to overcome policy fragmentation. Most of the reported interlinkages in approaches are climate centred, consisting of the expected contribution of the circular economy and biodiversity to climate mitigation and adaptation. This reflects the fact that in the EU Green Deal, climate neutrality is the most pervasive goal, and integrated approaches have the capacity to address multiple challenges while achieving climate resilience and net zero. Governance is still identified as a critical obstacle to implementing these nexus approaches, however the integration within the EU Green Deal is a positive step towards overcoming this.

Folkard-Tapp et al. (2025) present the case for a broad framework of approaches to address climate change with co-benefits for nature and humans, the concept of Integrated Nature-Climate Action (INCA). They provide examples of INCAs with significant, tractable benefits for people and nature. An inclusive INCA concept can help address the systemic drivers of the nexus crises. Examples included:

- Increase uptake of planetary health diets
    - Climate benefits: reduced GHG emissions from livestock and fertiliser production
    - Nature benefits: less land needed for food production, prevent further loss of biodiversity, reduce phosphorous and nitrogen pollution
    - Social benefits: better nutrition, reduced chronic disease
- Reform harmful subsidies (e.g. fossil fuels, fertilisers)
    - Climate benefits: reduced GHG emissions
    - Nature benefits: less pressure on ecosystems
    - Social benefits: less pollution impacts
- Extended producer responsibility laws for a wide range of individual waste flows and products
    - Climate benefits: less emissions from production and waste
    - Nature benefits: lower marine and land pollution from proper and improper waste disposal
    - Social benefits: reduced exposure to toxic waste

Employing INCA would empower a wider range of actors from across sectors and disciplines to tackle the drivers of the nexus. INCA has the potential to enhance collaboration between climate, biodiversity and social justice spheres.

Smith et al. (2022) identify examples of actions that benefit both climate and biodiversity. They state that protection and restoration of biodiverse and carbon-rich ecosystems is the top priority from a joint climate change mitigation and biodiversity protection perspective. They also mention nature-based solutions[5] as complementary solutions to the nexus challenges, and have co-benefits for mitigation, adaptation, and biodiversity.

- Reduction of emissions from deforestation and forest degradation has large climate mitigation potential and biodiversity co-benefits. Reducing the loss of forests has the single largest potential for reducing GHG emissions through land-based actions. Degradation of forests causes significant biodiversity loss, so any reduction would improve conditions for biodiversity.
- Conservation of non-forest carbon-rich ecosystems on land and sea, including important
- carbon stores such as peatlands and wetlands. Conservation of these carbon-rich areas
- has important climate mitigation benefits, along with co-benefits for biodiversity through
- habitat protection.
- Restoration of degraded ecosystems can provide significant contributions to emission reductions. However, IPCC scenarios do not differentiate between natural forest regrowth, reforestation with plantations, and afforestation of land not previously tree covered. This makes assessment of biodiversity impacts difficult. Peatland and coastal wetland restoration also have mitigative potential. Ecosystem restoration provides co-benefits for

[5]"Actions to protect, manage and restore natural or modified ecosystems, which address societal challenges, effectively and adaptively, providing human well-being and biodiversity benefits" (IUCN, 2016)

climate change mitigation and biodiversity conservation, which are maximised if restoration occurs in priority areas for both goals. Restoration also provides multiple co-benefits for people, such as regulation of water quality, regulation of the hydrological cycle, decreases in the frequency and severity of floods and droughts, and pollination.
- Climate and biodiversity friendly agricultural and fishing practices can reduce emissions and negative impacts on the environment and biodiversity. In the agriculture sector, emissions can be reduced on the supply side through improved cropland management, grazing land management, and livestock management. These measures can reduce methane emissions from enteric fermentation and livestock manure, and reduce nitrous oxide emissions from fertiliser production and application, while also creating soil carbon sinks. Their impact on biodiversity has been assessed as neutral to positive at various scales. In the fishing and aquaculture sector, reducing overfishing and bycatch, as well as focusing new aquaculture activities on low trophic level species (e.g. plankton feeders such as bivalve molluscs) and broadening the range of species cultivated could improve food security and marine biodiversity. Expanding seaweed cultivation also offers biodiversity friendly opportunities for sequestering carbon dioxide and producing food.

Smith et al. (2022) describe several integrated approaches to the nexus, with a few examples described above. They state that negative impacts of large-scale climate mitigation measures on biodiversity, such as monoculture energy crops and renewable energy installations, can be minimised or negated through careful implementation. By being more synergistic, holistic, and long-term in view, Smith et al. (2022) state that these integrated approaches to climate mitigation will not only benefit biodiversity and societal wellbeing, but are also likely to be more robust and sustainable.

The Global Water Partnership undertook an analysis to identify how to connect the water goal under the Sustainable Development Goals (SDGs) (UN, 2022) and the climate resilience agenda (GWP, 2019). This report highlights opportunities for simultaneously addressing climate resilience and sustainable development ambitions, indicating how integrated approaches to water resources management can assist with managing climate action and development action, increase climate resilience and advance the SDGs. Approaches include:

- Early warning systems for extreme drought or flooding events, which are cost-effective and save lives and livelihoods. Early warning systems strengthen resilience and adaptive capacity to climate related hazards.
- In the Maipo basin in Chile, the Nature Conservancy and partners plan to use wetlands, river-side vegetation, and forests as nature-based solutions to improve the quality and quantity of water reaching Santiago.

The GWP note that water security is essential to address climate change impacts and sustainable development, and that sustainable development, climate resilience and water security are interdependent. Conversely, climate change and unsustainable development, both individually and in combination, threaten water security. The GWP (2019) analysis determines that the central problem identified for water in climate adaptation is the failure to recognise, leverage, and plan for the linkages between climate resilience, sustainable development, and water security.

In Ireland, Molloy et al. (2024a) identified 81 nature-based solutions that have been implemented nationwide to tackle the nexus. These solutions highlight ongoing examples of integrated responses in Ireland, indicating that there is already a number of these approaches that can be and have been implemented. These approaches contributed to either climate adaptation or mitigation, or both, while providing co-benefits for human wellbeing and biodiversity. Nature-based solutions identified in Molloy et al. (2024a) also provided a range of services, including flood management, water quality enhancement, carbon sequestration, coastal protection, and pollination. Some examples of nature-based solutions identified that provide an integrated approach to the nexus include:

- The Tolka River Constructed Wetland. Constructed wetlands are implemented to treat wastewater, improving water quality by mimicking natural wetland processes, sequester carbon, and mitigate flooding. They can also provide habitat for aquatic and wetland biodiversity.
- The application of multi-species swards in several agricultural projects, such as the Inishowen Upland Farmers Project. The use of clover or a mix of grasses, legumes and forbs in pasture can reduce the need for chemical fertilisers due to the nitrogen fixing ability of legumes, enriching the soil. Use of multi-species swards can improve soil quality, reduce emissions, provide food for pollinators, and the reduced use of chemical fertilisers can improve water quality through reduced agricultural runoff.
- The Galway Bay Native Oyster Restoration Project aimed to restore a native oyster reef to act as a protective barrier from storm surges, reducing coastal erosion. Oysters are filter feeders which improves surrounding water quality through the removal of nutrients, and oyster reefs can provide habitat for many marine species.

This study identified current barriers to the implementation of nature-based solutions, such as limited funding and resources, lack of information on the implementation of nature-based solutions, along with a lack of evidence and published data on the effectiveness of nature-based solutions, and a lack of knowledge transfer from academics in this area to stakeholders wanting to apply these solutions. Molloy et al. (2024a) offered recommendations for implementing effective nature-based solutions. These included:

- A shared definition for nature-based solutions for policymakers for implementation across sectors.
- A dedicated cross-departmental unit or assignment to an existing unit with a mandate to work across government departments/agencies/units.
- High-level national and international policy ambitions on nature-based solutions need to be translated into sectoral policies and action plans to ensure their effective and coordinated implementation.

- Monitoring and evaluation of nature-based solutions to determine their effectiveness, any weaknesses, their impacts on the surrounding landscape and its functions, and their response to future climate impacts.
- A collaborative approach across governmental departments, non-governmental organisations, public service bodies, local authorities and the private sector, along with engagement with local communities and a clear governance strategy.

These recommendations are also applicable for effective implementation for integrated approaches to the nexus.

Identification of synergistic responses

Table 1. Summary of Irish approaches, derived from climate actions listed in the Climate Action Plan 2024 (DECC, 2023) **demonstrating whether they are integrated or siloed across the climate-biodiversity-water nexus.** Approaches with integrated benefits across multiple nexus elements are highlighted in grey. Symbols indicate whether actions have positive (+), negative (-) or neutral ( ) impacts. These impacts were adapted from data collected in Molloy et al. (2024a, 2024b). From Molloy et al. (2024a), benefits from nature-based solutions were adapted into the table below. From Molloy et al. (2024b), results of measures within impact assessment tables for energy and agriculture were also adapted into the table below. Some approaches may have negative and positive impacts for biodiversity recorded, depending on whether the nexus is considered holistically in the approach. For example, renewable energy development has the potential to produce biodiversity gains, or significant negative impacts if biodiversity isn't considered.

Sector	Action	Nexus element			
		Climate change mitigation	Climate change adaptation	Biodiversity	Water
Energy	Renewable energy development (offshore, onshore, solar)	+		-/+	-/+
	Bioenergy	+		-/+	
	Decarbonisation	+		+	+
	Improve energy efficiency	+			
	Electrify transport systems	+			
	Afforestation (native)	+	+	+	+
	Afforestation (non-native monoculture)	+	-	-	-
	Agroforestry	+	+	+	+
	Multi-species swards	+		+	+

Agriculture, forestry and land use (AFOLU)	Optimise fertiliser use	+		+	+
	Low-emission animal feeding	+		+	+
	Organic farming	+	+	+	+
	Improved soil and water table management	+	+	+	+
	Peatland restoration	+	+	+	+
	Woodland restoration	+	+	+	+
Infrastructure and planning	Sustainable Urban Drainage Systems		+		+
	Urban greening	+	+	+	+
	Sea walls		+	-	
	Integrated Constructed Wetland	+	+	+	+
	Coastal and marine ecosystem restoration	+	+	+	+
	Riparian buffer strip	+	+	+	+
	Bunds		+		
	Retention ponds		+	+	+
	Public transport expansion	+			
	Active travel expansion	+			
	Early warning systems		+		

Policy imperatives

Synergistic responses to the nexus are identified and described based on what key policy imperative they target. Policy imperatives include increasing resilience through adaptive measures, reducing emissions through mitigative measures, and restoring biodiversity and water quality. Some responses tackle both adaptation and mitigation and will be described as such below.

Tackling both climate change adaptation and climate change mitigation may not always synergise, unless approaches to tackling both are designed as such. While both aim to reduce the impacts of climate change, they operate at different time scales and priorities. Mitigation has long-term global benefits, while adaptation delivers short-term local benefits and may be favoured by policy makers. For example, large scale afforestation sequesters carbon and mitigates climate change over a long time period, however there is a need to ensure these forests are drought and disease resistant. If adaptation and the other nexus elements are not considered, and monoculture forests are planted only for their mitigation services, there may be increased vulnerability to pests and soil erosion. In urban areas, the need for increased green space to adapt to rising temperatures may conflict with increasing density of urban development to reduce transport emissions, further raising urban temperatures and limiting space for flood management. Any urban expansion to reduce emissions must be done while integrating urban greening, to ensure reduced urban heat island effect[6], provide green spaces for biodiversity and recreation, and ensure green space is available for flood management and water filtration. Otherwise, while climate change is being mitigated, adaptive responses are reduced and urban areas will be further impacted by climatic events. An OECD report looking into redesigning Ireland's transport for net zero (OECD, 2022) states that reallocating roadspace is a key strategy for urban greening expansion, and using freed up space from roadspace reallocation creates an opportunity to increase greenness without changing built-up density.

An integrated approach to these two issues is difficult to coordinate, as mitigation often requires centralised policies at a national level, e.g. national carbon budget targets, whereas adaptation is typically more localised (Klein et al., 2007).

Reducing emissions

Changing livestock management practices, for example through low-emission animal feeding, can reduce emissions and mitigate climate change. Some feed additives can also reduce nitrogen and phosphorous lost in animal waste, as well as reducing methane and ammonia and other noxious metabolic gases. Reducing the loss of these, particularly ammonia, will reduce the risk of eutrophication and acidification of ecosystems (Lewis et al., 2015). In Ireland, methane emissions contributed to 71.1% to the total emissions from the agriculture sector in 2024 (EPA, 2025c). This highlights that not only would changing management practices through feed additives be beneficial to biodiversity and water, it could also aid in reducing the significant amount of methane emitted by the agriculture sector.

Transitioning to organic farming through reducing chemical fertiliser (Case study 1), changes in livestock densities and grazing regimes, new cropping techniques and shifting to food crop and horticultural production represents an integrated approach as it reduces emissions and contributes to climate adaptation. Diversification of practices allows farmers to have multiple income streams, improving resilience of farms to future climate impacts. Without reaching the Climate Action Plan 2024 target of 450,000 ha agricultural land converted to organic farming (DECC, 2023), biodiversity and water will continue to be impacted by agriculture and emissions reduction targets may not be achieved.

Case study 1: Reducing pollution from agricultural practices (McCullagh, 2024)

Pollution is a significant threat to freshwater systems in Ireland, resulting in eutrophication from the release of nitrogen and phosphorous rich effluents into waterbodies. As our river water quality continues to decline (EPA, 2025b), there is a need for agriculture and aquaculture to

[6]The urban heat island effect alters the surface of cities, making them significantly hotter than surrounding suburban and rural areas (EC, 2024a).

consider the nexus elements through their practices. Common duckweed is a native plant that is fast growing, sequesters carbon, is tolerant to ammonium, and produces essential amino acids. They are present in waste streams and have demonstrated they can absorb nutrients, reducing levels in waste waters. The Brainwaves and Duck-Feed projects in collaboration with the Green Farmer Co-operative demonstrated that one ha of duckweed was able to remediate water fouled by 30 tonnes of rainbow trout and perch, showing clear benefits for water quality and habitat restoration. The resulting high-nutrient duckweed also represents potential valuable agri-feedstock, which would reduce reliance on imported animal feed and lower emissions. This holistic approach to improving water quality has positive impacts on freshwater biodiversity, while also sequestering carbon and providing benefits for the circular economy.

Drainage of organic soil for agriculture has caused the soil to become a carbon source. To improve carbon sequestration of agricultural soils, management intensity will need to be reduced, along with altering the water table level of drained organic soils. Rewetting grassland does not take it out of productive use – paludiculture, the continued productive use of rewetted grassland, is an important farming option which also reduces emissions from soil, and provides positive benefits for biodiversity (Martens et al., 2023). In order to meet emissions targets, rewetting areas of agricultural land will help towards achieving these goals.

Decarbonisation across sectors is required (McGee and McKlenaghan, 2025) to meet our emissions reductions targets. Decarbonisation mitigates climate change while also providing benefits for biodiversity, water and human health through improved air quality and reduced pollution from fossil fuel burning. Without decarbonisation and decreasing our reliance on fossil fuels, negative impacts from fossil fuel burning will continue to impact the nexus.

Renewable energy developments are imperative for climate change mitigation. Continued reliance on fossil fuels will drive biodiversity loss indirectly through climate change and directly through habitat loss and pollution (Harfoot et al., 2018). Therefore, the move towards renewable energy to reduce emissions is necessary. Large scale renewable energy installations will have negative impacts on biodiversity (Rehbein et al., 2020), particularly if biodiversity is not integrated into the planning and design of installations. Prioritising renewables that require less land, such as wind and solar over biofuel, especially as biofuel is less energy efficient (Searchinger et al., 2017), would also have less conflicts for biodiversity. Implementing solar onto existing buildings, considering all nexus elements while planning and designing renewables, along with appropriately siting installations (Gorman et al., 2023) is critical to minimise negative impacts on biodiversity, water and climate adaptation. While renewables demonstrate a siloed approach (targeting mitigation only), if installations look at the entire landscape, its land cover and uses (Molloy et al., 2024b) and ecosystem services, it is possible to integrate holistic solutions for the nexus.

Increasing resilience

Early warning systems and preparing for extreme weather events can assist with adaptation. These will be necessary as extreme weather events increase and continue to have significant impact on communities. In Ireland, it is clear from Storm Éowyn and its aftermath that more action is required to prepare and adapt to these events. The Climate Change Advisory Council (CCAC) has stated there is significant weaknesses in how the widespread impacts of this storm were managed (CCAC, 2025a). While improving adaptive responses, this doesn't address entire nexus. This sums up why the entire nexus must be considered at national level policies and plans, as addressing climate change mitigation, biodiversity and water will reduce the impacts of climate change and enhance resilience, while also reducing the negative impacts of extreme weather events. The CCAC highlights this in their "Preparing for Ireland's changing climate" annual review 2025, stating that "scaling up the use of nature-based solutions across sectors and implementing comprehensive measures to conserve and restore priority habitats and species are urgently required to protect against the impacts of climate change" (CCAC, 2025a). This further demonstrates the multiple benefits integrated approaches such as nature-based solutions can provide in tackling the nexus.

Nature-based solutions such as agroforestry (Case study 2) integrates trees and shrubs with livestock or crops. It can mitigate climate change through carbon storage and aid farmers to adapt to climate change impacts (Hernández-Morcillo et al., 2018) through shading and providing multiple sources of income, while also providing habitat for biodiversity and improving water quality. Multi-species swards enhance pasture productivity without synthetic fertilisers, providing adaptive services (Haughey et al., 2018) and mitigates climate change (Lanigan et al., 2023). Less reliance on synthetic fertilisers improves water quality, while multi-species swards increase forage for pollinators. Continued use of synthetic fertiliser will have detrimental impacts on our waterways, and multi-species swards are one alternative to reduce their impact.

Case study 2: Agroforestry for sustainable food production An experiment running since the 1980s at an Agri-Food and Biosciences Institute (AFBI) site in Loughgall, Co. Armagh, has been implementing agroforestry, specifically silvopasture, which integrates trees and livestock. Agroforestry offers a sustainable method to transform food production while mitigating climate change. Silvopastoral systems at this site, to date, have highlighted that this practice enriches biodiversity and can potentially promote soil carbon sequestration, but only if left long enough (ECT, 2025).

Urban greening through the addition of green spaces like parks, urban trees, green roofs, nature-based urban drainage systems and rain boxes represents a valuable integrated approach for urban areas (Case study 3). They can reduce local temperatures, improve air quality, reduce emissions, and improve flood management and water quality (Bowler et al., 2010; Junior et al., 2022; Lee et al., 2015). Urban green spaces also provide refugia for wildlife, along with social and health benefits (Roy et al., 2012). With continued urban expansion, urban greening is a vital integrated approach to the nexus to ensure society's resilience to climate change.

Case study 3: Nature-based solutions in the built environment

In the Irish built environment, there are several examples of nature-based solutions targeting the nexus (urban greening measures identified in Molloy et al. (2024a)). The Irish Green Building Council provided a "catalogue" of nature-based solutions in the built environment (Jammet and Rondini, 2025), stating that "careful consideration of the local environment and project context, including cost, is crucial". They also recommend the use of the Biodiversity Gain Hierarchy: avoid, minimise, protect & enhance, create. Two case studies in the built environment in Ireland are described, including:

- "Living roofs: boosting urban biodiversity from above". Green roofs support plant growth and can provide many services such as thermal regulation and water management for adaptation, carbon sequestration, and benefits for biodiversity. This case study focuses on the green roof installed on The Observatory building in Dublin city. Implementing the green roof provided positive impacts for biodiversity, including pollination and pest control services. Without the green roof, there would be less habitat for urban wildlife, increased stormwater runoff, and this runoff would not have been filtered by the green roof and would contain pollutants and sediments when entering waterways. The green roof also assists in insulation and reducing the urban heat island effect.

Dune fences, another nature-based solution, comprise of erected wooden fences which allow sand deposits to build up and stabilise the dune and protect from coastal erosion (e.g. Lawlor and Jackson, 2022). Restoring the dune system can provide habitat for coastal biodiversity. Dune systems are vital for coastal protection (Case study 4), and should be protected to ensure vulnerable coastal communities have increased resilience to extreme weather events.

Case study 4: Dune restoration for coastal resilience

The Maharees, a tombolo in Co. Kerry (Farrell and Farrell, 2023). The aim of this case study was to restore degraded sand dunes to increase their resilience to increasing storm surges, control sand deposition on an access road, and adapt to climate change, along with overcoming the challenges of working as a community, with partners, and learning and sharing knowledge. The Maharaees community identified many barriers to building resilience of the dune system, such as continued erosion, flooding, funding, adaptation and seasonal tourism which further degrades the dune system through anthropogenic impacts. Nature-based solutions were identified as an integrated approach to climate resilience in this area, and the Maharees Conservation Association organised community training events and local funding to implement them. By planting marram grass and controlling dune access, the dunes have been restored and become more biodiverse. Wooden sand fences were erected to control sand deposition, and since their implementation the access road has not been blocked. A coastal erosion and flood risk management study has been completed, setting out a medium to long-term prognosis for the tombolo and suggests protection measures for future resilience. Without this approach to restoring the dune system, the ecosystems would continue to be degraded, driving biodiversity loss, restricting road access from sand deposits, and increasing coastal erosion and decreasing resilience to future climate change impacts.

Integrated constructed wetlands (ICWs), engineered wastewater treatment systems which mimic processes similar to those of natural wetlands (Babatunde et al., 2008) provide adaptive services such as improving water quality and flood mitigation (Jamion et al., 2023). While they are implemented to treat wastewater, they target the nexus as they can also sequester carbon and mitigate climate change, while providing habitat for biodiversity and improving water quality. ICWs are a useful tool for wastewater treatment that provide multiple benefits for the nexus. Hard engineering solutions are more costly and developing large wastewater treatment infrastructure has negative consequences for biodiversity through habitat loss and degradation.

Integrated riparian approaches, such as retention ponds, efficiently attenuate stormwater runoff while also filtering pollutants and improving water quality. Riparian buffer strips also improve water quality and flood management, and woody buffer strips mitigate climate change through carbon storage (Cole et al., 2020). Bunds, a mound implemented to slow the flow of water, target the adaptive elements of the nexus through reducing flood risk (Teale, 2023). While hard engineering solutions cannot be ruled out, they are more costly and may not be as resilient to future extreme events.

Restoring biodiversity and water quality

Along with restoring biodiversity and water quality, habitat restoration can provide climate adaptation and mitigation synergies. For example, wetland restoration, specifically peatlands in an Irish context, can provide multiple benefits to address the nexus. Peatlands are the largest terrestrial organic carbon stock (Strack et al., 2022) (Case study 5), and deliver services such as water purification and the preservation of ecological and archaeological records (Andersen et al., 2017). Martin-Ortega et al. (2014) found strong evidence that peatland restoration reduced suspended sediment loads, and that rewetting prevented further decline in water quality. Degraded peatlands also release emissions (Bonn et al., 2014), highlighting the further importance of their effective restoration. The impacts of degraded peatlands include reduced water quality and water retention, and increased emissions, therefore restoring and protecting peatlands as an integrated approach to the nexus reduces counterproductive actions.

Case study 5: Peatland restoration for carbon storage

Clara bog, “the living bog project”, which was the largest single raised bog restoration project undertaken in Ireland. Bogland was restored to improve carbon storage and stop emissions being emitted from the degraded bog. Restoring bogland increased biodiversity and provided recreational and cultural services (McCullagh, 2024). This case study tackles all nexus elements, and highlights the importance of restoring bogs in Ireland.

Coastal and marine ecosystem restoration offer significant adaptive abilities. Saltmarsh and dune systems can offer flood and storm protection (Norton et al., 2018), lessening the damage from increasing winter storms. Saltmarshes also play a significant role in mitigation through carbon storage (Mason et al., 2023). Restoring native oyster reefs can act as a natural breakwater and help protect against storm surges and coastal erosion, while also having a benefit cost ratio higher than grey infrastructure alternatives (Hynes et al., 2022). Oyster reefs may also have a role in climate mitigation through carbon removal, although it is poorly understood, and they can also provide further adaptive services through water filtration, regulating water quality (Thomas et al., 2022). Marine life including oyster reefs can also play a role in protecting against coastal erosion (Case study 6), while also improving water quality, and saltmarshes store substantial amounts of carbon (Mason et al., 2023). This again highlights the benefits of habitat restoration as an integrated approach, and the potential detrimental consequences faced by communities if these measures aren't implemented.

Case study 6: Oyster reef restoration for coastal protection The Galway Bay Native Oyster Reef restoration project aims to restore a native oyster reef that would act as a protective barrier from storm surges impacting a coastal trail and the surrounding coastal area (Hynes et al., 2022). Restoring the reef also provides habitat for marine species and improves water quality through reduction of nutrients by filter feeding.

Blue carbon habitats also provide climate mitigation, through storage of carbon in living biomass or in sediments by seagrasses (Johannessen, 2022), and macroalgae through organic carbon export to the open ocean (Cott et al., 2021). Seagrasses could also play a role in adapting to future storm surges, through reducing flood risk and erosion by attenuating wave energy, a study by Forrester et al. (2024) has suggested. However, their ability to do so is limited, and Forrester et al. (2024) state that coastal wetland restoration or hard engineering solutions will still need to be implemented alongside seagrass beds.

Afforestation is another approach that can offer climate mitigative and adaptive solutions. Tree planting has become a major focus for climate mitigation targets, however it must be done with the "right tree, right place" approach. Afforestation can provide climate adaptation services through improving water quality (Duffy et al., 2020), and afforestation in the headwaters of a river basin can significantly reduce flows compared to deforested basins (Buttle, 2011). The need to meet our emissions targets may require planting of non-native conifers for their fast carbon sequestration abilities (Forster et al., 2021), therefore trade-offs with biodiversity will have to be carefully considered. Soil type and land cover will need to be considered when afforesting, as to avoid soil erosion and potential landslides. Forestry practices were recognised as potentially playing a role in Shass, Co. Leitrim (Sargent, 2020), where a landslide occurred after heavy rain in an event involving a heavily planted hill (plantation forestry) with peat underlying soil. While afforestation has significant benefits for mitigation, tree planting at large scales must consider the nexus elements, otherwise there is a risk of reducing adaptive capacities and resilience of planted forests and surrounding ecosystems.

River restoration provides effective climate adaptive solutions, reducing flood damage, and also provides climate mitigation through carbon sequestration (Vermaat et al., 2016). Riparian vegetation (Case study 7) provides multiple ecosystem services, including climate adaptation services like erosion control, flow regulation and nutrient removal in runoff, along with climate mitigation services like carbon sequestration. This vegetation can also provide habitat and enhance pollination (Riis et al., 2020). As Ireland faces increasing precipitation (Ryan et al., 2022), river restoration measures like riparian vegetation are vital. These integrated approaches will help to reduce flooding as extreme precipitation events increase, along with improving water quality within freshwater systems.

Case study 7: Flood management through riparian buffer zone enhancement The Culdaff Riparian Buffer Zone (CRiBZ) Scheme plants wildflowers and trees in riparian buffer zones to slow the flow of the river along with filtering sediment and protecting from pollutant runoff to improve water quality (Inishowen Rivers Trust, 2018).

These restoration measures may be implemented as nature-based solutions to tackle various societal challenges[7] while also offering dual benefits of climate adaptive and mitigative services. Habitat restoration measures are a significant approach for integrated efforts to the nexus. Restoring ecosystems can sequester carbon, support species diversity, improve air and water quality, mitigate flood risk, and increase pollination (Molloy et al., 2024a).

As highlighted, integrated approaches offer multiple benefits, can tackle many issues at once, and offer more advantages than siloed solutions. Table 1. represents a summary of the benefits associated with the discussed approaches, and whether they offer positive or negative contributions for the nexus elements.

Response options to the nexus

The above case studies demonstrate the ability of these approaches to tackle nexus challenges. This section illustrates viable responses to the nexus in Ireland, based on the assessment of the applicability of integrated responses to Ireland from Haughey (2021). This assessment was undertaken to identify the responses that could have the largest positive impact on climate mitigation and adaptation objectives in Ireland. Haughey (2021) notes that the efficacy of response options is significantly affected by local environmental and socioeconomic conditions, and some responses may only be applicable to certain ecosystems, climate zones or economic sectors. Some responses may increase in applicability with increasing weather extremes, and certain responses will have low applicability as the land cover it pertains to covers only a small area.

[7] climate change, natural disasters, social and economic development, human health, food security, water security, ecosystem degradation and biodiversity loss (IUCN, 2016)

Integrated responses were identified from the IPCC Special Report on Climate Change and Land (IPCC, 2019). Haughey (2021) ranked integrated responses Low-Moderate-High in terms of potential applicability in Ireland. The following examples from Haughey (2021) are mentioned below, with examples from the full range of ratings.

Dietary change ranked as having a high potential for potential applicability. Haughey notes this response can be applied to entire population of Ireland, encompassing multiple major sectors of the food system (production, retail, consumers). However, it is stated that there are significant barriers to adopting this response, and there is low confidence regarding the impact of this response on climate mitigation and adaptation in Ireland. Hallström et al. (2015) found that dietary change in areas with affluent diet has the potential to reduce GHG emissions and land use demand.

Improved grazing land management also ranked as high potential. This response applies to a large land cover area, with nearly 70 per cent (67.6%) of Irish land cover under agriculture (EPA, 2020a). Grassland cover and associated ruminants are dominant in Ireland. Research is underway to examine more efficient grazer management, multispecies swards, and improved grass and clover cultivars.

Reduced pollution including acidification ranked as high potential for applicability in Ireland. This response is particularly important for intensive agriculture, as excess nutrient application can result in pollution – both air pollution and eutrophication of waterways from leaching and run-off of nutrients.

Disaster risk management was ranked as having moderate potential. This response applies to a moderate area of natural and managed land at risk of climate-related events such as flooding, drought, and landslides. It is likely that the applicability of this response will increase in the future with increasing climate-related weather events. There is low confidence in this assessment, as this report did not assess the risks posed by climate change to humans and the natural landscape.

Forest management also ranked as moderate potential. In Ireland, forest land is dominated by non-native monocultures of conifer. It is likely there is considerable scope to implement sustainable forest management practices, balancing between biomass production and carbon sequestration, biodiversity and water quality.

Restoration and reduced conversion of coastal wetlands was ranked as low potential for applicability. Degraded coastal wetland extent is minimal in Ireland. Salt marshes specifically are rare in terms of their biodiversity and function, therefore their conservation is particularly important.

Reduced grassland conversion to cropland ranked as low potential. The land area likely to be converted to cropland in Ireland is negligible. Where this does apply, it could contribute to reducing the loss of soil carbon.

Finally, reduced soil erosion was also ranked as low potential for applicability in Ireland. This response applies to a small area of arable land most specifically. It is uncertain if soil erosion will be impacted by climate change. Rates of soil erosion in Ireland are well below the EU average. As rainfall patterns become more extreme, the issue could become more prominent.

Policy review

Siloed policy approaches

In Ireland siloed policies is a cross-sectoral issue, with climate, biodiversity and water issues often addressed separately. For example, in climate adaption, siloed approaches are recognised as barriers to positive outcomes. Brawley-Chesworth et al. (2025) conducted research on adaptation policy across governmental departments, the private sector and non-profit organisations in Ireland. A statement by one interviewee highlighted the siloed approach in adaptation policy at a national level "even at a national scale, where we have sectoral adaptation plans. They're very much separated into flood risk management, water, and agriculture". Siloed thinking was highlighted by interviewees as barriers to adaptation in all three sectors (flood risk management, agriculture, water quality and water services infrastructure). While a siloed approach may have benefits for policy making at national scales, integrated approaches are needed to ensure positive outcomes at local scales across the nexus. However, local solutions, local resources and local support are often lacking in Ireland because of governance structures.

Recent Article 17 reporting on the status of Ireland's protected habitats show that 90 per cent of habitats are in unfavourable status, with half showing ongoing decline (NPWS, 2025). The most frequent pressure recorded was associated with agricultural pressures, with 69 per cent of habitats impacted. The most common pressure under agriculture was intensive grazing or overgrazing by livestock. In December 2025, the EU granted a three-year extension of Ireland's nitrates derogation, which allows farmers to keep more livestock per acre of land than is allowed under the EU Nitrates Directive and 7,000 Irish dairy farmers to spread more fertiliser on their land than European counterparts (Cox, 2025). This highlights a lack of coordination and ongoing siloed action between government departments, evident in Ireland's serious water pollution problems, which are being exacerbated by agricultural nitrogen runoff, and in overgrazing pressures on protected habitats.

The implementation of the Food Wise 2025 (DAFM, 2020a) strategy had similar impacts on water bodies. Aimed at expanding agricultural output, and combined with the removal of dairy quotas, this strategy coincided with a period of increasing pressure on water bodies from agricultural activities between 2015 and 2021 (EPA, 2024b). This outcome highlights how economic and sectoral growth strategies, when developed in isolation from environmental objectives, can undermine water quality and biodiversity, creating downstream challenges for climate adaptation and ecosystem resilience. It demonstrates that siloed policies do not merely fail to deliver co-benefits; they can actively exacerbate pressures elsewhere in the system. The result of this policy instrument and ongoing impacts the nitrates derogation will have highlight the urgent need to address the impacts of agricultural runoff on water quality.

While measures under the nitrates derogation have been introduced to reduce phosphorous pollution, such as vegetative buffer strips along rivers, these are not designed to intercept and stop nitrogen entering our waterways (McGoff, 2025). Over half of rivers are in moderate to bad condition (EPA, 2025b), further highlighting the extent of water pollution and lack of approach to address this nexus issue. An integrated approach to the nexus is required within agricultural policy to ensure these crises are addressed, while also ensuring the livelihoods of farmers are protected.

Marine governance further provides evidence of a siloed approach. The Maritime Area Planning (MAP) Act (2021) (Irish Statute Book, 2021) (operated under the Department of Climate, Energy and the Environment) represents a significant step forward in embedding an ecosystem-based approach into maritime planning, with explicit reference to sustainable use of the maritime area and minimisation of biodiversity loss. However, while biodiversity considerations are acknowledged, climate mitigation and adaptation are not explicitly integrated into the Act's objectives. This partial integration risks overlooking important synergies, such as the role of healthy marine ecosystems in carbon sequestration or coastal protection. The limitations of this approach are compounded by the continued operation of the Foreshore Act (1933) (Irish Statute Book, 1933) (operated under the Department of Housing, Local Government and Heritage), which regulates seabed leases under a different governmental department. The parallel operation of MAP and the Foreshore Acts, with overlapping but unaligned processes, exemplifies how siloing similar or related policy instruments across departments may create confusion, delays and negative environmental outcomes. In this case, fragmented marine governance may undermine biodiversity protection and sustainable planning, despite ostensibly shared objectives.

Sector-specific climate policies further demonstrate the drawbacks of siloed decision-making. The Renewable Energy Support Scheme (RESS) (DCEE, 2019), a pivotal component of Ireland's Climate Action Plan, is designed to accelerate the deployment of renewable energy and support emissions reductions in line with EU and international commitments. While the scheme contributes positively to climate mitigation and, indirectly, adaptation (Kim and Park, 2023), its impacts on biodiversity and water systems have not been evaluated in Ireland, and could potentially have negative impacts. Evidence from the literature suggests that certain renewable energy developments can have adverse effects on biodiversity (Rehbein et al., 2020) and water systems, for example through habitat fragmentation associated with poorly sited infrastructure and hydroelectric dams fragmenting habitats (Baranovskaya and Fursov, 2025). The prioritisation of climate mitigation without sufficient safeguards for biodiversity and water illustrates how narrow sectoral objectives can generate trade-offs across the nexus.

Similarly, the River Basin Management Plan (DHLGH, 2024) under the Water Framework Directive (EC, 2025) focuses primarily on improving water quality. This delivers clear co-benefits for freshwater biodiversity and contributes to climate adaptation by enhancing natural flood regulation through restored river systems. However, climate mitigation is largely absent from the policy's objectives, despite the potential role of wetlands, riparian zones and restored rivers in carbon sequestration. The lack of explicit integration limits the policy's capacity to contribute fully to broader climate and biodiversity goals.

Ireland's climate governance framework reflects both progress and persistent fragmentation. The Climate Action and Low Carbon Development Act (Oireachtas, 2015) provides a cross-cutting statutory basis for climate action and a biodiversity-rich state, including legally binding carbon budgets. However, responsibility for implementation largely rests with sector-specific departments such as transport, agriculture and the built environment. This decentralised delivery structure has contributed to slow progress (CCAC, 2025b), with limited coordination across sectors. Crucially, carbon budgets do not explicitly incorporate biodiversity considerations, meaning that measures designed to reduce emissions may inadvertently damage ecosystems or soil carbon stocks (Molloy et al., 2024b). Despite ambitious targets, fragmented delivery across departmental silos places Ireland at risk of missing its legal obligations, underscoring the gap between high-level integration in statute and compartmentalised implementation in practice. Ireland faces potential EU fines of €8 to €26 million if it fails to meet its 2030 emission reductions targets (Irish Fiscal Advisory Council, 2025).

Integrated policy approaches

Against this backdrop, there is evidence of increasing recognition at policy level of the value of more integrated approaches. The Forestry Act 2014 (Irish Statute Book, 2014) provides a clear example of a policy framework that explicitly addresses multiple dimensions of the nexus. The Act links afforestation and forest management to climate mitigation through carbon sequestration, while simultaneously promoting biodiversity enhancement, water quality protection and public amenity. By embedding these objectives within a single legislative framework, the Act acknowledges that forestry outcomes depend on balancing environmental functions rather than maximising a single objective.

The Agri-Climate Rural Environment Scheme (ACRES) (DAFM, 2023) under the Common Agricultural Policy offers an integrated approach to the nexus while also securing livelihoods, offering targeted actions for farmers, with an increased focus on biodiversity and payments for various biodiversity enhancing actions. This policy also aims to implement climate mitigation measures and reduce GHG emissions. Other policies with an increasing focus on biodiversity and water include the Forestry Programme 2023-2027 (Teagasc, 2023) which incentivises the planting of native woodlands while also putting measures in place to protect key habitats such as those of the Freshwater Pearl Mussel (NPWS, 2025). The Water Action Plan 2024 (DHLGH, 2024) provides a roadmap for protecting rivers, lakes, estuaries and groundwater. It also includes a Community Water Development Fund to support local conservation projects. If these biodiversity and water focused policies are implemented appropriately, actions could contribute to improving the status of protected habitats, water bodies, and the wider natural landscape. The EU Nature Restoration Regulation (EU, 2024), with legally binding targets for restoring nature across systems including terrestrial, freshwater, and marine, will also improve biodiversity and water. Restoring carbon store habitats for emission reductions is also a target under this law, highlighting its significance for implementing integrated approaches to the nexus.

The Wildlife (Amendment) Act 2023 (NPWS, 2023) similarly reflects a growing appreciation of integration. Through National Biodiversity Action Plans (e.g., NPWS, 2024), it prioritises habitat restoration, including bog restoration for carbon sequestration, thereby linking biodiversity protection with climate mitigation. Although climate adaptation is not an explicit focus, the restoration of ecosystems such as wetlands delivers clear adaptation co-benefits, including flood attenuation and coastal protection. This illustrates how integrated thinking is beginning to shape biodiversity policy, even if not all nexus dimensions are fully articulated.

More explicitly cross-cutting in intent, the National Oil Reserves Agency Act (2007) (Irish Statute Book, 2007) enables support for projects that reduce GHG emissions, enhance biodiversity and building climate resilience, including through nature-based solutions. While the continued reliance on fossil fuels presents inherent contradictions, the Act nonetheless signals recognition of the need to address multiple environmental objectives in tandem, rather than in isolation.

Ag-Climatise (DAFM, 2020b) represents a further step towards integration within the agriculture sector. Its vision of a climate-neutral food system by 2050 explicitly links emissions reduction, land use, carbon sequestration, renewable energy and biodiversity outcomes. The policy's roadmap emphasises collaboration across stakeholders and identifies actions that deliver multiple co-benefits, such as reducing nutrient losses to improve water quality while enhancing biodiversity and increasing carbon storage in soils and landscapes. This contrasts with earlier described agricultural strategies by explicitly acknowledging the interconnected nature of climate, water and biodiversity challenges.

Notably, a higher degree of policy integration is often evident at the local level, where governance is spatially focused rather than organised around discrete sectors. Local authorities operate within defined geographic areas and are therefore required to address multiple, overlapping challenges within the same landscapes and communities. This spatial lens lends itself to more holistic nexus-based approaches, where single interventions can serve multiple objectives. For example, flood mitigation measures implemented through afforestation or wetland restoration can simultaneously enhance biodiversity, improve water regulation, sequester carbon and support both climate mitigation and adaptation. Statutory requirements also reinforce this integration: under the Climate Action and Low Carbon Development Act (Oireachtas, 2015), local authorities must prepare Local Climate Action Plans that address both mitigation and adaptation, while the Planning and Development Act (Irish Statute Book, 2024) mandates that City and County Development Plans include objectives for climate action, biodiversity protection and sustainable settlement patterns.

Institutional arrangements further support integration at this scale, with local climate action teams and biodiversity officers increasingly working together, as noted in The Heritage Council's guidelines (The Heritage Council, 2024). By contrast, at national level these functions remain dispersed across multiple departments and agencies, each operating under distinct legislative mandates, budgets and accountability structures, which can inhibit coordinated action. However, this local integration is not without constraints. The OECD policy coherence scan of Ireland (OECD, 2025) notes that, despite strong national-level commitment to implementing the Sustainable Development Goals, which explicitly address the nexus, unclear mandates and inadequate resourcing limit the capacity of local authorities to contribute fully and consistently. This underscores both the potential of locally integrated approaches and the need for stronger vertical coordination and support to translate national ambitions into effective place-based action.

Taken together, these examples suggest that there is growing awareness at policy level of the limitations of siloed approaches and the potential benefits of integration. However, this recognition remains uneven and partial. Integrated objectives are more often articulated in individual acts or strategies than embedded consistently across the policy system. Implementation frequently remains constrained by departmental boundaries and sectoral targets. As a result, while policy trajectory points towards greater integration, much remains to be done to translate this recognition into coherent, cross-sectoral delivery that can effectively address the complex interdependencies of the nexus.

Barriers and enablers

Barriers to an integrated approach

Institutional barriers

A range of structural, institutional, and political barriers continue to hinder policymakers' ability to implement integrated approaches across the nexus. As identified by Flannery et al. (2025) a major challenge lies in the limited capacity and resourcing available within government departments and agencies. These constraints reduce the efficiency and effectiveness of policy delivery and decision-making processes. Furthermore, impaired integration between departments and fragmentation of data prevent the coordinated responses that are essential for addressing cross-cutting environmental challenges.

Another significant barrier identified by Flannery et al. (2025) is the limited harmonisation of competing objectives across different policy domains, particularly in the management of marine and coastal environments. Divergent priorities among departments can result in conflicting mandates and inefficiencies in resource allocation. The lack of clarity and consistency in the monitoring, evaluation, and revision of legislation further compounds these issues, creating uncertainty around accountability and long-term policy continuity. Flannery et al. (2025) also provide a set of recommendations to address these barriers, including improving interdepartmental coordination, enhancing capacity, and developing integrated monitoring frameworks.

While cross-sectoral and interdepartmental groups exist to support integrated approaches, their effectiveness may be limited by institutional fragmentation and power imbalances. Integration often requires engagement across government departments, local authorities, and local communities, each operating under different mandates and priorities. The Department of the Taoiseach formally holds a cross-government coordination mandate (Government of Ireland, 2025), and cross-departmental groups are established to address complex, interconnected challenges. However, in practice, power dynamics between departments (Mac Cormaic, 2016) can often obstruct genuine collaboration. These power plays can result in siloed decision-making, diluted outcomes, or agreements that undermine integration.

Each government department operates under a distinct ministerial remit, supported by its own legislative framework and dedicated budget line. This structure likely incentivises departments to prioritise sector-specific objectives over shared or cross-cutting outcomes. This was highlighted in Ireland's struggle with the Water Framework Directive, where fragmented departmental responsibility, lack of resources and prioritisation of economic interests disrupted policy development and implementation (Augustenborg et al., 2025). This ultimately led to Ireland's referral to the European Court of Justice (EC, 2024b, 2021). Conversely, there is a recognition in government of the need to work across departments on complex issues, and inter departmental working groups have been set up, for example, the Interdepartmental Working Group on the Rising Cost of Health-Related Claims (DoH, 2025), along with whole of government Cabinet Committees such as the Committee on Environment and Climate Action (Department of the Taoiseach, 2024).

Augustenborg et al. (2025) identified several institutional and political barriers to effective environmental policy implementation based on interviews with 34 stakeholders involved in policy design and delivery. A key challenge was fragmented responsibility across government, which complicates coordinated action. For example, biodiversity policy is managed by one department while resourcing decisions sit with another, creating siloed structures that hinder coherent implementation. Such fragmentation limits the effective transposition of EU legislation and constrain the adoption of integrated approaches at the policy design stage, including catchment-based water management.

Integrated approaches often struggle to gain traction because they do not align neatly with existing accountability structures. Without shared budgets, joint legislative mandates, or collective performance indicators, departments have limited incentives to invest time and resources in integrated policymaking, reinforcing institutional silos.

Financial governance arrangements further constrain implementation. Restrictive public spending rules limit the ability of policymakers to recognise and justify co-benefits across sectors. For instance, investments that improve air quality can also deliver significant public health benefits, yet these cross-sectoral gains are often insufficiently acknowledged within budgeting frameworks (Augustenborg et al., 2025). As a result, resource allocation for co-benefit projects, such as public transport improvements with air quality and health advantages, are frequently constrained, reducing the overall effectiveness of environmental interventions.

Structural barriers

Role ambiguity, combined with overlapping authority and political incentives, means that efforts to improve coordination and accountability frequently encounter structural resistance (Mac Cormaic, 2016). Political considerations can influence both policy priorities and administrative processes, leading to delays or dilution of integrated environmental initiatives. These dynamics suggest that the barriers to effective policy implementation are not merely technical or procedural but are also deeply embedded in the political and institutional fabric of government. Addressing them will require not only improved capacity and clearer governance mechanisms but also cultural and organisational change within the public sector.

At a local level, the OECD's "Policy coherence scan of Ireland" (OECD, 2025) notes that departments and agencies still operate within traditional siloes of responsibility. When tackling the nexus, this needs to be addressed to holistically approach these crises in an integrated way.

There is also a notable disconnect between the level of risk posed by climate change and biodiversity loss and the amount of political and administrative attention devoted to addressing them. Risk assessment frameworks, such as Risk in Focus 2026 (ECIIA, 2025), consistently identify climate change and biodiversity loss as among the most significant long-term risks. Despite this, comparatively limited time and resources are being dedicated to these issues within policy agendas. This mismatch undermines integrated approaches, which require sustained attention, long-term planning, and cross-sectoral commitment to address systemic risks effectively.

Political barriers

The absence of an overarching national environmental policy position has been identified by the EPA as a key issue negatively impacting the success and coherence of various environmental plans and policies (EPA, 2020b). This means that while individual policies exist for areas like climate, water, and biodiversity, they do not form a unified strategy. The EPA (2020b) states that collaboration and better connectivity across the different systems and policies are needed, as many are interlinked, and a national policy position for Ireland's environment could help to achieve environmental objectives.

Programmes for Government play a decisive role in shaping policy priorities and guiding civil servants' actions. As civil servants are required to operate within the commitments set out in these programmes, any issue that is weakly represented becomes structurally marginalised. A comparison between recent Programmes for Government illustrates this barrier clearly. In the 2020 Programme, climate was referenced 98 times and biodiversity 51 times (Department of the Taoiseach, 2020), signalling a relatively strong prioritisation of environmental issues. By contrast, the 2025 Programme for Government mentions climate only 48 times and biodiversity just 5 times (Department of the Taoiseach, 2025). This sharp decline indicates a reduced prioritisation of environmental concerns at the political level. This shift in emphasis constrains the ability of policymakers to pursue integrated approaches such as climate–biodiversity or broader nexus strategies when these are not explicitly aligned with government priorities. As a result, integrated policy initiatives may be perceived as exceeding mandates or lacking political backing, creating a significant implementation barrier.

Political will is another barrier to integrated policymaking. When there is limited motivation or ambition at the top, it diminishes incentives for civil servants and departments to pursue integrated, cross-cutting solutions. Strong leadership and commitment to addressing nexus issues is required at the highest level.

While collaborative governance is often promoted to address complex environmental challenges, extensive collaboration can prolong decision-making and slow policy delivery (Emerson and Nabatchi, 2015). In addition, short political cycles, the prioritisation of economic objectives over environmental goals, and sectoral lobbying were found to shape policy ambition. These dynamics have contributed to delays in measures such as marine protection and to disparities in resourcing between climate change and biodiversity policy (Augustenborg et al., 2025).

Political disengagement during the delivery phase can undermine long-term environmental action (Howes et al., 2017), acting as a barrier for implementation of policy instruments. Follow through from formal policy commitments to delivery must be adhered to.

Enablers for an integrated approach

Data sharing

Shared definitions are fundamental to effective data sharing across departments, agencies, and governance levels. Without a common understanding of key concepts, such as “nature restoration,” “integrated planning,” or “co-benefits”, data cannot be consistently collected, interpreted, or applied. Developing agreed definitions supports interoperability of datasets and reduces fragmentation in policy design and implementation. The Central Statistics Office (www.cso.ie) with data on natural capital accounting and environmental data, and the Environmental Protection Agency (www.epa.ie) with information on water and GHG statistics, can play a key role in supporting this process by providing authoritative, evidence-based briefings and synthesised research to inform policymakers and ensure consistency of terminology.

Enhanced data sharing strengthens evidence-based policymaking and can increase political will, particularly where data clearly demonstrates the benefits of integrated approaches. When shared definitions underpin data repositories, they enable more effective cross-departmental analysis and integrated spatial and sectoral planning. Internationally, the Global Water Partnership (GWP, 2019) recommends collaboration with other countries working towards nexus approaches, including the sharing of effective management actions and harmonised frameworks. Strong political leadership is critical in establishing platforms that coordinate data and action across climate, water, and biodiversity, supported by designated integration champions who maintain shared data repositories and facilitate knowledge exchange (Flannery et al., 2025).

Natural capital accounting provides a means to integrate our natural assets into political and economic decision-making, strengthening and improving the governance of natural resources (McGrath and Hynes, 2020). This approach could offer a platform for coherent data sharing and bring the nexus into one framework. The NESC (2024) report on natural capital accounting examines the opportunities and scope for natural capital accounting to support nature restoration and the delivery of nature-based solutions. It sets out the role of natural capital accounting at both national and local levels, including its contribution to spatial planning and to the mobilisation of more sustainable finance and investment. The report further contends that the full potential of natural capital accounting will be achieved through its effective integration within the broader, existing system of national accounts. By highlighting the value (and risks) of nature, more informed decision-making can be implemented to approach the nexus in an integrated way.

Financing

Recent budgetary commitments in Ireland indicate growing alignment between public finance and environmental objectives. The 2026 budget includes substantial allocations, such as €173 million to incentivise greener and more sustainable farming, €20 million for greenways and active travel, €5 million for peatlands rehabilitation, and a €256 million boost for nature restoration and heritage (DPEIPSRD, 2025; Lambert, 2025). These investments demonstrate the potential of public expenditure to support integrated policy goals and deliver multiple co-benefits across sectors.

Evidence-based funding mechanisms further enhance the effectiveness of public investment. For example, Arts Council Basic Income for Artists illustrates how government expenditure can act as an enabler, leveraging broader societal and economic benefits beyond its immediate remit, with a cost-benefit analysis on the programme finding it delivered over €100 million in social and economic benefits from 2021 to 2025 (Alma Economics, 2025).

The Global Water Partnership (GWP, 2019) highlights the importance of engagement between those working on climate, water, and biodiversity and ministers of finance, in order to strengthen and open up the wider climate finance architecture. This includes the development of clear strategies, monitoring systems, and robust project pipelines to support climate and environmental investment.

Addressing financial barriers to policy implementation also requires more strategic use of existing resources. Taking a whole-of-government approach to nexus policy and finance to diversify resources, along with encouraging alignment between the nexus and other policies in the absence of budgeting, for example, as in OECD (2025), they suggest aligning the Sustainable Development Goals (SDGs) with Ireland's Well-being Framework, including integrating well-being indicators into SDG-related policies.

Capacity

Capacity constraints across government departments and agencies continue to pose challenges to effective policy implementation. Flannery et al. (2025) recommend the development of a systematic process to identify where resourcing for management actions or processes is insufficient. This process should be led by a designated government agency and involve assessing the types of resources required, including staffing, training, monitoring, and technology. Regular evaluation of expenditure and resource use is essential to ensure accountability and continuous improvement.

Enhancing cross-departmental working is a key mechanism for addressing capacity barriers, and has increased in recent years with cabinet committees comprised of ministers from across departments, and interdepartmental working groups such as the Sustainable Development Goals

Interdepartmental Working Group with members from all departments (DCEE, 2022). Providing dedicated resources for advisory groups and shared negotiation spaces can improve communication and knowledge sharing within government. The designation of integration staff can help build bridges across departments, support collaboration, and foster a culture of coordinated action. Such approaches also contribute to the enhancement and maintenance of shared data repositories and institutional knowledge.

Capacity-building must also address planning and implementation challenges. Recent reforms in the Planning and Development Act (2024) (Irish Statute Book, 2024) sets out statutory decisions periods for planning authorities based on whether they are standard planning applications, or if environmental impact assessments or Natura impact assessments are required. This type of measure aids in reducing delays in planning, and similar methods could be applied to planning and decision-making processes.

Conclusion and recommendations

For Ireland, this review has identified ways in which adopting integrated approaches would strengthen climate resilience, reduce long-term public costs, and help meet legal obligations under national and EU climate, water and nature legislation. It would also support more sustainable rural livelihoods, healthier urban environments, and greater social acceptance of climate action by demonstrating tangible local benefits. Integration offers a pathway to avoid maladaptation, where progress in one area undermines another, and to make more efficient use of limited public resources by maximising co-benefits. The case for acting for a nexus approach has not yet been fully articulated in Ireland, with the benefits remaining unclear. This paper contributes to advancing this discussion.

Failing to move beyond siloed approaches risks locking Ireland into a cycle of compounding crises. Continued fragmentation will likely accelerate biodiversity decline, further degrade rivers, lakes and coastal waters, and weaken the natural systems that buffer communities from extreme weather. This would increase reliance on costly hard engineering solutions, heighten exposure to climate impacts, and raise the risk of missing national and EU targets, with associated financial penalties and loss of public trust. Ultimately, inaction on integration would undermine Ireland's capacity to adapt to a changing climate and to safeguard its natural capital for future generations.

Some key recommendations were identified to enable policy makers to move forward with implementing integrated approaches:

- Strengthen data sharing and coherence through developing shared definitions and interoperable datasets across climate, water and biodiversity policy. Institutionalise shared data repositories and spatial datasets to support cross-departmental analysis, integrated spatial planning and land-use decision-making, including biodiversity protection and restoration as explicit land uses.

- Prepare national strategies and plans through coordinated, consultative processes, engaging all relevant departments and stakeholders to identify synergies and avoid misalignments across the nexus.
- An overarching national environmental policy position. This policy position could set out the ambition for protecting Ireland's environment in the short, medium and long term, that all government departments, agencies, businesses, communities and individuals can sign up to in order to play their part in protecting our environment.
- Embed natural capital accounting within national and local decision-making, integrating it into the wider system of national accounts to identify the value, risks and trade-offs associated with natural assets.
- Use natural capital accounting to support spatial planning, nature restoration, and nature-based solutions, ensuring biodiversity, water regulation and climate mitigation and adaptation are considered together.
- Scale up nature-based solutions that deliver simultaneous benefits for flood regulation, water quality, carbon sequestration, biodiversity and human wellbeing.
- Mainstream monitoring and evaluation of nature-based solutions, generating evidence on effectiveness, trade-offs and long-term resilience under climate change.
- Establish cross-departmental data platforms supported by political leadership and designated integration staff.
- Target public investment toward interventions with multiple co-benefits, such as sustainable farming, active travel, and nature restoration, explicitly linking budget lines to nexus outcomes.
- Engaging communities to deliver integrated approaches at local levels.
- Engage ministries of finance in nexus governance, supported by clear strategies, monitoring systems, and robust project pipelines that align climate, biodiversity and water finance.
- Adopt whole-of-government approaches to funding, coordinating existing resources and aligning sectoral policies even where dedicated nexus budgets are absent.
- Build institutional capacity for integration by systematically assessing and addressing resourcing gaps across departments and local authorities.
- Support cross-departmental working through dedicated staff, training, advisory spaces and statutory timelines.
- Reform harmful subsidies (e.g. fossil fuels, fertilisers) to remove incentives that undermine climate, biodiversity and water objectives.
- Apply taxes and charges to environmentally damaging practices, encouraging behavioural change and investment in more sustainable land and water-use practices.
- Promote dietary shifts toward planetary health diets, reducing demand for resource-intensive livestock production.
- Reduce fertiliser use through agricultural practices, such as multi-species swards and improved soil management, lowering emissions, nutrient runoff and water pollution.

Together, these actions would help translate growing policy recognition of the nexus into consistent, coordinated delivery, enabling Ireland to move from fragmented responses towards a more resilient, sustainable and integrated environmental governance system.

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