Taighde, Idirphlé, Comhairle
Research, Dialogue, Advice

Natural Capital Accounting
A Guide for Action

COUNCIL REPORT

No.164 January 2024

An Chomhairle Náisiúnta Eacnamaíoch agus Shóisialta
National Economic & Social Council

An Oifig Náisiúnta um Fhorbairt Eacnamaíoch agus Shóisialta
National Economic & Social Development Office NESDO

1. The main tasks of the National Economic and Social Council shall be to analyse and report on strategic issues relating to the efficient development of the economy and the achievement of social justice.

2. The Council may consider such matters either on its own initiative or at the request of the Government.

3. Any reports which the Council may produce shall be submitted to the Government, and shall be laid before each House of the Oireachtas and published.

4. The membership of the Council shall comprise a Chairperson appointed by the Government in consultation with the interests represented on the Council, and

   - Three persons nominated by agricultural and farming organisations;
   - Three persons nominated by business and employers organisations;
   - Three persons nominated by the Irish Congress of Trade Unions;
   - Three persons nominated by community and voluntary organisations;
   - Three persons nominated by environment organisations;
   - Four other persons nominated by the Government, including the Secretaries General of the Department of Finance, the Department of Business, Enterprise and Innovation, the Department of Housing, Planning and Heritage, the Department of Public Expenditure and Reform.
   - Seven people possessing knowledge, experience and skills which the Taoiseach considers relevant to the functions of the Council

5. Any other Government Department shall have the right of audience at Council meetings if warranted by the Council's agenda, subject to the right of the Chairperson to regulate the numbers attending.

6. The term of office of members shall be for three years. Casual vacancies shall be filled by the Government or by the nominating body as appropriate. Members filling casual vacancies may hold office until the expiry of the other members' current term of office.

7. The numbers, remuneration and conditions of service of staff are subject to the approval of the Taoiseach.

8. The Council shall regulate its own procedure.

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A full list of the NESC Secretariat can be found at **www.nesc.ie**

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Abbreviations

ACRES	Agri-Climate Rural Environment Scheme
AICBRN	All-Island Climate and Biodiversity Research Network
BIM	Bord Iascaigh Mhara
CoE	Census of Environment (Canada)
CSO	Central Statistics Office
CWON	Changing Wealth of Nations
DAFM	Department of Agriculture, Food and the Marine
DECC	Department of the Environment, Climate and Communications
DEFRA	Department for Environment, Food and Rural Affairs
EPA	Environmental Protection Agency
EU	European Union
GDP	Gross Domestic Product
GII	Gross Inclusive Income
INCASE	Irish Natural Capital Accounting for Sustainable Environments
LULUCF	Land Use, Land-use Change and Forestry
NBDC	National Biodiversity Data Centre
NCAVES	Natural Capital Accounting and Valuation of Ecosystem Services
NCI	Natural Capital Ireland
NESC	National Economic and Social Council
NGO	non-governmental organisation
NOVI	*Nationale Omgevingsvisie* (National Environmental Vision)
NPWS	National Parks and Wildlife Service
OECD	Organisation for Economic Co-operation and Development
ONS	Office for National Statistics
PBL	Planbureau voor de Leefomgeving
PES	Payment for Ecosystem Services
SACs	Special Areas of Conservation
SDGs	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounting
SEEA-CF	System of Environmental-Economic Accounting Central Framework
SEEA-EA	System of Environmental-Economic Accounting for Ecosystem Accounts
SNA	System of National Accounts
TCD	Trinity College Dublin
UCD	University College Dublin
UK	United Kingdom
UN	United Nations
UN CBD	UN Convention on Biological Diversity
WEF	World Economic Forum

Glossary

Habitat: The place or type of site where an organism or population naturally occurs (CBD, 2006). In ecology, it is more than vegetation but is the sum of the specific resources that are needed by an organism or population (Hall *et al.*, 1997).

Ecosystem services: The contribution of ecosystems to the generation of benefits (i.e. final outputs of an ecosystem) used by the economy and society (CSO, 2021).

Biodiversity: The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part (Diaz *et al.*, 2015).

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (UNEP, 1992).

Natural capital: An economic metaphor for nature, which includes all entities and processes that constitute the planet earth, including plants, rocks, animals, insects, water and gases and their interactions with each other (NCI, 2021a).

Natural capital accounting: An umbrella term for an information framework and an approach to integrating environmental data into the United Nations (UN) System of National Accounts (SNA) for economic activity. It provides a systematic way to measure and report on ecosystems and the stocks and flows of natural capital, ecosystems and their services (EEA, 2018).

Acknowledgements

The National Economic and Social Council (NESC) would like to thank the experts who have provided advice from the beginning of this project, including Dr Catherine Farrell and Professor Jane Stout from Trinity College Dublin and the Irish Natural Capital Accounting for Sustainable Environments (INCASE) project; Deirdre Lynn and Gemma Weir from the National Parks and Wildlife Service (NPWS); and Alan Cahill, Nova Sharkey and Sylvie Clappe from the Central Statistics Office (CSO).

The Council is grateful to all the stakeholders from across the policy system, including departments and agencies, experts, practitioners and representative organisations that participated in the roundtable discussions and met directly with the NESC Secretariat over the year. International experts, academia, and government and statistical agencies in Australia, Canada, Mexico, the Netherlands and the United Kingdom (UK) all kindly gave their time to discuss natural capital accounting. The Council would also like to thank the Mexican Embassy for convening a meeting with Mexican officials.

The roundtables were expertly facilitated by Deirdre Joyce and supported by Natural Capital Ireland's (NCI's) Dr Emer Ní Dhúill and Iseult Sheehy. The Council is particularly grateful to them, for their expert contribution as rapporteurs, and to NESC staff Gaye Malone and Steven Hanrahan for their work on hosting the roundtables at NESC.

Executive Summary

How can Ireland better account for nature? On request from Government and drawing on in-depth engagement with key stakeholders, this Council report provides advice on natural capital accounting and a guide for action. It examines what is required in order to value, recognise and bring considerations of nature more effectively into policy decision-making in Ireland.

This report's conclusions exemplify the Council's longstanding approach of fusing economic, social and environmental considerations in its research; an approach currently being highlighted under the NESC@50 programme of research and events.

The report provides clarity about what natural capital accounting is and what it is not. It describes how this accounting framework can systematically bring nature's hidden risk and value into view. It examines recent work on developing key components – ecosystems accounts that identify ecosystems and their condition – and research that explores the services they provide to people, including their monetary value. It outlines the centrality of natural capital accounting to protecting Ireland's natural capital and biodiversity.

The Central Statistics Office (CSO) and Eurostat are using the United Nations (UN) standardised approach to natural capital accounting. Mandatory European Union (EU) reporting on ecosystem accounts is expected by 2026. There is also significant policy momentum, including Ireland's forthcoming National Biodiversity Action Plan 2023-2030, the European Green Deal, and the likely requirement for a national nature-restoration plan, outlined in the proposed EU Nature Restoration Law, all of which depend upon working methods of accounting for nature. As recent NESC reports on agriculture and just transition argue, there is a particular urgency in developing Payment for Ecosystem Services (PES) schemes that can be supported by natural capital accounting.

The Council, therefore, considers that there is now a unique opportunity to make significant progress on valuing nature in the Irish policy system, particularly when it is integrated with decision-making processes.

The report delves into the opportunities and scope for national capital accounting to underpin work on nature restoration and nature-based solutions. It outlines the role of natural capital accounting in national and local planning, in enabling more sustainable finance and investment, and in helping to enhance Ireland's National Well-Being Framework. It argues that the full potential of natural capital accounting will be realised by working hard to integrate it into the existing, wider system of national accounting.

There are, however, a number of risks in how Ireland develops natural capital accounting, expressed clearly at the roundtables held as part of this NESC work. Despite ongoing statistical efforts to progress natural capital accounting, and the relevance to policy in many areas, there is a risk that natural capital accounts will not be developed quickly enough to underpin nature restoration at the scale required and to be widely used in practice; and further that it will remain peripheral to policy- and decision-making. There is also a strong sense that the urgency and need for action may not yet be sufficiently understood in the wider policy system.

Structure of the Report

This report provides the clarity of purpose that has been stalling progress. It sets out what natural capital accounting is and its potential purpose and role in supporting a range of policy requirements in Ireland. It provides examples of how nature is valued and accounted for in other countries, including Australia, Canada, Mexico, the Netherlands, the United Kingdom (UK). With this clarity comes insight into what needs to happen next.

The structure of this report is as follows.

Chapter 1 outlines the request from Government and the approach taken by NESC.

Chapter 2 examines what natural capital accounting is and its development in Ireland.

Chapter 3 outlines some opportunities and risks in the further development of natural capital accounting in Ireland.

Chapter 4 discusses insights from other countries' experience of natural capital accounting.

Chapter 5 sets out the Council's recommendations and guide for action on maximising natural capital accounting in Ireland.

The Appendix provides a list of roundtable attendees.

Recommended Areas of Action

The Council recommends three areas of action that will help develop natural capital accounting and embed it into the wider policy-making system. A full list of recommendations can be found in Chapter 5.

The three areas of action are:

1. **Capacity-Building:** Identification of actions to enhance Ireland's work on developing natural capital accounting, building capacity in areas including skills around ecosystem services and spatial mapping, and in using the accounts in national departments, agencies and local authorities.
2. **Spotlight on Payment for Ecosystems Services Schemes:** Examination of the development of natural capital accounting to support PES schemes aimed at supporting the transition in agriculture and land use and supporting farmers in caring for nature, water, forestry, carbon sequestration and a range of other ecosystem services.
3. **Support for Integration:** Advice on how to integrate natural capital accounting into the wider policy system.

The Council considers that natural capital accounting is an important part of the solution to working more closely with nature. It is a key complement to a range of broader approaches to recognising and caring for nature, for its own intrinsic value and contribution to livelihoods, food, culture, recreation, beauty and to people's health and wellbeing.

Chapter 1

Recognising and Valuing Nature

> *One million plant and animal species now face extinction. This is in part due to the characteristics of nature that make it easy to ignore: largely silent, invisible, and mobile. These characteristics result in nature being undervalued or unvalued in markets and mean that our impacts on nature largely go unaccounted for (OECD, 2021:3).*

1.1 Introduction

In Ireland, along with most of the European Union (EU), there is a recognised accounting and data gap on the status of nature. The EU is seeking to address this with an increased focus on building data on biodiversity, habitats and ecosystems.

Governments around the world are using natural capital accounting to better understand people's relationship with nature, their impacts and dependencies on it, and to monitor and improve policy responses to addressing biodiversity loss and climate change (Capitals Coalition, 2021).

The EU Biodiversity Strategy for 2030 calls on Member States to develop natural capital accounting and to better integrate biodiversity considerations into public and business decision-making at all levels (EC, 2020). Following this, the expected EU Nature Restoration Law will require Member States to produce national nature-restoration plans alongside increasing their focus on ecosystem accounts in order to inform policy and practice (EC, 2022b). In Ireland, policy momentum on biodiversity has increased with the forthcoming National Biodiversity Action Plan 2023-2030, due to be published in early 2024, the reports of the Citizens' Assembly on Biodiversity Loss, and the Children and Young People's Assembly on Biodiversity Loss (Citizens' Assembly, 2023; DCU, 2023; (NPWS, forthcoming).

These policy and statistical developments represent a significant moment of opportunity and it is timely that the Council reflects on what natural capital accounting is and how it can be effectively used in Ireland.

1.1.1 Request from Government on Natural Capital Accounting

Following a request from Government 'to provide advice on natural capital (nature) accounting frameworks' in the Climate Action Plan 2021 (Government of Ireland, 2021a), NESC has engaged widely in its efforts to examine how Ireland accounts for nature and to explore the potential of natural capital accounting.

The work of the Council builds on research supported by the National Parks and Wildlife Service (NPWS), the Environmental Protection Agency (EPA), and the Department of Agriculture, Food and the Marine (DAFM), which was undertaken by Trinity College Dublin (TCD), University College Dublin (UCD), and the University of Galway, among others. In recent years there has been a deepening in natural capital accounting knowledge, practice and collaboration also aided by the work of Natural Capital Ireland (NCI).[1] The Central Statistics Office (CSO) is advancing natural capital accounting through the establishment of a unit to develop ecosystem accounts, which is a key component of the process.

This report forms part of the programme marking NESC's fiftieth anniversary and provides an example of the Council's longstanding commitment to economic, social and environmental considerations. In the last decade, NESC's work has brought key insights to the area of natural capital. Two early research papers provided an overview of the different perspectives and potential value of natural capital accounting (Bresnihan, 2017; Bullock, 2017). From a shared-island perspective, the Council outlined biodiversity and natural capital as areas with existing collaboration and the potential to develop this further (NESC, 2021). More recent work has highlighted the natural capital gap in Ireland's National Well-Being Framework (NESC, 2023a). Overall, the Council recognises that there is a gap in knowledge and practice in how Ireland accounts for nature and this report seeks to help address this.

Engagement with farmers during NESC's Just Transition in Agriculture and Land Use project yielded valuable insights on the role that Payment for Ecosystem Services (PES) can play in responding to climate and biodiversity challenges. The Council concluded that 'progressing a framework for accounting for nature in Ireland would be valuable for agriculture

[1] Established in 2014, Natural Capital Ireland (NCI) is a group of organisations and individuals from academia and public, private and non-governmental organisation (NGO) sectors interested in the development and application of the natural capital agenda in Ireland. Over the years it has worked to promote, value, protect, and restore Ireland's natural capital and ecosystem services in public policy and corporate strategy (NCI, 2022).

and land-use transition; and support for results-based payment for ecosystem services to become a viable new business model for farming' and recommended 'that work on accounting for nature should be accelerated' (NESC, 2023b:81).[2]

A recent Secretariat paper outlines the need for greater action to deliver environmental progress, as part of a thriving Ireland (Cahill & FitzGerald, 2023).

1.2 Engagement with Policy Stakeholders

With natural capital accounting at an important stage of its development in Ireland, NESC provided a space for high-level dialogue and expert input to understand how it works, what it can deliver, and how it can be used effectively. Throughout the project, NESC met with nearly 80 key stakeholders and experts, including departments and national and international experts, in bilateral meetings and through roundtable discussions. This engagement reflects good practice internationally as natural capital accounts require engagement with multiple stakeholders across various spatial scales as well as interconnected domains (UN, 2020a).

An overview paper was prepared, drawing on the available literature, which set out the policy context and challenges and identified key issues to be considered by stakeholders. This drew on extensive work by the CSO, NPWS and the EPA, as well as experts including Prof. Jane Stout, Dr Catherine Farrell, and others working on natural capital accounting in Ireland. NCI (Dr Emer Ní Dhúill and Iseult Sheehy) supported the NESC team and prepared a paper introducing natural capital, which will be published in due course.

NESC also conducted case studies of the international experience, and discussions were held to produce case studies of countries such as Mexico, the Netherlands, and the United Kingdom (UK), which are already using natural capital accounting. These are outlined in Chapter 4.

Three roundtables were convened in May and June 2023 with senior officials, experts, key agencies and practitioners in order to discuss their experience, knowledge and perspectives on how Ireland examines and assesses the status of nature. The roundtables brought together 45 stakeholders, 1 expert facilitator, 2 rapporteurs from NCI and 8 NESC analysts. A list of participants can be found in the Appendix. We particularly sought to include a wide range of policy stakeholders in the roundtables that cover a diversity of areas and perspectives in order to contribute to this work. Wider engagement beyond the policy system would also be required as natural capital accounting is further developed. A separate overview of the key themes (rapporteur's report) from the roundtables is published alongside this report.

The roundtable discussions aimed to discover different perspectives on how nature is accounted for in Ireland and to provide an opportunity to explore the operational, administrative, policy and governance challenges of delivering and using natural capital accounts. An overarching question providing the focus of the roundtables was: 'How is Ireland accounting for nature (at a strategic policy level, agro-ecologically and statistically) and how can this be further developed through natural capital accounting?'

As well as addressing this broad question, each roundtable had a distinct focus, as follows.

Roundtable 1: Understanding Benefits and Perspectives examined current developments and practices in valuing nature and natural capital across the policy system and identified areas to strengthen practice and policy.

Roundtable 2: Agro-Ecological Accounting in Agriculture, Forestry, and Other Land Use explored agro-ecological accounting in these areas and discussed recent developments in PES, the development of carbon farming,[3] and other areas of potential benefits from accounting for nature.

Roundtable 3: Operational Challenges focused on the development of the System of Environmental-Economic Accounting for Ecosystem Accounts (SEEA-EA) and broader natural capital accounts in Ireland and what is required to

[2] There is a body of research and practice in Ireland on result-based agri-environment schemes that shows their potential, such as the Burren LIFE programme, AranLIFE, European Innovation Partnerships and the Agri-Climate Rural Environment Scheme (ACRES), using a hybrid results-based approach (DAFM, 2022).

[3] Carbon farming used in relation to carbon sequestration refers to 'the farm-level management of carbon pools and flows with the purpose of mitigating against Climate Change', as recognised in DAFM, 2020: 21.

enable further progress, as well as identifying opportunities and enablers for future utilisation of accounts in decision-making and any enabling policy that is required.

Rapporteur's Report

In its rapporteur's report, the NCI describes the discussions at each roundtable, and summarises the main themes that emerged. Box 1.1 outlines these key themes.

Box 1.1: Roundtable Themes from Rapporteur's Report

Nature is poorly recognised and undervalued in Irish policy; there has been a lack of vision for nature in Ireland; there is a general lack of recognition of nature in decision-making.

There are issues around communication on natural capital and biodiversity; uncertainty around the language, definitions and meaning of natural capital and natural capital accounting; and issues around communication on biodiversity and natural capital.

There is concern about the fragmentation of current national nature policy and how proposed European policy on natural capital here.

There is a perceived misalignment of agricultural policy and nature policy.

There is a lack of tools available to enable natural the development of capital accounting in Ireland and work is needed to explore how such tools could be developed and implemented.

There is a need for a whole-of-government, whole-of-society approach to valuing nature.

We need to examine the relationship between nature policy, and health and well-being policy.

The Council has drawn on the views and perspectives outlined at roundtables and through bilateral engagement in order to prepare this report. In summary, there was widespread agreement that our current approach to accounting for nature – including biodiversity issues in data and in public policy – is underdeveloped. Without urgent attention, Ireland will lack the information needed to effectively address these challenges and make the informed decisions on nature restoration and land use that are essential for Ireland's transition to a low-carbon biodiverse economy and society.

While some of the stakeholders consulted had expert knowledge on natural capital accounting, others were less clear about what it was and how it could be used. The contribution of those involved in recent research and practice was welcomed, such as the Irish Natural Capital Accounting for Sustainable Environments (INCASE) project focus (Farrell & Stout, 2020), although stakeholders considered that to date, natural capital accounting has lacked an integrated national approach. For those with agricultural and land-use expertise, there was an added emphasis on the need for increased data and accounting frameworks that could help scale up the PES schemes for farmers. Many identified that while building data was a necessary and significant challenge, a key issue was the need to raise the profile of nature in policy decision-making. There were concerns expressed that natural capital accounting, it itself, would not address the challenges faced, if it didn't result in action.

In this report, the Council explores natural capital accounting as a key tool that can help unlock current and future policy challenges. However, the Council identifies some significant risks. Without active policy engagement and integration to build familiarity and purpose, the accounts and wider information system may not sufficiently impact decision-making.

The structure of this report is as follows.

Chapter 2 examines what natural capital accounting is and its development in Ireland.

Chapter 3 outlines some opportunities and risks in the further development of natural capital accounting in Ireland.

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The Appendix provides a list of roundtable attendees.

Chapter 2

Understanding Natural Capital Accounting

2.1 Introduction

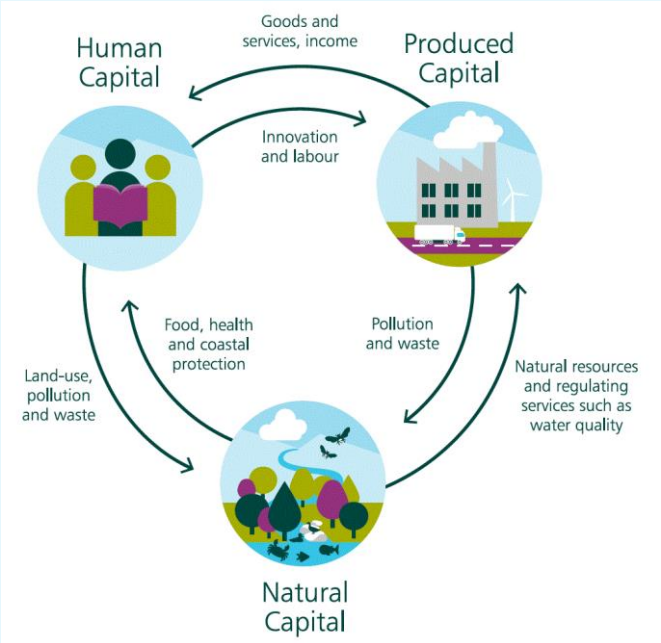
Given that natural capital accounting is relatively new in Europe, it is not surprising that there is a lack of familiarity in the policy system with the concept and approach. This chapter provides an overview of what natural capital accounting can do and what it cannot. It places this in the context of the policy momentum across Europe and internationally in using the accounts through the System of Environmental-Economic Accounting Central Framework (SEEA-CF), which will both provide a standardised approach in the European Union (EU) and Ireland but will also enable international comparative analysis and inform future global biodiversity responses. A key recent development is a particular focus on ecosystems accounts, part of the umbrella of natural capital accounting, and this has further opened up the potential of what natural capital accounting can do.

2.2 What is Natural Capital?

'Natural capital' is an economic metaphor for 'nature', which includes all entities and processes that constitute the planet earth, such as plants, rocks, animals, insects, water, gases, etc. and their interactions with each other (NCI, 2021b). It is increasingly used in the EU and internationally and captures the flow of benefits that nature, through biodiversity and ecosystems, provides to people (Capitals Coalition, 2021).

It is based on the theory that capitals – i.e. natural capital, social capital, human capital and produced capital – form the foundation of human well-being and economic success, wherein if we invest in them, they create value, and if we degrade them, we limit their ability to create value (Capitals Coalition, 2023). Dasgupta (2021) illustrates how some of these capitals interact (see Figure 2.1).

Figure 2.1: Interaction Between Capitals



Source: Dasgupta (2021: 39).

2.3 What is Natural Capital Accounting?

'Natural capital accounting' is an umbrella term for an information framework and an approach to integrating environmental data into the United Nations (UN) System of National Accounts (SNA) for economic activity, such as Gross Domestic Product (GDP). It provides a systematic way to measure and report on ecosystems and the stocks and flows of 'natural capital', ecosystems and their services (EEA, 2018). Applied in the EU and Ireland using the UN System of Environmental-Economic Accounting (SEEA) framework, natural capital accounting can increase the visibility of nature through the measurement and monitoring of natural assets or ecosystems, such as rivers, peatlands, woodlands and their services to society; and it is a valuable tool for informing decision-making.

Box 2.1 outlines the key elements of the SEEA approach to natural capital accounting used in the EU and Ireland.

Box 2.1: UN SEEA

Natural capital accounting encompasses both the UN SEEA-CF, which relates to environmental accounting, and the System of Environmental Economic Accounting for Ecosystem Accounts (SEEA-EA), which relates to ecosystems and services. The UN SEEA-CF was agreed in 2012 as the first international standard for environmental-economic accounting. It includes 'environmental assets', such as water resources, energy resources, forests and fisheries, which are already used in the economy and also the economy's returns to the environment in the form of waste, air and water emissions.

The SEEA-EA standard was adopted by the UN Statistical Commission in 2021 to provide guidance on accounting for ecosystems and ecosystem services. The goal of ecosystem accounting is to provide a coherent and harmonised understanding of ecosystems and their relationships to the economy, and of the overall beneficiaries of ecosystem goods and services.

Both the UN SEEA-CF and the SEEA-EA are designed to be compatible with an SNA and its estimates of countries' wealth and income (e.g. GDP) to allow our understanding and measurement of income or wealth to be adjusted for environmental factors.

The ecosystem accounts include a focus on assets, ecosystem condition, services, benefits and beneficiaries. An asset, for example a forest ecosystem, as depicted in Figure 2, based on its overall health delivers important services such as natural water filtration before flowing to streams, rivers and lakes, producing further benefits to identifiable populations. Ecosystem condition accounts can include factors such as tree cover, hedge density, water-quality indicators, air pollution and urbanisation. Ecosystem services are split into three categories: provisioning services (timber, crops), regulating services (water purification, air filtration, pollination, rainwater regulation, coastal protection, carbon sequestration), and cultural services (recreation, tourism).

Source: UN, (2022); CSO, (2021).

A full set of natural capital accounts can show changes in the health of our natural capital over time and be used to inform decisions on land use, human health, climate-change mitigation and adaptation. It can inform integrated economic and political decision-making, sectoral policies and responsible business strategies, as well as supporting evidence-based investment, rural development, and health and sustainability outcomes (Farrell & Stout, 2020).

Under the umbrella of natural capital accounting, there is a range of environmental accounts that are already produced in Ireland under the UN SEEA-CF, some of which are mandatory under Regulation (EU) No 691/2011. These accounts include water resources, energy resources, forests, fisheries, etc. and the economy's returns to the environment in the form of waste, air and water emissions.

The EU's environmental accounts are a collection of comparable data from all EU Member States consistent with the SEEA-CF and structured in modules. However, not all areas of the SEEA-CF are currently implemented. Ireland, along

with other Member States, collates data on air emissions accounts; physical energy flow accounts; environmental taxes; environmental goods and services accounts; and environmental protection expenditure accounts (EC, 2023a).

Environmental-economic integrated accounts under the SEEA-CF focus on the relationship between the environment and the economy, in terms of both the impacts of the economy on the environment and the contribution of the environment to the economy. These include information about the extraction of natural resources and their use within the economy, natural resource stock levels, the changes in those stocks during a specific period, and economic activity related to the environment. Environmental-economic integrated accounts present this information in physical and monetary terms, as appropriate (UN, 2022).

Additional modules have been proposed by the European Commission, including environmental accounts for forests, environmental subsidies and ecosystems. Ecosystem accounting is the newest addition to the wider umbrella of natural capital accounting within the UN SEEA approach, reflecting the EU's recognition that it needs more consistent reporting on ecosystems and their condition (EC, 2021a). These SEEA-EA accounts are compiled using spatially explicit data and information about the functions of ecosystem assets and the ecosystem services they produce. Guidelines for ecosystem accounting currently under development at Eurostat are guided by steering groups for Member States in which the Central Statistics Office (CSO) is actively participating.

The UN has outlined that the new SEEA-EA takes the perspective of ecosystems and considers how individual environmental assets interact as part of natural processes within a given spatial area (UN, 2022). While natural capital accounting is the umbrella term used, this report primarily focuses on ecosystem accounting, as it offers the potential to examine nature's direct contribution to people.

2.4 What is Natural Capital Accounting Not Designed For?

Natural capital accounting is designed to bring nature's contributions to people into an integrated framework, alongside economic and social data. Many values of nature are not captured by natural capital accounting, such as the intrinsic value of nature, which is beyond measure. The natural capital accounting approach is only of use as one piece of a much broader policy response – other approaches are also required.

Natural capital accounts do not provide a full measure of sustainable development, which requires additional measures on public health and well-being, with broad social issues to be accounted for (McGrath & Hynes, 2020; Government of Ireland, 2023d). Further analysis would be required to quantify the multifaceted and interconnected relationship between a nation's economy, environment and society that can inform more reliable and robust indicators of sustainable development (Obst, 2015).

The SEEA-EA framework focuses on ecosystem services, linked to ecosystem types. It is not designed to assess biodiversity directly, but rather the ecosystems that flow from species and their habitats. This means that it complements, but does not replace, other measurements of biodiversity health.

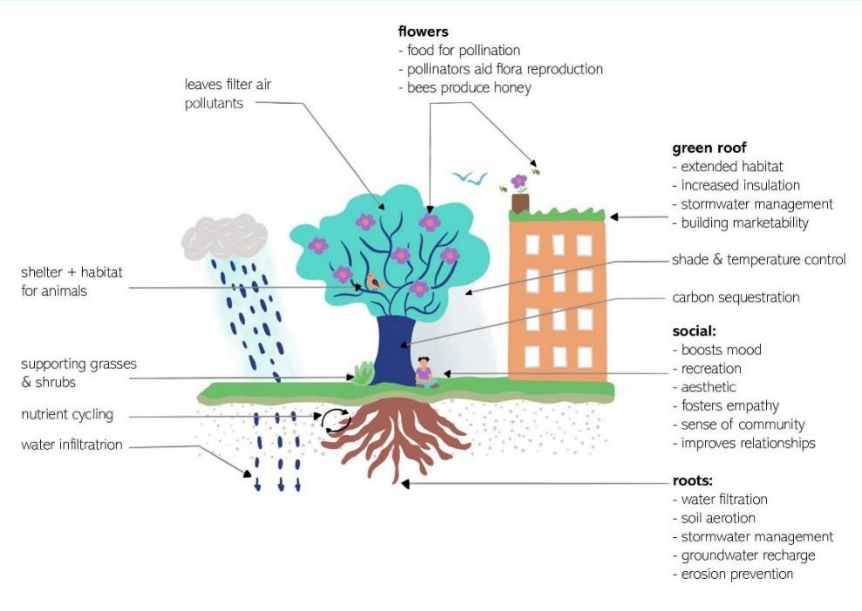
Natural capital accounts can support and sit alongside other policy approaches that strengthen nature protection and restoration. However, without the data and integrated framework that natural capital accounting provides to bring it into policy decision-making, it will be more difficult to assess what is happening to the ecosystems that we depend on and how to address threats to their health.

The growth of considering nature as part of a broader well-being approach reflects this value of nature for society. Most stakeholders identified the need for a holistic and broader suite of policy approaches to nature, of which natural capital accounting is only one, which would bring a heightened focus to nature restoration in Ireland. One stakeholder outlined that natural capital accounting 'is not the silver bullet for nature protection and restoration' but that it is a very useful tool. Stakeholders also expressed interest in supplementary approaches to natural capital accounting in relation to the National Well-Being Framework, also noted in the Citizens' Assembly on Biodiversity Loss.

2.5 Ecosystem Accounts

The new, and potentially most challenging, accounts to build under the umbrella of natural capital accounting are those that outline, assess and monitor complex ecosystems and the services they provide. Ecosystems such as rivers, peatlands and woodlands provide services to people that can be tracked over time. For example, the services from a single tree are illustrated in Figure 2.2, capturing the complexity but also the remarkable ways that nature supports us.

Figure 2.2: Example of Ecosystem Services from a Tree



Source: Clearing House Project (2020).

Using economics terminology, ecosystems are assets or stocks that can increase or decrease in amount, as with any economic asset. Their condition can also improve or deteriorate, impacting the expected future flow of benefits or services from the asset.

There are defined stages in the accounting process. The flow of ecosystem services supports the flow of benefits from the ecosystem assets, as illustrated in Figure 2.3. Ecosystem accounting is a way to account for the contribution of nature to human well-being, by tracking changes in ecosystems and measuring the contribution of ecosystem services through their services and benefits to the economy and society (CSO, 2023).

Figure 2.3: The Stages in Ecosystem Accounting

Source: IDEEA Group (2017).

Services can be measured in physical or monetary terms. For example, in a forest, ecosystem services fall into three categories: provisioning (such as timber), regulating (such as flood regulation or air filtration), and cultural services (such as tourism or recreation). (See Figure 2.4 for an illustration.)

Figure 2.4: Illustration of Ecosystem Accounts for a Forest

Source: UN (2021).

It is expected that reporting to Eurostat on the ecosystem accounts module will become mandatory in 2026 for the reference year 2024. Other countries are increasingly providing this data. Countries such as Canada, Mexico, the Netherlands and the UK are monitoring changes to the natural environment through ecosystem extent accounts. (See Chapter 4.)

2.6 Monetary Valuations

Natural capital accounting creates the potential for the development of indicators that have a more complete perspective of the economy and environmental sustainability, and the SEEA-EA has the potential to present environmental information in monetary values, which is often required by economic policy-makers (Clarke *et al.*, 2023). The SEEA represents an information framework that can help policy-makers break away from siloed policies and understand the trade-offs and complexities involved in climate-change policies (UN, 2020b).

Monetary valuation is possible but not required for most natural capital accounts. A key feature of natural capital accounting using the SEEA framework is the organisation of information in physical terms in order to facilitate comparisons with economic data, even without monetary valuation (UN, 2022). While the SEEA framework includes estimation of monetary values for natural capital assets and ecosystem service flows, it does assess whether these results are prioritised or how they are used. The Organisation for Economic Co-operation and Development (OECD)

(2018) emphasises the importance of valuation in monetary terms to compare with standard economic measures. For example, in UK natural capital ecosystem accounts, emphasis is placed on the estimation of monetary values. In the Netherlands, while estimations of monetary values are provided, a decision was taken to not place emphasis on the results of these accounts but rather to focus on the physical flows and measures.

For the measurement of ecosystem services and benefits in monetary terms, it is generally necessary to apply well-established market and non-market valuation methods that have been developed in the field of environmental economics. These methods include resource rent, replacement cost, hedonic pricing and production function methods (see Döhring *et al.*, 2023).

A working paper for the OECD notes that natural capital accounting is an important measure of the contribution of the environment to the economy. 'The SEEA (drawing on various stocks and flows accounts) is now, and will increasingly be, a key source of data for these estimates, particularly if SEEA compilers can provide them as monetary values so that they can be used directly by national statisticians' (Clarke *et al.*, 2023: 22).

The development of monetary valuations as part of the suite of accounts may be beneficial for certain uses, but not all, particularly when making comparisons with standard economic measures, such as GDP or labour market impacts (employment and unemployment levels).

The EU has included monetary valuations as part of its experimental work on ecosystem accounts. Based on 2012 data, the EU estimated an annual flow of €172 billion from just seven selected services from the EU's ecosystems. This work highlighted the significant risks arising from the potential loss to the economy, as well as nature, if pressures continue along current trends. Ecosystem services have also been researched in Ireland on river basin catchments, forests, and the marine. A 2008 study estimated ecosystem services to be worth billions of euro to the Irish economy every year (Bullock *et al.*, 2008). Marine research has also estimated ecosystem services values in Ireland (Norton *et al.*, 2018).

2.7 Irish Developments in Natural Capital Accounting

The CSO has been proactive in the development of natural capital accounting in Ireland and, like the EU, has adopted the UN's SEEA framework that integrates economic and environmental data in order to analyse the relationships between the environment and the economy.

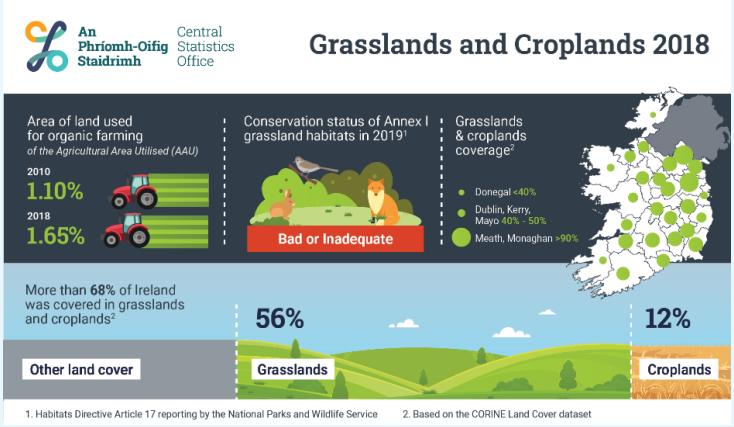
The CSO's Ecosystem Accounts Division, established in 2020, is working towards the compilation of ecosystem accounts for Ireland. The compilation of a comprehensive set of ecosystem accounts is outlined as a long-term goal and the methodology is under development. The set of ecosystem accounts comprises a series of connected accounts (i.e. extent, condition, services and monetary accounts) along with thematic accounts focused on topics of interest in their own right and in direct relevance in the measurement of ecosystems (CSO, 2021).

Recent work has focused on compiling ecosystem extent accounts and examples of that preliminary work is already available on the CSO website. The CSO published 'Ecosystem Accounts – Peatlands and Heathlands 2018' (CSO, 2018a) and 'Grasslands and Croplands 2018' (CSO, 2018b) as frontier publications to highlight this use of new methods. Recently, as a first major step, the first national Ecosystem Extent Accounts were published, giving national and county ecosystem extent, and tracking changes between 2000 and 2018 (CSO, 2023). See Box 2.3 for an example of the CSO's reporting on ecosystem extent for grasslands and croplands.

In May 2023, the CSO hosted a stakeholder forum on ecosystem accounting, which was attended by 42 participants from over 16 different organisations, as a first step in creating national engagement with stakeholders on the development of ecosystem accounting. Issues raised included the significant data gaps, in particular in relation to ecological stocks.

These gaps are slowly being addressed. The National Biodiversity Data Centre (NBDC) has developed the National Pollinator Monitoring Scheme to address one of the data gaps on pollination across the island. Pollination, a key ecosystem service, is being supported by the innovative All-Ireland Pollinator Plan (NBDC, 2021).

Box 2.3: Example of CSO's Reporting on Ecosystems Extent



Ecosystem extent accounts provide information on the type, range and extent of ecosystem assets, i.e. grasslands and croplands. CSO (2021) examines where grasslands and croplands occur in Ireland, what types of grasslands and croplands these are, and gives some indicators for ecosystem condition. Grasslands and croplands, and associated semi-natural features, provide a range of ecosystem services, including: provisioning services, such as biomass (material from living organisms that can be divided into food, fuel and fibre); regulating services, including climate regulation, flood regulation, soil retention, and pollution removal; cultural services (e.g. recreational and amenity services); and intermediate services, including habitat diversity, pollination, and pest-control services. The CSO also produced a report on the condition of rivers and lakes using available data. A full account of how condition is approached is outlined in its overview of ecosystem accounting. Developments in the condition accounts are currently underway at EU level.

Source: CSO (2021).

There is a commitment to produce the first national assessment of ecosystem services in the forthcoming National Biodiversity Action Plan 2023-2030 (NPWS, forthcoming). An advance draft indicates that 2027 is the target delivery date for this, and a further commitment to develop and implement systems and standards for natural capital accounting by 2027 is also expected.[4]

Ireland has increased its spatial analysis alongside the CSO's work to build natural capital accounts. The National Land Cover Map developed by the Environmental Protection Agency (EPA) and Tailte Éireann provides a valuable, high-resolution, field-scale, land-cover map, 250 times more detailed than previous datasets, enabling users to gain a far deeper understanding of Ireland's diverse environments (Tailte Éireann, 2023). Early work commissioned by the National Parks and Wildlife Service (NPWS) produced a pilot Mapping and Assessment of Ecosystems and their Services for a suite of prioritised services based on available data (Parker *et al.*, 2016).

While Eurostat will provide guidelines on the operationalisation of the new ecosystem accounts, there is some flexibility in how a country can develop and use the accounts. As Chapter 4 will outline, there is no single approach. Across the world, different approaches have been taken by countries such as Australia, Canada, Mexico, the Netherlands, the United Kingdom (UK) and the United States. In determining what is measured, countries have had the flexibility to incorporate country-specific characteristics and to define which ecosystem condition factors are relevant or important.

This is an active research area in Ireland.

[4] Advance draft of targets courtesy of NPWS 13/11/2023.

The EPA-funded Irish Natural Capital Accounting for Sustainable Environments (INCASE) project is a four-year research project running from 2019 to 2023 to develop a system for natural capital accounting for Ireland. It applies natural capital accounting using the SEEA-EA at a pilot (catchment) scale, building on the pilot development by the NPWS (Farrell and Stout, 2020). Four river catchments were included: Bride, Caragh, Dargle and Figile. The project has developed a framework to ensure the appropriate use of monetary valuation and to determine how these values can be integrated with existing economic and environmental policies to inform decision-making. The project sought to assess the impact of policy change on natural capital stocks; produce sectoral natural capital management frameworks; produce a gap analysis of information monitoring systems and the policies underpinning them; and conduct economic impact assessments to better understand the trade-offs between policy options. A risk register for flows of peatland services and benefits was developed at catchment scale. This identifies areas where restoration would have multiple benefits for climate, water, biodiversity and people. This approach could be extended regularly across other ecosystem types. The final report includes recommendations to develop and use ecosystem accounting as a national priority; increase expertise to operationalise the accounts; develop a detailed, high-resolution map of ecosystems; and establish a centralised data platform. It emphasises the need for a standardised approach to ecosystem service assessment, and cautions against monetising all accounts (Stout *et al*., 2023).

A collaborative ForES sustainable forestry project funded by the Department of Agriculture, Food and the Marine (DAFM) is using natural capital accounting to co-develop tools for sustainable forestry management decision-making (ForES, 2021). (See Box 2.4 for other research examples.)

One area of research that has highlighted some of the opportunities and challenges in the economics of ecosystem services is the University of Galway's work on the marine (see Box 2.5). Marine ecosystem services are provided by the processes, functions and structure of the marine environment that directly or indirectly contribute to societal welfare, health and economic activities (Norton *et al.*, 2018).

There has been some sectoral analysis of natural capital accounting and innovative pilot studies conducted across the seafood, forestry, and marine sectors; for example, the sectoral analysis undertaken for Bord Iascaigh Mhara (BIM) by the IDEEA Group (IDEEA Group & BIM, 2022) (see Box 2.6).

Box 2.4: Examples of Irish Research and Demonstration

- The LIFE on Machair project aims to improve the conservation status of Ireland's Machair grassland and fixed dune habitats and the ecological conditions for breeding waders and pollinators within the project sites from 2022 to 2028 (LIFE on Machair, 2023). This includes working with farmers and landowners to develop and roll out agricultural management agreements on project sites in order to incentivise and reward farmers for improving habitat quality, while, in return, delivering essential support for breeding waders and pollinators in the long term.
- The Hen Harrier Project was a European Innovation Partnership Locally Led Scheme. The Project was funded by the DAFM as part of Ireland's Rural Development Programme 2014–2020. Over 1,600 farmers managing approximately 40,000 hectares of land have participated. Over €4,300,000 was paid out to participating farmers for delivering quality habitats and actions including planting wild bird cover, and delivering water infrastructure and sustainable grazing infrastructure.
- Coillte Nature is the not-for-profit branch of Coillte that is dedicated to the restoration, regeneration and rehabilitation of nature through large-scale projects. It is collaborating on the ForES research project, which aims to co-develop tools for sustainable forestry management decision-making over four years. ForES is led by Trinity College Dublin (TCD), in collaboration with University College Dublin (UCD) (ForES, 2021).
- The ESManage project focused on' embedding ecosystem services and the ecosystem services approach into policy and decision-making for the sustainable management fresh water resources, as required by the Water Framework Directive' (WFD) (Kelly-Quinn *et al.*, 2020: ix).
- Farm Zero C Project which is a collaboration with TCD, BiOrbic, Carbery and others addressing carbon neutral farming;
- Nature+ Energy is working to develop new ways of accounting for the value of nature for wind farms (MaREI, 2021).
- The Connecting Nature, Horizon-funded, project led by TCD focuses on the large-scale implementation of nature-based solutions to build climate resilience in cities (Connecting Nature, 2020).
- Waters of Life (2023) is an EU LIFE Integrated Project that aims to help reverse the deterioration of Ireland's most pristine waters, using a hybrid model of results-based ecosystem services. It will be piloted across five catchment areas, with a sixth catchment area acting as a control.
- The BRIDE (Biodiversity Regeneration In a Dairying Environment) Project is an agri-environment project based in the River Bride catchment of north-east County Cork and west Waterford, and aims to design and implement a results-based approach to conserve, enhance and restore habitats in lowland, intensive farmland (BRIDE Project, 2018).
- Funded by Science Foundation Ireland, Valuing Natural Capital in Communities for Health (VNiC Health) will evaluate the actual and potential health benefits provided by urban natural capital, providing a framework for societal-natural capital engagement. It will generate evidence for the inclusion and maintenance of natural capital in planning and development (SFI, 2023).

Box 2.5: University of Galway's Work on Ecosystems Valuation

The Socio-Economic Marine Research Unit in the University of Galway has been conducting research funded through the Irish Marine Institute and the EPA that estimates the value of marine ecosystem service benefits to Irish society (Norton *et al.*, 2018).

The work aims to provide a profile of the marine ecosystem services derived from Ireland's coastal, marine and estuarine natural resources, to provide estimates of the value to society of these marine ecosystem services and, finally, to identify knowledge gaps that continue to exist in the valuation of marine ecosystem services.

Even though not all of the ecosystem services provided by the marine environment can be monetised, this work indicates that the value of those that can is substantial.

The Unit has found that, each year, an estimated value of €1.6 billion is provided by Irish marine ecosystems in recreational services. Fisheries and aquaculture are estimated to be worth €664 million in terms of output value from Irish waters; carbon absorption services are valued at €819 million; waste assimilation services at €317 million; scientific and educational services at €11.5 million; coastal defense services at €11.5 million; seaweed harvesting at €4 million; and the added value per annum to housing stock of being close to the shore (aesthetic services) at €68 million.

In 2023, the CSO, University of Galway and the Marine Institute have supported doctoral research on marine ecosystems services accounts.

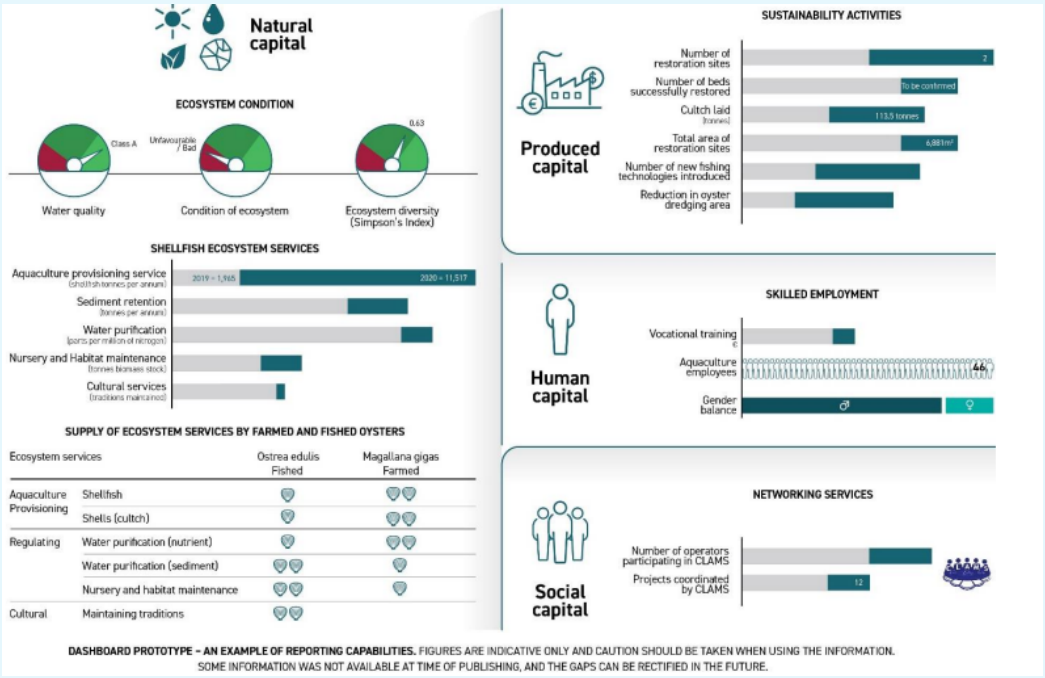
Source: McGrath & Hynes (2020); Norton et al. (2018).

Box 2.6: Natural Capital Potential for Bord Iascaigh Mhara

In one recent innovative example, BIM was advised in 2020 by the IDEEA Group about how natural capital accounting could support BIM and the aquaculture and fishery operators within the seafood industry. A natural capital framing can be used to improve the understanding of the complex relationships between seafood sector activities and the natural environment, by describing the contribution of the environment to the benefits associated with the seafood sector. The IDEEA Group outlined how accounts can be used across multiple accounting applications, and how these applications can address different challenges and opportunities.

In a case study of Clew Bay, ecosystem services identified included: (i) provisioning services such as the ecosystem inputs to the seafood sector in terms of fish catch; (ii) regulating and maintaining services such as the contribution of ecosystems to water purification and carbon sequestration; and (iii) cultural services such as the role of the ecosystems in providing amenable and high-quality locations for recreation. The study concluded that first attempts at natural capital accounting are generally similar in that data is patchy, methods are exploratory, and there are no systems in place. They suggest a step-by-step process to gradually embed natural capital accounting. More data is required to progress this for the seafood sector. The IDEEA Group has produced a mock indicator to show how future data could be presented.

Mock Aquaculture Sector Dashboard



Source: IDEEA Group (2022).

2.8 Ireland's Natural Capital

Currently, it is not possible to assess Ireland's stock of natural resources and ecosystems; however, data on Ireland's land cover is available. Together, agriculture and forestry represent 81 per cent of Ireland's land cover. Most (60 per cent) of the agricultural land is grassland, used for pasture, hay, silage and rough grazing (Government of Ireland, 2023b).

Using data from 2000 to 2018, the CSO has produced extent accounts for ecosystem types in Ireland. These show that 68 per cent of the country is covered by grassland and cropland, and 14 per cent by inland wetland. In that period there has been a 16 per cent increase in settlements and other artificial areas and a 13 per cent increase in forest and woodland; and a decline in cropland (5 per cent), inland wetland (4 per cent), and heathland and shrubs (2 per cent) (CSO, 2023).

The OECD (2020) notes that the Ireland's natural or semi-natural vegetated land cover is the second-highest share in the OECD. Using this as a proxy for natural capital, it found that Ireland's performance in natural capital was above average among OECD members. However, the type of land cover does not indicate its condition or use, so it is not possible to assess its status or quality or its benefits to people in terms of ecosystem services. However, as the *Land Use Evidence Review Phase 1 Synthesis Report* has noted, changes in land use over several decades have had negative environmental impacts, including the loss of hedgerows (which are important for biodiversity); low forest cover and low forest-planting rates; the loss of wetlands and peat bogs and their importance as ecosystems and as a carbon sink; the impacts of increasing urbanisation and urban sprawl on urban air quality and environmental noise; and the need for an integrated approach to land and soil management (Government of Ireland, 2023b).

Ireland performs relatively well on the Red List Index, based on the International Union for Conservation of Nature Red List of Threatened Species.[5] However, the UN (UN, 2007: 245) notes that 'The RLI does not capture particularly well the deteriorating status of common species that are declining slowly as a result of general environmental degradation', pointing to the shortcomings of this index as a proxy for natural capital. The Botanical Society of Britain and Ireland in 2023 noted that 'Most Irish native plant species (56%) have declined in range and abundance or both' (BSBI, 2023).

Recommendations outlined in the *Land Use Evidence Review* point to the importance of increased data on natural capital and of mapping and monitoring ecosystems.

2.8.1 Ireland's Biodiversity

A fundamental aspects of ecosystems, and hence of natural capital, the status of biodiversity in Ireland is poor in many respects. The draft National Biodiversity Action Plan 2023-2030 set out the problem as: 'Despite ongoing conservation and restoration efforts, Ireland's biodiversity is in a state of crisis, and urgent, impactful action is imperative to prevent the continued erosion of our natural heritage' (DHLGH, 2022: 6). The rate of habitat degradation and loss of biodiversity is also accelerating across Europe (SJI, 2023; (EC, 2021a) (see Box 2.7).

Ireland is not alone in needing to address biodiversity loss. International and EU policy attention has increasingly been focused on the evidence that global progress towards healthy ecosystems is insufficient (IPBES, 2019), despite the positive results of some conservation efforts (Citizens' Assembly, 2023; Government of Ireland, 2021b).

[5] This is an indicator of the combined overall extinction risk for at-risk birds, mammals, amphibians, cycads and corals and disaggregated nationally, shows how well species are conserved in a country relative to its potential contribution to global conservation of these species groups (IUCN, 2023) Red List Index https://www.iucnredlist.org/assessment/red-list-index#:~:text=The%20Red%20List%20Index%20(RLI,targets%20for%20reducing%20biodiversity%20loss.

Box 2.7: Status of Irish Biodiversity

The draft National Biodiversity Action Plan 2023-2030 outlines that 'Despite ongoing conservation and restoration efforts, Ireland's biodiversity is in a state of crisis and urgent impactful action is imperative to prevent the continued erosion of our natural heritage. We should remain hopeful as nature is resilient and the right actions in the right place will yield a recovery in our precious wildlife and secure ecosystem services for future generations' (DHLGH, 2022: 6).

More than one-half of Ireland and Britain's native plants have declined since the 1950s due to pressures from agriculture, housing and infrastructure development; climate change and non-native invasive species; and resource extraction (BSBI, 2020).

The 2020 *Status and Trends* report from the National Biodiversity Data Centre (NBDC, 2021) demonstrates that 76 per cent of the indicators show static or poor progress in delivering biodiversity conservation, 21 per cent show that progress has been made and another 3 per cent are uncertain. The NBDC produces the National Biodiversity Indicators, a suite of 71 sub-indicators grouped under 8 focal areas, which provides a high-level overview of how Ireland is addressing the biodiversity crisis. The indicator groups for the 'status of biodiversity' and 'measures that mainstream biodiversity' accounted for the highest number of 'poor' statuses across all time periods. The most positive statuses are in awareness of biodiversity and knowledge of Irish biodiversity.

Under EU Directives, Member States are obliged to assess the status of the particular habitats and species that they are required to protect. A small subset (60) of Ireland's species were included in the 2019 assessment of status. Some negative trends were noted. While over one-half of species assessed in 2019 achieved 'Favourable' status, 30 per cent were of 'Unfavourable' status (i.e. 'Inadequate' or 'Bad'), with 15 per cent demonstrating ongoing declining trends. The trend for habitats was worse, with 85 per cent of habitats being of 'Unfavourable' status, with 46 per cent of habitats demonstrating ongoing declining trends (EPA, 2023; NPWS, 2019).

The loss of endemic species, only found in Ireland, is of particular concern (Citizens' Assembly, 2023).

2.9 Policy Momentum on Nature

Efforts to bring greater policy attention to biodiversity are emphasising nature's contribution to a healthy planet and to people. An ambitious plan to transform our societies' relationship with biodiversity is outlined in the UN Kunming-Montreal Global Biodiversity Framework. Its vision for 2050 is: 'biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people' (CBD, 2022: 8).

The framework sets out twenty-three targets to be achieved by 2030, including 30 per cent conservation of land and sea and 30 per cent restoration of degraded ecosystems (CBD, 2022; DHLGH, 2022).

The European Green Deal includes a focus on embedding stronger policies and practices to protect and restore Europe's natural capital (EC, 2019a). Key policies include the EU Birds and Habitats directives, the EU Biodiversity Strategy for 2030 and the proposed EU Nature Restoration Law (EC, 2022b).[6] The EU Biodiversity Strategy for 2030 recognises the importance of building on an integrated and whole-of-society approach, including measuring and integrating the value of nature, and measurement of the footprint of products and organisations, through life-cycle analysis and natural capital accounting. The strategy calls for an EU-wide methodology to map, assess and achieve good condition of ecosystems so that they can deliver benefits via the provision of ecosystem services (EC, 2022a).

[6] These policies include the EU Forest Strategy for 2030, the EU Water Framework Directive and Soil Strategy, the EU Pollinators Initiative, and the EU Regulation on Invasive Alien Species.

The proposed EU Nature Restoration Law is a draft regulation currently under negotiation in the EU Council and Parliament. It combines an overarching restoration objective for the long-term recovery of nature in the EU's land and sea areas with binding restoration targets for specific habitats and species. As currently set out, binding targets would include a focus on restoring habitats and species protected by EU nature legislation, improving biodiversity on farmland and restoring drained peatlands. Delivering ambitious action will not be possible without systematic reporting and tools for valuing progress and impacts. Data on the status and health of ecosystems will be used to monitor progress towards any agreed targets of the final Nature Restoration Law (EC, 2022b).

The European Commission has proposed a new Directive on Soil Monitoring and Resilience. This recognises that soils host more than 25 per cent of all biodiversity and are the second-largest carbon pool on the planet. Degraded soils reduce the provision of ecosystem services such as food, feed, fibre, timber, nutrient cycling, carbon sequestration, pest control and water regulation but currently do not have the same level of legal protection in the EU as air and water (EC, 2023a).

Biodiversity policy is not just land-based – the EU Marine Strategy Framework Directive aims to achieve 'Good Environmental Status' of EU marine waters and sustainably protect the resource base upon which marine-related economic and social activities depend; and the EU Water Framework Directive focuses on ensuring the qualitative and quantitative health of rivers and lakes, groundwater and bathing waters (EC, 2023a; 2008; 2000).

The implementation of existing EU directives creates further momentum. Implementation of the EU Habitats and Birds directives has resulted in the creation of a network of sites for habitat and species protection, Special Areas of Conservation (SACs) known as the Natura 2000 network, and Special Protection Areas for the protection of birds. A total of 430 SACs are legally protected in Ireland, covering an area of approximately 13,500 square kilometres, although a little over 40 per cent of these has yet to be formally designated by statutory instruments (EPA, 2023).[7] A review by the European Commission published in February 2023 found that in no Irish case were specific, targeted, measurable and time-bound conservation measures found to be in place in the SACs to ensure the favourable status of species (DHLGH, 2023). In a recent ruling by the European Court of Justice, Ireland was found to have failed to designate 217 SAC sites in and prior to 2019.

Since then, a dedicated NPWS unit has been established to lead on the implementation of conservation measures across all of Ireland's Natura 2000 sites; more than 95 per cent of all Natura 2000 sites in Ireland are now covered by a statutory instrument (DHLGH, 2023). Ireland has 6.2 per cent of land area designated as Special Protected Areas under the EU Birds Directive, which is at the lower end of the scale compared with other EU Member States, with Croatia having the highest percentage of land area at 30.2 per cent (CSO, 2021).

The draft National Biodiversity Action Plan 2023-2030 set out a vision for Irish biodiversity that, by 2050, biodiversity in Ireland will be valued, conserved, restored, and sustainably used, maintaining ecosystem services, sustaining a healthy planet, and delivering essential benefits for all (DHLGH, 2022). Delivering this vision must be underpinned by robust governance and evidence-based decision-making in order to ensure healthy ecosystems. Natural capital accounts are expected to be outlined as making 'visible the economic cost of continuing to degrade nature and can inform new roadmaps toward a safer, healthier and more economically viable future for all'.[8] The draft actions are summarised in Box 2.8.

A number of other significant developments create a heightened focus on the importance of biodiversity and natural capital in Ireland.

The Citizens' Assembly on Biodiversity Loss reported in 2023 with a total of 100 members, including an independent chairperson and 99 randomly selected members of the public (Citizens' Assembly, 2023). The Assembly recently examined, and reported on, how the State can improve its response to the issue. Its report contains over 150 recommendations that have the potential to dramatically transform Ireland's relationship with the natural environment.

Central to the report's recommendations is the need for the State to take prompt, decisive and urgent action and to provide leadership in protecting Ireland's biodiversity for future generations. The Assembly asserts that biodiversity has

[7] These include raised bogs, blanket bogs, turloughs, sand dunes, machair (flat sandy plains on the north and west coasts), heaths, lakes, rivers, woodlands, estuaries and sea inlets. The 25 Irish species that must be afforded protection include salmon, otter, freshwater pearl mussel, bottlenose dolphin and Killarney fern (NPWS, 2023).

[8] As outlined in the advance draft of the National Biodiversity Action Plan, courtesy of NPWS, 13/11/2023.

an intrinsic value that should be recognised and that the essential ecosystem services it provides are impossible to replace. The Oireachtas Committee on Environment and Climate Action have examined the recommendations of the report and published their recommendations in December, 2023 (Joint Committee on Environment and Climate Action, 2023).

Box 2.8: Forthcoming National Biodiversity Action Plan 2023-2030

The forthcoming National Biodiversity Action Plan 2023-2030 is expected to commit to targets in relation to natural capital accounting and ecosystem services assessment, including the following:

- A network of experts in natural capital and ecosystem accounting will be established for the island of Ireland.
- Systems and standards for natural capital accounting will be developed by 2027.
- The CSO will develop ecosystem accounts for Ireland, with the first national ecosystem accounts to be completed by 2027.
- Relevant bodies will provide appropriate guidance for key sectors on the use of natural capital accounting, with the natural capital approach mainstreamed across all sectors by 2027.
- Relevant organisations will conduct a national assessment of stocks, flows and trends in ecosystem services in order to identify priority ecosystems and threats to natural capital using appropriate tools, which will be co-ordinated with relevant authorities in Northern Ireland.
- The first national assessment of ecosystem services will be completed by 2027.
- The National Biodiversity Action Plan aims to achieve recognition for the value of Ireland's biodiversity and proposes regular assessments of ecosystem services to reflect this.
- Tools to maintain and enhance biodiversity and ecosystem services associated with agroecology systems will be in place by 2027.

Source: Updated from the advance draft of the National Biodiversity Action Plan, courtesy of NPWS, 13/11/2023

The 2022 Children and Young People's Assembly on Biodiversity Loss brought 35 young people together to discuss how to protect and restore biodiversity in Ireland. Their recommendations included treating the earth as a friend or member of the family. It was further proposed that every decision must take biodiversity into account. They reported their vision of 'An Ireland where we are connected to and care for the rights of nature and each other so that biodiversity is restored and protected and we live and grow up in healthy, clean and fair environments' (DCU, 2023: 31).

The National Bioeconomy Action Plan 2023-2025 includes a key action for developing an agreed approach to natural capital accounting. It outlines the importance of having 'full oversight of our natural capital baselines to fully ensure that our bioeconomy complements and does not negatively impact our natural resources' (Government of Ireland, 2023a:19). It also identifies the need to develop and align natural capital accounting frameworks with the bioeconomy to help measure changes in the stocks and flows of natural capital at a variety of scales, for better management of nature and biodiversity (Government of Ireland, 2023a).

Civil society organisations have called for greater focus on data and accounting in Ireland for biodiversity; for example, Social Justice Ireland has argued that Ireland needs to improve its data collection methods when it comes to biodiversity and to monitor the impact of climate change in this context in order to protect both our natural resources and our economy. Our natural capital and ecosystems should also be assigned value in our national accounting systems (SJI, 2023).

2.10 Shared-Island Collaboration

Given the UK's experience of natural capital accounting, there is rich potential in increasing co-operation with the UK as Ireland's accounts develop. The National Economic and Social Council's (NESC's) shared-island report, *Collaboration on Climate and Biodiversity: Shared Island as a Catalyst for Renewed Ambition & Action*, identified natural capital as one area to be further supported across the island (NESC, 2021).

Northern Ireland was first included in the UK's National Ecosystem Assessment, published in 2011 with more recent focus on ecosystem services by the Northern Ireland Environment Link (NIEL, 2011; 2023a). The Department of Agriculture, Environment and Rural Affairs' (DEFRA's) Northern Ireland's Environment Strategy recognises the value of natural capital, as does the Green Growth Strategy and Northern Ireland's Draft Biodiversity Strategy (DAERA, 2021; NIEL, 2023b). Derry City and Strabane District Council used natural capital accounting to calculate the benefits of green spaces, greenways and woodland: every £1 spent was found to generate £22 of benefits. Green spaces provide over £500 of benefits per adult resident per year (Vivid Economics, 2019).

Northern Ireland Environment Link's recent report for DEFRA has highlighted the value of a natural capital approach. It recommends making protecting natural capital a strategic goal in Northern Ireland and also that all Government policies and actions should recognise that functioning natural systems are a critical public good, delivering a range of public benefits (NIEL, 2023b).

The All-Island Climate and Biodiversity Research Network (AICBRN) recognises the importance of natural capital in an all-island context and the need for collaboration. AICBRN is a multidisciplinary network that brings together researchers from across the island of Ireland who are undertaking research in climate and biodiversity (AICBRN, 2023).

2.11 Conclusion

The development of natural capital accounting in Ireland and the EU will provide an increased understanding of the health of nature, with particular focus on ecosystems and their contributions to people. With increasing research and practice on building and using accounts, it will be possible to assess Ireland's natural capital more fully. Expected soon to become a mandatory reporting requirement by the EU, the operational side of the accounts is only one part of what is required. The next chapter outlines the policy opportunities and risks in how natural capital accounting is further developed and used.

Chapter 3

Delving into the Opportunities and Risks

3.1 Introduction

The development of natural capital accounts using the System of Environmental-Economic Accounting (SEEA) framework will play an important role in increasing Ireland's knowledge and assessment of nature. When complete, it will be possible to not only map where ecosystems are but to have regular reports on their condition and assess changes to the services they provide to people.

Stakeholders outlined their hope that natural capital accounting could provide a key opportunity. One stakeholder considered the potential of natural capital accounting was that it could help meet the need to 'pull this altogether', with natural capital accounting presenting a 'huge opportunity to literally nail it down'.

There are several key areas of opportunity. While the value of nature and its contribution to people is not yet fully recognised in Ireland, it will play an increasing role in delivering solutions, particularly in relation to climate change through the development of nature-based solutions.

Natural capital accounting can also provide an opportunity for considering nature, alongside other environmental, economic and social considerations, in national and local policy decision-making. It provides a useful tool for policy integration to ensure uptake of this information at relevant stages of decision-making (EC, 2019b). It can also provide a key to unlock a number of pressing policy challenges in agriculture, land use and nature restoration, as further outlined in Chapter 4.

However, the Council recognises that there are a number of significant risks to be considered in Ireland's approach to natural capital accounting. One risk is that comprehensive accounts may not be produced in time to inform pressing policy needs. A further risk is that, despite ongoing policy attention, the scale, risk and urgency of the challenge is not yet sufficiently understood in the wider policy system. Finally, there is a risk that natural capital accounts will not be used in practice and will not be integrated into wider policy and decision-making. This chapter outlines the opportunities for using natural capital accounting, beginning with the increased recognition of nature's contribution to people, followed by a short discussion of these three risks. It then outlines what is required to mitigate against these risks and to ensure that natural capital accounting is effectively utilised in Ireland.

3.2 Opportunities from Valuing Nature

A strong focus among stakeholders consulted is the importance of recognising the value of nature, which a number of roundtable participants considered had been absent from public policy. A key point made was that there is no single value that can be placed on nature. This is also a theme from Irish and international debates, as there are multiple values of nature that are context-dependent across the planet (Bresnihan, 2017; Bullock, 2017). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services provides the Nature Futures Framework, with three interconnected sets of values: (i) intrinsic values ('nature for nature'); (ii) relational values ('nature as culture'); and (iii) instrumental values ('nature for society') (IPBES, 2022; Pereira et al, 2020).

- Nature has *intrinsic value* separate from our reliance on it: an ocean, gorilla or oak tree are fundamental parts of our living world. These values are 'beyond any human experience or evaluation' and thus 'beyond the scope of anthropogenic valuation approaches' (Diaz *et al.*, 2014: 5). Some cultures believe nature and humans exist within an interconnected web of life. Rights-of-nature laws, such as used in Spain and Ecuador, 'treat nature itself as a legal entity having enforceable rights in the same way that companies have rights' (Citizens' Assembly, 2023: 88).

- *Nature as culture* is a strong value in Ireland: personal and cultural connections are deeply rooted in our heritage and culture, as recognised by the Citizens' Assembly on Biodiversity Loss. Ireland's flora and fauna have always been a source of national pride and enjoyment. Nature also gives us a sense of belonging. The recent State of the Union address by European Commission President Ursula von der Leyen emphasised that 'the loss of biodiversity not only destroyed lives but also the feeling of "*heimat*"(home)' (EC, 2023b).

- Accounting frameworks such as natural capital accounting are focused entirely on values captured as *nature for society*, i.e. nature's contribution to people. These frameworks refer to the essential ecosystem services from biodiversity that sustain life on earth. Every species, once extinct, will be impossible to replace

(Citizens' Assembly, 2023. A high level of biodiversity ensures that we are supplied with the 'ecosystem services that are essential to the sustainability of our standard of living and to our survival' (Bullock *et al.*, 2008: 5).

3.3 Nature's Contribution to People

Nature's contribution to people is critically important for livelihoods, economies and quality of life, and therefore vital to sustaining human life on earth (IPBES, 2018; Sandström *et al.*, 2023). Nature's ecosystems regulate services through climate, soil, and fresh water; brings material benefits, such as food and feed, and energy; and supplies non-material services such as physical, psychosocial, learning and identity (IPBES, 2019). Humanity's dependence on nature for survival, well-being, and economic prosperity is not generally recognised (Dasgupta, 2021). However, natural capital accounting can make these ecosystem services more visible.

A staff working document from the European Commission outlines how some ecosystem services are visible and tangible, and their benefits widely recognised, such as timber from forests. While these benefits are usually partly reflected in market-trading and investment choices and prioritised in policy decisions, ecosystem services are often overused. Other ecosystem services such as the potential of wetlands to store carbon or improve flood protection are increasingly recognised as providing long-term benefits but are not sufficiently 'mainstreamed' in decision-making. Short-term needs are often prioritised (EC, 2019b).

As well as providing services to people, nature restoration can bring additional benefits to climate action and other environmental areas that can be captured by natural capital accounting. The EC's impact assessment of the proposed Nature Restoration Law shows that healthier, more biodiverse ecosystems deliver significantly better on results such as climate-change mitigation, disaster prevention, water quality, clean air, healthier soils, and overall well-being. Every euro spent on restoration, depending on the ecosystem, delivers a return on investment from between €8 and €38 in benefits from the many services healthy ecosystems provide (EC, 2022b). Nature's contributions will continue to evolve as the climate changes. The nature-based solutions[9] increasingly used in climate adaptation can support resilience to climate change and can safeguard biodiversity.

The draft National Biodiversity Action Plan 2023-2030 recognises the essential role that nature plays: 'Species decline and extinction are beginning to affect the ecosystem services we utterly depend upon, such as the production of food and water, pollination, flood control, soil formation and nutrient cycling. These services are essential to human survival, to our health and well-being, and to economic prosperity' (DHLGH, 2022: 4).

However, stakeholders in the roundtables reflected that, in their experience, government departments often do not understand the impacts on nature of the decisions they make.

3.4 Opportunities to Address Policy Challenges: What Can Natural Capital Accounting Contribute?

The following sections outline areas where natural capital accounting could usefully inform and help address current policy challenges.

3.4.1 Nature Restoration

The key EU policy priorities driving the development of natural capital accounts are the Biodiversity Strategy for 2030, the proposed Nature Restoration Law, and the Sustainable Finance Framework.

Some countries placed natural capital accounting in the context of a broader vision for nature, such as in the United Kingdom's (UK's) 25 Year Environment Plan; the Netherlands' 'National Environmental Vision' strategy, *Nationale Omgevingsvisie* (NOVI); and Australia's Nature Positive Plan and action plan for environmental-economic accounting. This broader vision for nature step is important in how natural capital accounting is viewed by the policy system as

[9] The United Nations Environment Programme defines nature-based solutions as 'actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human wellbeing, ecosystem services, resilience and biodiversity benefits' (UNEP, 2023).

either a necessary and useful core tool and national information framework to inform decision-making, or as a valuable, but not central, body of knowledge used by specialists and responsible government departments.

In the EU, data on the status and health of ecosystems will form part of the monitoring of the proposed Nature Restoration Law (EC, 2022b) and, once enacted, Member States will have to develop their own national nature-restoration plan within two years. Increasing pressures on land use for nature restoration, as well as for renewable energy, food production and housing, will necessitate nature-informed decision-making in order to understand potential synergies and trade-offs. Once a plan has been developed, there will be requirements for systemic reporting and tools for valuing progress and impacts. Data from natural capital accounts (through SEEA-EA) on the status and health of ecosystems will be used to monitor progress towards any agreed targets of the proposed Nature Restoration Law (EC, 2022b) but can also be used to inform nature restoration policy and practice.

Natural capital accounting can underpin the development of future plans, as well as inform, at a more granular level, the status and condition of ecosystem types and the services and benefits that derive from them, and can provide a baseline for assessing future changes. Spatial place-based data and mapping could be very useful in local assessments and community engagement, as illustrated by the Irish Natural Capital Accounting for Sustainable Environments (INCASE) project.

3.4.2 Nature-Based Solutions

The development of nature-based solutions requires data from natural capital accounting, through which governments are being encouraged to better integrate nature-smart planning and practices into systems and to invest in nature-based solutions (Power *et al.*, 2022).

Assessing the resilience of ecosystems is complex, particularly in the context of a changing climate without appropriate data. In a report about the risks of climate change, Flood *et al.* outlined that more research was needed on 'the capacity of the natural environment to continue to provide vital buffering against climate hazards, and understanding more about how this capacity could be further enhanced' (Flood *et al.*, 2020: 27). Improvements in nature can be made that will bring co-benefits to human health, economies, livelihoods and communities. Harnessing natural assets for nature-based solutions, with adequate protections in place, could help Ireland to develop effective strategies in addressing flooding, rising sea levels, and wetter and damper weather.

Nature-based solutions that support resilience and adaptation to climate change often have multiple co-benefits, such as climate mitigation, biodiversity support, flood regulation, recreational uses, etc. Such solutions require an integrated approach that relies on having data on ecosystems to inform and monitor policy and practice.

The business case for nature-based solutions may not be easily made where the benefits are preventative in focus and not immediately visible, and even harder if the benefits from ecosystem services are not measured. For example, flood prevention and alleviation work may involve purchasing and rewetting land and it is not clear how future biodiversity benefits can be currently included in a cost benefit analysis.

Ongoing flood prevention by the Office of Public Works is drawing on nature-based solutions. This work would be further enabled by using natural capital accounts to inform decision-making.

Policy opportunities in the bioeconomy and circular economy, agriculture, and land use in which natural resources form a central role are also naturally aligned with nature-based solutions. The potential of natural capital accounting to inform and help monitor policy developments in these areas will be critical. Power *et al.* (2022) recommend that ministries of finance work to build awareness of nature-based risks across Government; integrate nature-related criteria into their strategies and decision-making; and co-ordinate nature-related risk management.

Some countries are placing natural capital accounting within this particular policy framing in order to facilitate nature-based solutions. For example, Canada's national statistics office, Statistics Canada, frames its Census of Environment (CoE) as contributing to tackling climate change through helping manage/identify nature-based solutions (see Box 3.1).

Box 3.1: Canada's Census of Environment

Designed to inform biodiversity and climate policy, and the development of nature-based solutions, Canada's CoE will provide a catalogue of Canada's ecosystems in order to support 'evidence-based decisions to protect, rehabilitate, enhance and sustain our environment' and provide that critical 'missing piece'. It is designed to help track, over time, the size and condition of ecosystems such as wetlands, coastal areas and urban forests. The Census will also highlight the services these ecosystems provide (e.g. clean air, food, recreation) and how they benefit human well-being and the economy.

Source: Statistics Canada, (2023a).

3.4.3 National, Regional and Local Planning and Development

Natural capital accounting can inform future iterations of the Strategic Environmental Assessment process by which environmental considerations are required to be fully integrated into the preparation of plans and programmes and strategies prior to their final adoption under the EU Strategic Environmental Assessment Directive (EU, 2001). Along with strategic flood-risk appraisal and assessment of the potential impact on biodiversity, Strategic Environmental Assessment helps integrate climate change, biodiversity, nature conservation and green infrastructure aspects into land-use planning at the national, regional and local levels (OECD, 2021).

Natural capital accounting could potentially be used in cost benefit analysis and at the project decision-making level. Clear guidance, such as in the UK and Netherlands (see Chapter 4), would need to be in place to support doing this. Natural capital accounting can also support different stages of decision-making, including informing, deciding and designing (IPBES, 2022; Lucas & Vardon, 2021), and across the policy cycle from policy design to monitoring, and review for strategic decisions. Lucas and Vardon (2021) identify some of these policy uses:

- The data can be used to inform *problem identification* through, for example, assessing the status and condition of ecosystems in a particular catchment area. Data can capture changes over time and be used as part of scenario planning for future development. This could inform a nature-restoration plan development.
- In terms of *policy design*, accounting data can be used in an ex-ante assessment of policies' effects on the economy and environment, considering the potential impacts, beneficiaries and costs of any proposed policy. This would be valuable in land-use policy design, for example.
- For *policy implementation*, accounting data can be used to inform a detailed pros and cons analysis of any policy intervention and can help assess what aspects should be delivered first. This would be key in implementing nature-based solutions.
- To *monitor and review policy*, the data can be used in an ex-post assessment of policy progress and evaluation of the need to adjust policy instruments or determine their effectiveness.

Natural capital accounting, particularly when used as a source of information on ecosystem services in spatial planning, can help with the early identification of potential risks of damage, conflicts or trade-offs, identify synergies among policy objectives delivered by nature-based solutions, and support more effective protection of biodiversity (EC, 2019b). Using natural capital accounts for decision-making in planning and development can help prevent unintended consequences in which decisions and policies can negatively impact nature, which in turn negatively impact people, albeit potentially facilitating climate-change mitigation or economic savings.

The green infrastructure approach has potential and is already included in the National Planning Framework (DHPLG, 2018) as a means of both more sustainable land management and of capturing ecosystem services.

Ecosystem accounts, under the SEEA, enable the placement of natural capital in a spatially explicit context. Spatial data can be helpful in local usage, as developed and used in the Netherlands (see Chapter 4). The quantity and quality of ecosystems, and the services that they provide, can be location-specific and indicated through mapping. This shows which locations and ecosystems provide what benefits and where degradation is taking place (UN-SSEA, 2023). By quantifying ecosystem extent, condition and services in a spatial manner, tracking their changes over time and making data available to the public, natural capital accounting (used in SEEA) has the potential to address a very wide range of economic and natural capital planning and policy issues (Bagstad *et al.*, 2021).

Natural capital accounting can be used in city planning to inform decisions; for example, in relation to urban green infrastructure planning, particularly for nature-based solutions. Dublin City Council's Development Plan 2022-2038 includes a focus on urban greening/nature-based solutions to ensure that the benefits of ecosystem services are realised within the city, including green roofs; tree planting for drainage, canopy cover, shade and air quality; constructed wetlands to improve water quality and prevent flash flooding; increased biodiversity; and providing corridors for movement of wildlife within the city (DCC, 2022).

UK cities are using natural capital accounts to help decision-making on green spaces (see Box 3.2).

Box 3.2: The City of Birmingham's Natural Capital Planning Tool

The City of Birmingham in the UK has worked with stakeholders to develop an accessible and easy-to-use natural capital assessment tool to monitor and increase green space as part of its Green Living Spaces Plan. The City of Birmingham estimated the stock of natural capital assets and flow of ecosystem services at a city-wide level as a basis for establishing targets for increasing green space as part of the Green Living Spaces Plan and to inform a 25-year Natural Capital Plan. The Green Living Spaces Plan assessment includes indicative monetary values in annual terms and asset values (over 100 years), based on value transfer.

The city adopted the natural Capital Planning Tool to inform planning and policy for sustainable land use, enabling the indicative but systematic assessment of the impact of proposed developments and plans on natural capital and ecosystem services.

Source: Phinney (2022).

3.4.4 Sustainable Finance and Investment

The standardisation of natural capital accounting through the EU and United Nations (UN) will underpin sustainable finance in the coming years. The development of standardised natural capital accounting practices is highlighted at EU level as one of a range of initiatives to pursue green finance and investment, for example via the EU Green Deal. The European Investment Bank provides investment potential, such as the Natural Capital Financing Facility, the InvestEU programme, and other public–private approaches to mobilising capital (EIB, 2023). The European Environment Agency has outlined that 'government policies need to promote national development policies in which natural capital is valued and considered. With these frameworks in place, financial institutions and public authorities can align their efforts, leading to outcomes that better prioritise sustainable development and the conservation of natural resources' (EEA, 2023: 3).

The EU taxonomy for sustainable activities is a classification system that establishes a list of environmentally sustainable economic activities to assist in the identification and/or reporting of sustainable finance investments or expenditures. One of the environmental objectives set out in the regulation is the protection and restoration of biodiversity and ecosystems (EC, 2021c), which will act as criteria for designation as green finance. It will inform future green budgeting, with a focus on biodiversity and other environmental objectives for sustainable investment. Natural capital accounting (used in SEEA) will be part of the evidence base for achieving this, over time, in order to ensure future evolutions of the taxonomy. There will be considerable opportunities for environmentally sustainable investment that is compliant under the EU taxonomy.

3.4.5 Towards an Integrated System of National Accounts

Implementing natural capital accounting can provide governments with a more complete view of their countries' public assets and support strategic management of natural capital, including balancing trade-offs. It can be used in budgeting, policy and planning to integrate nature considerations, along with climate-change, economic and social considerations, and in policy and planning as part of a whole-of-government approach to ensure effective asset management of all forms of a nation's capital. It can also be linked to social advancement, employment, and national wealth (Power *et al.*, 2022; EC, 2021b).

The forthcoming 2025 UN System of National Accounts (SNA) will include detailed guidance on how to measure and value natural capital as well as estimates of renewable mineral and energy resources (e.g. wind, solar, water and geothermal power) and enhanced guidance on other assets like uncultivated biological resources (Clarke *et al.*, 2023). While it is expected that the SNA and SEEA will ultimately closely align, it will take more time to fully integrate natural capital accounting.

Natural capital accounting is a prerequisite where countries wish to assess changes in inclusive wealth (OECD, 2021). Countries such as Canada, Mexico, the Netherlands and the UK are integrating natural capital into national measures of inclusive wealth, broad prosperity, environmentally adjusted net domestic product and quality of life. Natural capital accounts can enable participation in future assessments, such as via the Integrated Reporting Framework and the wealth accounting undertaken by the World Bank for 146 countries (IDEEA Group, 2023).

To develop an integrated approach and governance framework, certain key elements need to be considered if natural capital accounting is to be as useful as it can be, such as those outlined by the IDEEA Group, a leading global authority on natural capital accounting. Its considerations focus on the operational aspect of standards and methods, and on using and integrating the data with policy (IDEEA Group, 2023).

In the shorter term, there are opportunities to consider natural capital accounts alongside current economic and social data. For example, combining environmental/natural capital data with other socioeconomic data in the SEEA framework can give a richer understanding of well-being, deprivation and vulnerability – linking with place-based data. However, other macroeconomic and sustainable finance-policy uses are possible. Vardon *et al.* (2023) describe how natural capital accounting can be useful across the 'fiscal triangle' for taxation, spending and borrowing.

The OECD's guidance increasingly connects with the UN System of Environmental-Economic Accounting Central Framework (SEEA-CF); for example, on environmentally related tax revenue accounts (OECD, 2023). The SEEA-CF natural capital accounts, with regard to environmentally harmful subsidies and pro-environmental subsidies, can also inform efforts in green budgeting, where governments attempt to identify their annual fiscal budgets' impact on the environment. This exercise in Ireland focuses on identifying taxes, expenditures, subsidies and effective subsidies that have an impact (positive or negative) on environmental outcomes. It adds up the fiscal (monetary) amount of those subsidies. It is hoped that green budgeting could eventually be tied to an assessment of outcome; that is, the overall environmental impact. Ireland currently undertakes green budgeting with a focus on climate action only (OECD, 2021).

At a national, overarching level, information from natural capital accounting, tracking positive or negative national trends over time, can inform decision-makers' sense of priorities and awareness of areas requiring attention. Information from natural capital accounting can also, in very specific ways, be included in decision-making on whether to undertake specific activities; for example, by incorporating natural capital accounting data into multi-criteria or cost benefit analysis, or for specific sectors, such as agriculture or aquaculture.

The same set of accounts can underpin risk assessments and cost benefit analyses, assessing impacts on natural capital stocks (i.e. long-term sustainability), participation in environmental markets, and use in economic modelling, land valuations and supply chain assessments (IDEEA Group, 2023; OECD, 2023). It can also be used in economic modelling, in national accounts and to support strategic and local decision-making.

3.4.6 Well-Being Framework

The OECD's development of the Framework for Measuring Well-Being and Progress offers more holistic approaches that include natural capital (OECD, 2020). More recently, the OECD has identified that maintaining countries' natural capital is key for environmental sustainability (OECD, 2023).

Natural capital accounting can increase the visibility of nature's many benefits to society and well-being, which, in turn, can be better reflected in decision-making. Many direct and indirect benefits from nature contribute to health and well-being. Greater understanding of the distribution of ecosystems and services in urban areas, for example, can support green infrastructure development and climate adaptation measures and is important for planning developments in rural areas. The UK has examined the health benefits from recreation as part of the Natural Capital Accounts. The value of health benefits associated with outdoor recreation in the UK in 2020 was estimated to be between £6.2 billion and £8.4 billion (ONS, 2022a).

The National Well-Being Framework (Government of Ireland, 2021b) provides a further policy use as part of a wider shift to recognising that a country's well-being is assessed by more than economic development and a single measure of GDP, as noted in the report of the Citizens' Assembly. There is greater appreciation of the need for integrated information bringing economic, social and environmental considerations together in standardised, accessible ways for societal deliberation and public policy-making.

3.4.7 Reporting Requirements

Natural capital accounts can provide the data to address other reporting requirements. In particular, the information provided by ecosystem extent accounts and ecosystem service accounts can provide data for reporting on the extent of natural ecosystems and the services they provide. Some of these requirements are outlined briefly in Box 3.3.

Box 3.3: Reporting Requirements

The UN Kunming-Montreal Global Biodiversity Framework under the Convention on Biological Diversity (UN CBD) requires reporting on agreed targets, including the extent of natural ecosystems and the services they provide.[10] Member States' national reports to assess progress are due by 28 February 2026.

EU Member States must report to Eurostat with environmental economic accounts, following a proposed amendment from the European Commission to Regulation (EU) No 691/2011, after negotiation between the Council and Parliament as part of the UN System of Environmental-Economic Accounting (SEEA) framework.

Implementation of the SEEA framework and reporting system is included as a key indicator in the Sustainable Development Goals (SDGs) (UN, 2023). Some SDGs are directly related to natural capital and ecosystem accounting, but accounts can also provide a wide range of resource values essential to the realisation of all 17 SDGs; however, this relationship is frequently unrecognised –there are broader benefits from focusing on nature. Biodiversity-focused SDGs can act as multipliers for co-benefits across all goals (Government of Ireland, 2023e).

[10] The Framework's reporting requirements will include listing the services provided by ecosystems; the extent of natural ecosystems; indicators of monetary benefits received; and indicators of non-monetary benefits as well as other indicators on expenditure, agriculture production and green/blue space.

3.5 Risks that Could Limit Natural Capital Accounting

The Council recognises that fully integrating natural capital accounting, while providing important opportunities for Ireland, will require policy focus and commitment. However, concern over risks in the near future may limit how effective natural capital accounting will be for Ireland.

3.5.1 Comprehensive Accounts May Take a Long Period of Time

There is a risk that it may take a long time for comprehensive accounts to be fully developed, particularly given that the required regulations are still being finalised. Comprehensive accounts may not be produced in time to inform the pressing necessity of addressing biodiversity and climate policy challenges in policy-making.

Supporting the delivery of natural capital accounting to meet EU and international requirements is being led by the Central Statistics Office (CSO) and supported by the National Parks and Wildlife Service (NPWS); the Environmental Protection Agency (EPA); the National Biodiversity Data Centre (NBDC); experts, non-governmental organisations (NGOs); and citizens. The EU has been incrementally adopting the SEEA framework for natural capital accounting in recent years, with the latest development of SEEA-EA. This provides Ireland with a structured and robust foundation and the CSO is working on developing these modules through its Frontier Series and liaising with Eurostat. The CSO has increased its dedicated resources for ecosystems accounts but acknowledges that this is not an easy task. Recent research and practice have deepened our understanding of complex water and air quality, greenhouse gas emissions, forests, soil quality and other vital ecosystems and services.

The assessment of nature and increased use in policy requires a rapid increase in accounting scale and pace. This important operational work is underway and the CSO is building capacity and a collaborative approach to data gathering and analysis; this effort is reflected in the recent production of Ireland's first ecosystem extent accounts (CSO, 2023). Issues around data gaps and access to data remain key challenges, along with a lack of the capacity and ecological expertise that are required.[11] The lack of consistency of data collection, collation and utilisation is a barrier to understanding the true state of Ireland's nature.

The development in Ireland of data and systems that can support Payment for Ecosystem Services (PES), sustainable finance and the bioeconomy in agriculture is particularly urgent. The potential of natural capital accounting is that it can be the information system that informs and underpins an integrated approach that includes carbon, water, soil and other ecosystems that can help progress PES.

Ecosystem accounts are spatially explicit and underpinned by detailed spatial data. Regular updates of the National Land Cover Map will be required from Tailte Éireann to inform ongoing natural capital (and other land-use) reporting requirements. Additional work can build on this to develop an ecosystem map of Ireland.

3.5.2 Risks and Potential Impacts Not Fully Understood

A second risk is that, with evidence only now emerging, the potential risks and impacts of biodiversity, while recognised by Government, are not yet fully understood. The need for urgent action to prevent the continued erosion of Ireland's natural heritage has been outlined in forthcoming policy (DHLGH, 2022) and has been included in Ireland's 2023 Risk Assessment:

> *Irish biodiversity is a unique and priceless natural resource which is a fundamental part of what makes Ireland an attractive place to live. It also plays a vital role in supporting our rural economy … [It] will result in economic loss due to reduced ecosystem services, including diminished crop yields and fish catches and increased susceptibility to flooding, wildfires and disease, all of which have the potential to severely impact on people's quality of lives (Government of Ireland, 2023c: 26-7).*

[11] Many of the same issues that were raised by stakeholders about gathering and storing data have been detailed in the INCASE research project and in Natural Capital Ireland's (NCI's) *Data 4 Nature* report (2021b).

However, there may be other risks as yet unassessed; for example, reputational risks for Ireland if environmental decline undermines the country's green image that is used so effectively in marketing our agri-food sector abroad. It may be some time before this permeates more widely to departments, agencies and the wider public, a delay that may lead to lower prioritisation of the policy developments required to turn natural capital accounts into action.

A further risk is invisibility of the problem- in most countries, the benefits of biodiversity and healthy ecosystems for our well-being and future, for nature and the planet, are not generally counted and so can be hidden (OECD, 2021; IPBES, 2022; DHLGH, 2022). A natural capital approach can highlight the value of the natural environment that might otherwise go unnoticed, including the results of not protecting it (NIEL, 2023b). This invisibility may help to explain why, as the Citizens' Assembly outlined, Ireland has not treated biodiversity loss as the emergency it has been declared to be (Citizens' Assembly, 2023).

Described as a systemic weakness in economic measurement and analysis in the UK's Dasgupta review, it points to the need for governments and financial institutions to consider nature, biodiversity and ecosystems in its risk assessments and future planning (It concludes that 'nature needs to enter economic and finance decision-making in the same way buildings, machines, roads and skills do' (Dasgupta, 2021:4).

As IPBES outlines:

> *Economic incentives have generally favoured expanding economic activity, and often environmental harm, over conservation or restoration. Incorporating the consideration of the multiple values of ecosystem functions and of nature's contributions to people into economic incentives has, in the economy, been shown to permit better ecological, economic and social outcomes (IPBES, 2019: xviii).*

There is growing recognition around the world of economic and business nature-related risks. Some countries are already tracking risks using environmental economic accounting and natural capital accounting, as in the UK, for example, or using environmentally adjusted net domestic product, as in Mexico.

The World Economic Forum (WEF) has estimated that $44 trillion of economic value generation – more than one-half of the world's total GDP – is moderately or highly dependent on nature and its services and is therefore exposed to nature loss (WEF, 2020).

The financial risks from biodiversity loss and ecosystem degradation are increasingly being raised in the business and finance community (E3G, 2023). The European Central Bank has completed a preliminary assessment revealing that nearly 75 per cent of all bank loans in the euro area are to companies that are highly dependent on at least one ecosystem service, with 65 per cent noted for Irish bank loans. A board member of the European Central Bank has stated that 'If nature degradation continues as now, these companies will suffer and banks' credit portfolios will become riskier' (Elderson, 2023). In the Netherlands, where the government is supporting business in examining nature-related risks, De Nederlandsche Bank found that Dutch financial institutions alone have €510 billion in exposures to biodiversity risks (De Nederlandsche Bank, 2020).

For many other businesses, biodiversity is an input into the supply chain. For these sectors, the continued provision of ecosystem services is critical. As the WEF warns, 'as nature loses its capacity to provide such services, these sectors could suffer significant losses' (WEF, 2020: 13). These losses will 'reign in economic growth, employment and incomes and ultimately demand high levels of spending simply to protect whatever environmental quality remains' (Bullock *et al.*, 2020: 6).[12]

In 2022, the International Sustainable Finance Centre of Excellence published a scoping study that examined the risks and opportunities for Ireland in nature and biodiversity finance. It identified particular exposure risk in relation to real estate, land and development activities; manufacturing, whole/trade and repairs; and agriculture, forestry and fishing. A risk register could be developed using ecosystem extent accounts (ISFCOE, 2022). The INCASE project on natural capital accounting has developed an example of a risk register (Farrell *et al.*, 2022).

[12] Businesses are being supported in Ireland through NCI's Business for Biodiversity Platform and the international framework, and internationally with the Natural Capital Protocol (Business for Biodiversity Ireland, 2022; Capitals Coalition, 2016); the EU Corporate Sustainability Reporting Directive; and the Taskforce on Nature-related Financial Disclosures (TNFD, 2023).

Environmental risks from ecosystems in poor condition are not fully known. Recent focus on the pollution levels from blue-green algae in the freshwater Lough Neagh in Northern Ireland has raised awareness of some of the economic, tourism and societal impacts, as well as the impacts on nature, of a valuable water resource (see O'Reilly, 2023). However, without data on ecosystem services, it is hard to quantity these impacts.

3.5.3 Lack of Use and Integration

The final risk the Council identifies is that natural capital accounting will not be used or effectively integrated in order to impact decision-making. Without policy guidance, natural capital accounts may not be used in practice and will not be integrated into wider policy- and decision-making. A minimal response from Ireland in meeting new reporting requirements for natural capital accounting is possible, without using or incorporating the data more widely. However, this would not maximise the benefits for Ireland of building and managing these accounts.

There was a concern among stakeholders at the roundtables that nature and biodiversity have not integrated with wider policy. One participant reflected that 'we have nature policy, we've put that in a box over here, but we haven't let it influence economic and social policy'.

A potential 'influence gap' is not unique to Ireland and has been noted by the European Environment Agency (2018) and across OECD countries (Clarke *et al.*, 2023). A gap remains between 'the aspirations for natural capital accounting in policy use and actual uptake' (Bagstad et al, 2021:4). Vardon *et al.* characterise this as the need for both an 'accounting push' from practitioners and statisticians to develop and publicise the accounts and a 'policy pull' i.e. a demand by users for such data to inform policy-and decision-making (Vardon *et al.*, 2016). A key approach to building a 'policy pull' is to engage with decision-makers to reflect on the potential use and value of the data that can be produced. It can be difficult to achieve this result in practice. In the Netherlands an advisory group was established that aimed to maximise the decision relevance of Dutch SEEA-EA accounts (Hein *et al.* (2020) as cited in Vardon *et al*. (2016). However, the intended outcome has not yet materialised in practice.

This influence gap reflects a broader challenge of biodiversity mainstreaming. The Convention for Biological Diversity (CBD) calls for biodiversity issues to be mainstreamed across national decision-making, and to be integrated into all sectors of national economies and policy-making frameworks. This is reflected in the draft National Biodiversity Action Plan 2023-2030, which, in line with the CBD and the EU Biodiversity Strategy, strives for a 'whole of government, whole of society' approach to the governance and conservation of biodiversity (DHLGH, 2022: 5). The EU Biodiversity Strategy for 2030 also recognises that biodiversity considerations need to be better integrated into public and business decision-making at all levels. This should include measuring the environmental footprint of products and organisations, through life-cycle approaches complemented by, and eventually integrated into, natural capital accounting (EC, 2020). Data from the NBDC (2021) on biodiversity indicators shows poor status across measures aimed at mainstreaming biodiversity.

3.5.4 Policy Supports for the Effective Use of Natural Capital Accounting

Embedding valuations of nature into decision-making requires particular policy consideration and guidance and can ensure that data feeds into policy-making, as recommended by the expert group on natural capital accounting, the IDEEA Group (2023). Policy or legislative drivers, used in the UK and Mexico, can help hasten development of the accounts and their use. Irish research on freshwater ecosystem services recommends further efforts to 'build decision-support systems to move beyond the conceptual framework to mainstream ecosystem services into public and private decision-making processes' (Kelly-Quinn *et al.*, 2020: 32).

Three key areas can be considered in the effective development of natural capital accounting in Irish policy.

First, the policy actions and targets that have been prioritised by Government for short- to medium-term delivery can be explicitly linked as the purpose of the accounts. Better data is welcome but, when it is required for policy delivery, it can more directly address government commitments and, in turn, will more effectively drive the development and use of the accounts.

Second, consideration should be given to placing natural capital accounting within a wider environmental or societal vision or as part of a legislative or regulatory approach. Experience from other countries provides some examples to consider, such as outlining principles that reflect societal considerations around access to natural resources and healthy ecosystems, a step that would benefit from stakeholder engagement; for example, in how a just transition approach is used in climate policy.

Third, the governance for using the accounts in public policy could set out how and when data will be reported and where the information will be considered in the policy system – at the national, cross-government, departmental and local levels – and at what stages of the policy process; for example, at the problem identification, policy design, implementation evaluation and review stages.

Clarity in policy and departmental roles can underpin guidance and timing, for example in setting out short- and medium-term targets and, if particular supplementary analysis is required, on the condition and changes in particular ecosystems, such as forests, freshwater lakes, marine, and soil. It could also outline future ambitions for the development of natural capital accounting, such as the integration of the accounts with the SNA, currently being revised by the UN. This will take time to establish. A roadmap or sequencing of incremental steps to bring natural capital accounting firmly into the policy process would be valuable.

Governance considerations could also include capacity-building to enhance understanding of the accounts and their uses, but also to provide clarity of roles and accountability to bring natural capital accounting firmly into routine use.

3.5.5 Governance for Effective Use of Accounts

To progress to a holistic, joined-up vision across the governance landscape, Neill *et al.* (2022) pointed to the need for governance systems to be primed and ready to make use of emerging science and management tools. This will require increased ecological capacity across the policy system and points to the wider connections needed between accounts, research and public governance (EEA, 2018). To bring a 'whole of government' approach to natural capital accounting could help to ensure that all departments have a role. As one stakeholder commented, 'every department understands the economy, they don't have to be prompted, it's embedded in the system. How to get the point to be thinking about nature in that way?'

Guidance on using information from environmental accounts can potentially make the policy-making process more structured. It supports evidence-based policy-making and transparency, and creates a clearer perspective on the trade-offs resulting from political choices – it can depoliticise parts of the process (Döhring *et al.*, 2023). This requires an institutional set-up and competencies characterised by a demand-driven approach, co-operation, transparency, trust and data sharing; recognised tasks; and multiple, effective communication channels.

The European Commission in a staff working document has presented key steps for the integration of ecosystems and their services into decision-making, as well as examples of questions to address in each step, and are intended to be broad so that they can adapted to apply to specific processes in both higher-level (sectoral) policy-making and concrete decisions on the ground (EC, 2019b). In the Netherlands, as outlined in Chapter 4, a 'policy compass' provides guidance to policy-makers on formulating a new policy, intervention, or policy revision.

Incorporating natural capital accounting into a wider, principle-led approach can help shape the purpose and use of accounts. Developing principles, safeguards and good practice guidelines for using natural capital accounting is advisable in order to improve the quality of ecosystem-related decision-making (EC, 2019b).[13] These could include principles on improving ecosystem condition while contributing to well-being and prosperity for net social gain; addressing net interdependences and trade-offs; tackling potential negative impacts; or applying the precautionary principle to protect ecosystem condition and resilience, as well as supporting the delivery of ecosystem services (EC, 2019b). As environmental data is increasingly used in decision-making, it will not always be easy to reconcile and balance with economic, social and environmental considerations.

In the UK, the Department of Agriculture, Environment and Rural Affairs' (DEFRA's) five principles included in the Environment Act 2021 help to inform policy and how accounts are used: integration, prevention, rectification at source, polluter pays, and the precautionary principle (DEFRA, 2023a). Principles can reflect broader societal, economic and

[13] This includes the Convention for Biological Diversity's 12 principles of the ecosystem-based approach (CBD, 2007).

environmental objectives. Another guiding framework that can inform natural capital accounting is Agenda 2030- the Sustainable Development Goals. One consideration for the development of a policy framework is how to reflect existing and future environmental limits (e.g. carbon budgets, water-quality targets, planetary boundaries) into the governance within which decisions are made (EEA, 2018).

Distribution and Environmental Justice Considerations

Distribution and environmental justice issues can be part of the suite of policy questions and uses for the SEEA-EA (Atkinson & Ovando, 2022). Data and mapping will bring into view existing inequalities in the access to ecosystem services and requires appropriate processes and governance. In the development of a policy framework for using natural capital accounting and its potential impact on policy, equality-of-access questions will arise; for example, who may *not* be benefitting from ecosystem services such as clean water and air quality? This is an emerging issue internationally with a focus on environmental justice, access to clean air, green spaces and climate impacts (Atkinson & Ovando, 2022). Distribution questions will be highlighted through the spatial mapping of ecosystem services.

In ecosystem accounts, it is possible to identify the supply and use of ecosystem services. Denmark has piloted Supply and Use Tables for ecosystems services from plants (crops, timber) and animals (fish, wild terrestrial animals), as well as from groundwater, and their use by industries and households (Vind, 2018).

Scotland has adopted an approach to natural capital that takes social and community aspects into account through the Scottish Land Rights and Responsibilities Statement (Scottish Land Commission, 2022) and Scottish Land Commission's protocol on natural capital and carbon management (Scottish Land Commission, 2023b). Engaging communities in decision-making on natural capital projects can help to share the benefits that these projects generate (Scottish Land Commission, 2023a).

This is an emerging area of knowledge and practice that requires a learn-by-doing approach where policies and procedures can be adapted as more is learned. This requires coherence and clear and consistent governance but also collaboration and wide engagement to ensure that the accounts are effectively used.

3.6 Conclusion

The use of the UN SEEA framework for natural capital accounting provides a standardised and robust approach to accounting for nature that provides Ireland with a firm foundation on which to build. It provides a number of significant opportunities to meet policy numbers but also has risks in how it is further developed. The purpose, use and application of the accounts requires Irish consideration in order to meet national requirements. This will enable the SEEA framework to function as it was intended: as an integrative framework for environmental data that can sit alongside economic and social data. It is how these accounts can be integrated into policy decision-making that is the value-add for Ireland.

The next chapter provides an insight into how other countries have applied natural capital accounting.

Chapter 4

International Experience of Natural Capital Accounting

4.1 Introduction

According to the United Nations (UN), 91 countries have compiled accounts using the UN System of Environmental-Economic Accounting Central Framework (SEEA-CF) and 41 of these have compiled System of Environmental-Economic Accounting (SEEA) ecosystem accounts (UN, 2023). The level of implementation, or completeness, of these accounts, varies considerably. In 2020, just 18 countries had undertaken 1 or more of either ecosystem extent, condition or service accounts, or a national-level biodiversity assessment (Hein *et al.*, 2020).

A relatively small number of countries so far have managed to systematise production of the national-level System of Environmental-Economic Accounting for Ecosystem Accounts (SEEA-EA) in order to present ecosystem accounts and natural capital asset estimates nationally, although more countries are now moving in that direction. This reflects the comparative 'youth' of the standardisation of these accounts. Nevertheless, with a global crisis in biodiversity and the agreement of the UN Kunming-Montreal Global Biodiversity Framework in 2022 (see Section 2.1), interest is high, and implementation is steadily progressing in rich and poor nations alike.

To support the preparation of this report, a review of international experience and legislative or policy context with natural capital accounting was undertaken. A detailed exploration of the experience in Mexico, the Netherlands and the United Kingdom (UK) was also undertaken, with a brief introduction to relevant developments in Australia, Canada and the United States.

The approaches vary significantly with each country offering diverse and valuable insights and learnings. The UK example demonstrates how natural capital accounts can be deeply embedded in policy-making processes through legislation, policies and government guidelines, but, at the same time, how a lack of spatial or ecosystem based data can reduce or limit its application or local relevance. The Netherlands demonstrates the possibilities of a rich, spatial dataset for insights but the dangers of neglecting the policy and implementation linkages. The Mexican example demonstrates the value of collaboration and strong linkages between key data providers. Australia, Canada and the United States offer further insights on these themes.

4.2 Countries' Experiences

Our review of countries' experiences shows that all countries align their statistical and accounting efforts with the UN SEEA standards. But even within those standards, countries have been able to take varied approaches, adjusting their focus and perspective tailored to in-country priorities and conditions and to data availability. Different choices, data limitations or approaches can influence the suitability or attractiveness of the data to inform different types of use, whether that is policy-making, environmental management, decision-making or public awareness.

Relatively few countries have experience of years of systematic production of natural capital and ecosystem accounts. The UK and Netherlands have the most experience in the systematised production of complete natural capital accounts, including ecosystem accounts. Mexico has a long history of producing environmental economic accounts and recently completed a project to develop natural capital accounts including ecosystem accounts. Canada and the United States have programmes or strategies in place to get to that point. Overall, natural capital accounting is a comparatively new area of statistical development. Nevertheless, there are some useful insights already to be gained from a review of some international experiences to date.

Table 4.1 offers a brief overview of the selected countries and how their experience fits within the framework of building, enabling and impacting.

Table 4.1: Overview of Selected Countries' Approaches to Natural Capital and Ecosystem Accounting

	What	How		
		Building	Enabling	Impacting
UK	Annual valuation of ecosystem services and derived asset values for the UK. Other modules completed for ecosystem types such as forestry, peatlands periodically.	Established the Natural Capital Committee in 2012 to advise on approach – (Department of Environment, Food and Rural Affairs (DEFRA) and Office for National Statistics (ONS). Ten ONS staff work on natural capital.	Enacted the 2021 Environment Law with five principles for policy-making and mandates, including for 15-year environment plans and environmental targets aimed at bringing nature into planning processes.	DEFRA's Nature at Work for People and the Economy: 10 Insights from the England and UK Natural Capital Accounts (2023b) recommends taking natural capital into account in decision-making via Treasury guidelines.
Netherlands	Three-yearly ecosystem extent, condition and ecosystem service accounts split by ecosystem type and province, physical and monetary estimates	There is early funding from EU and the agriculture Ministry and consultation with advisory board of users, in addition to four staff in the national statistics office and contracted support from Wageningen University & Research. Funding research on nature-based solutions is available.	A legislative and policy framework for nature and environment sets the overall ambition. Detailed policy work and implementation are devolved to the provinces. It supports business, sectors and regions in considering biodiversity risk.	There has been a parliamentary request to include natural capital in well-being monitor. Policy compass (guidelines) includes how to reflect impacts on nature.
Mexico	There are pilot ecosystem extent and condition accounts with physical and monetary estimates, ecosystems and conditions mapped. A long time series on ecologically adjusted National Domestic Product (NDP), known locally as PINE.	Early World Bank funding built environmental economic capacity. Later EU funding built capacity on ecosystem accounts. There are seven staff working on natural capital and environment statistics at the national statistics office Instituto Nacional de Estadistica y Geografia (INEGI).	Established the right to a healthy environment via constitutional amendment. The General Law of Ecological Equilibrium and Environmental Protection created a framework law on environment including a mandated calculation of ecologically adjusted net domestic product (NDP). There is also an interministerial commission on biodiversity	Ecologically adjusted NDP is mandated as a measurement of sustainability of economic growth in the national development plan. Natural capital accounts are linked to UN CBD reporting.
Australia	Modules including ecosystem extent have been carried out. A legal basis for eco credits has been created.	Cross-government and territories' policy on environmental data aims to enable decision-making that balances economic, social and environmental outcomes. Legislation for bio credits has been created.		
Canada	Modules including ecosystem extent have been completed. A, Census of Environment is in development.	A five-year Treasury-funded programme to build the CoE has been co-sponsored by the ministry of Environment and Climate Change. Policies for data disaggregation and mapping and a quality of life index are in place.		
United States	There is a commitment to develop ecosystem accounts.	There is a cross-agency strategy, led by White House Office of Science & Technology Policy with the Office of Management and Budget and the Dept of Commerce. There is a 15-year plan to develop a 'Change in Natural Asset Wealth' core statistic.		

Source: Author's own research and interviews with international experts.

4.3 National Statistical Offices

The countries we reviewed have all mandated their national statistical offices to gather, develop and publish natural capital accounts. The national statistical offices are independent institutions with established reputations for robust and reliable data.

With regard to place-based data and ecosystem extent accounts, some national statistical offices benefit from strong linkages to official geographical mapping institutes. For example, in Mexico the national statistics agency, the National Institute of Statistics and Geography, is responsible for developing and disseminating statistical and geographical information about Mexico. Weak linkages in this regard can be a barrier to advancing place-based statistics. On the other hand, very large countries have challenges in compiling complete landcover and land-use data and therefore often look to satellite data and analysis rather than administrative data.

Of the countries reviewed, national statistical agencies in Australia, Canada, Mexico and the UK located the natural capital or environmental accounts team within their economics division. This reflected the long-term intention in those countries to create linkages between the two areas for a more complete view of the economy.

4.4 Leadership from Central Government

In some countries, political commitment to nature, the environment or natural capital is evident in their policy and regulatory frameworks, particularly in the UK and Mexico. Some countries (Australia, Mexico, UK) give a specific place in policy-making to the consideration of environmental data. Leadership from central government is evident in some form in all the countries examined.

Mexico amended its constitution in 1999 to capture the right to a healthy environment and to establish liability for environmental damages:

> *Any person has the right to a healthy environment for his/her own development and well-being. The State will guarantee the respect to such right. Environmental damage and deterioration will generate a liability for whoever provokes them in terms of the provisions by the law' (Government of Mexico, 2019).*[14]

Under a framework environmental law, the General Law of Ecological Equilibrium and Environmental Protection, enacted in 1988, the official statistics agency, the National Institute of Statistics and Geography, was mandated to prepare the ecologically adjusted net domestic product statistic (abbreviated as 'PINE' in Spanish) annually (Government of Mexico, 1988).

In the UK, the Environment Act 2021 sets out environmental principles that must be taken into account by ministers when making policy, including the principle that environmental protection should be integrated into the making of policies; the principle of preventative action to avert environmental damage; the precautionary principle in relation to the environment; the principle that environmental damage should as a priority be rectified at source; and the polluter pays principle (UK Government, 2021).

Under the 2021 Act, the Secretary of State for Environment, Food and Rural Affairs is required to set a number of long-term environmental targets, including for biodiversity and species abundance. The Act also sets a requirement for an environment improvement plan covering at least 15 years. The 2018 environment improvement plan, 'A Green Future: Our 25 Year Plan to Improve the Environment', specifies the intention to 'set gold standards in protecting and growing natural capital – leading the world in using this approach as a tool in decision-making. We will take into account the often-hidden additional benefits in every aspect of the environment for national well-being, health and economic prosperity, with scientific and economic evidence to the fore' (HM Government of England and Wales, 2018: p.9). The

[14] See the Political Constitution of the United Mexican States at https://www2.juridicas.unam.mx/constitucion-reordenada-consolidada/en/vigente [accessed 13/11/23].

UK Treasury also showed leadership by commissioning the influential Dasgupta review on the economics of biodiversity, which was published in 2021 (Dasgupta, 2021).

Specifically on the development of natural capital accounts, DEFRA provided leadership by establishing the Natural Capital Committee in 2012 to advise the Government on natural capital, and by collaborating closely with the ONS in the early development of natural capital accounts.

In Australia, the Government and state and territory governments agreed on a strategy and action plan for environmental-economic accounting. The agreed vision is that 'the Australian community understands the environment's contribution to our quality of life, and its condition and value are accounted for in decision making for a prosperous and healthy society' (Australian Government, 2020; p3).

In Canada, the ministry of Environment and Climate Change co-sponsored Statistics Canada's proposal for funding the Treasury for a five-year programme to build its CoE.

4.5 Spatially based data

National-level data is useful in informing high-level discussions on the ambition of nature policy or the success of its implementation but is not well suited to supporting environmental management. Place-based data at higher resolution can support local environmental management and decision-making. Availability and mapping of local data can also increase the interest and engagement of the public with the data.

The Netherlands produces data on ecosystem extent, condition, and services at a resolution of 10 m^2 (CBS, 2021). This data is reproduced on maps so that anyone can become informed about the ecosystems and respective services in their local area. Aggregate statistics of ecosystem-service values, ecosystem extent and condition are produced at the provincial and national level. For comparison, until the recent publication of Ireland's Landcover Map (at a resolution of 1 hectare), Ireland relied on the European Corine database, which offers resolution at a scale of 25 hectares.[15]

In Mexico, a much larger country, ecosystem extent and condition data is produced at a resolution of 6.25 hectares and is reproduced on maps (INEGI, 2021). Canada, an even larger country with many areas extremely sparsely populated, has produced data on ecosystem extent at a scale of ecozones, which is an established official approach to dividing the territory of Canada according to geographic and climatic features (Statistics Canada, 2023b). Canada has 15 ecozones. Statistics Canada has a policy to increase the disaggregation of its statistics to make it more relevant to different communities and to make it available, where possible, on maps.

Maps are a useful tool for visualising data, and for bringing disparate statistics on individual areas together, helping the user see the data of relevance to them and to make connections between datasets. In the UK, the ONS found, across all areas, 'charts that allow the user to get information that is personalised or local to them, like calculators or maps, tend to get more interaction' (Broad, 2021). Similarly, statisticians with Statistics Canada found that the environmental data that generated the most media interest was the urban greenness indicator, where the performance ('greenness' in terms of tree cover etc.) in different communities and localities can be compared.

[15] One hectare is 100 m by 100 m or 10,000 square metres.

4.6 Monetisation

Official statistics on the monetary values of nature can facilitate the inclusion of nature in evaluation and appraisal techniques such as cost benefit analysis or cost effectiveness analysis. This can inform environmental management decisions or decision-making across sectors more broadly. Other options for reflecting biodiversity in decision-support methodologies, like biodiversity points, also require a substantial amount of source data and have similar limitations.

However, monetary values in the natural capital accounts will not fully reflect the importance of ecosystems for people and the economy.[16] This valuation does not aspire to generate a full, or true, value of nature or to 'put a price' on nature. Further, monetary valuation will not be appropriate in all decision-making contexts, and, in all cases, using associated biophysical data on stocks and flows will remain relevant (UN, 2022).

The UN acknowledges the different perspectives among statisticians and, more broadly, different perspectives on the use of monetary values of environmental stocks and flows in the measurement and assessment of the environment. Different perspectives raise and focus on issues regarding the underlying framing, potential to support decision-making, and the reliability of values in practice (UN *et al.*, 2022).

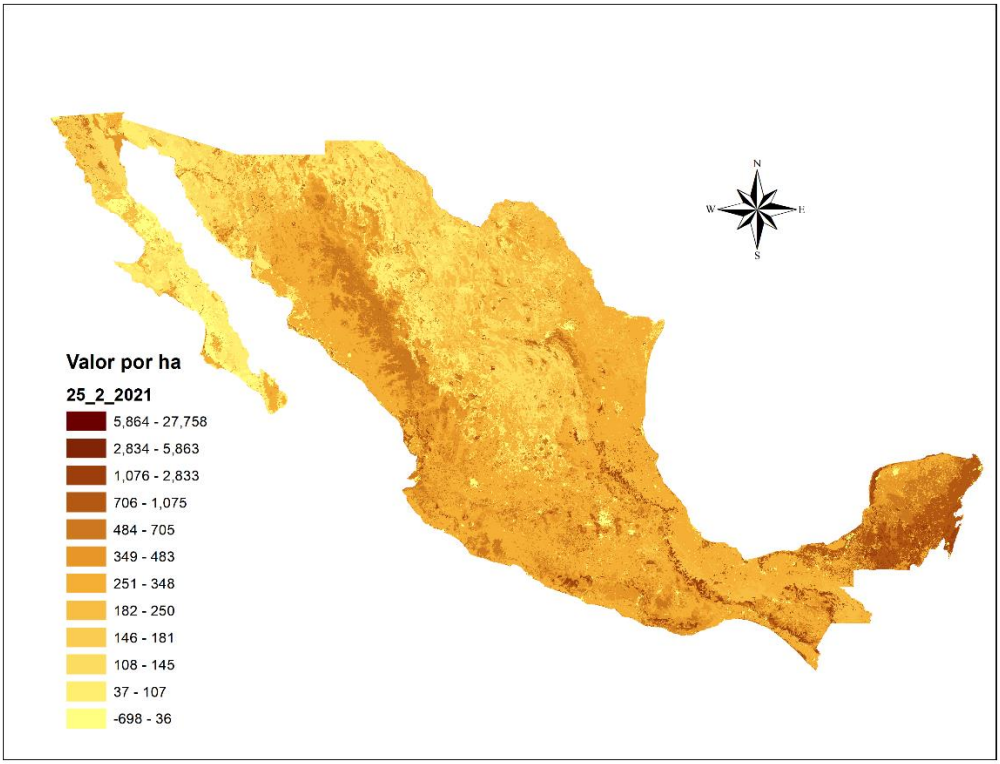
Natural capital accounting can also be used to inform national/global sustainability assessment measures, such as 'genuine savings' or 'inclusive wealth accounts', which are informed by both physical and monetary natural capital accounts. For example, the World Bank Changing Wealth of Nations (CWON) 2021 report examines the underlying value of a nation's wealth, taking into account human, produced, and natural capital and noting where assets are being managed sustainably or unsustainably. The report represents the world's most comprehensive accounts to date of the wealth of nations comprising not only what was made by people (produced capital) but also the wealth embedded in people themselves (human capital), and the wealth offered by nature (natural capital) (World Bank, 2021).

The UK's natural capital accounts are designed for monetisation of the annual flows and asset values of ecosystem services across all ecosystems. This valuation is used by the ONS to underpin periodic valuations to the UK of different individual ecosystem types. For example, an estimate of the asset value of forestry and woodland ecosystems, taking into account the value of ecosystem services from standing trees, has been regularly prepared. Less regular estimates have also been prepared for peatlands, the marine and, most recently, urban natural capital. These estimates are useful for informing policy priorities; for example, the estimates of value of woodland ecosystems routinely show that the value of ecosystem services from woodlands is greater than the harvesting value of the timber. In fact, the value from woodlands of carbon sequestration, pollution removal or recreation are each greater than the value of timber provision in both annual value and asset terms (ONS, 2023).

Mexico produced estimates of monetary valuation of ecosystem services as part of its Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project. This found that, in 2013, the net contribution of ecosystems services assessed under the project (agricultural provision, carbon (soil and biomass) sequestration and storage, pollination, residential water and nature tourism) was estimated at 2.79 per cent of GDP. The largest share of that was from carbon storage and sequestration service, assuming a carbon price of US$25/t CO_2. The valuations per hectare of the different assessed ecosystem services were mapped across the country at a 6.25-hectare resolution (see Figure 4.1). The NCAVES project noted that 'The monetary valuation of ecosystem services relies on a considerable amount of physical data that serve as input for the biophysical models. Therefore, it is recommended to compile ecosystem services flow accounts, in a spatially-explicit manner, before starting with the monetary valuation' (INEGI, 2021: 169).

[16] UN SEEA guidelines recommend inclusion of exchange values rather than a full valuation of the benefits of natural capital. This is to maintain consistency and the ability to integrate with systems of national accounts.

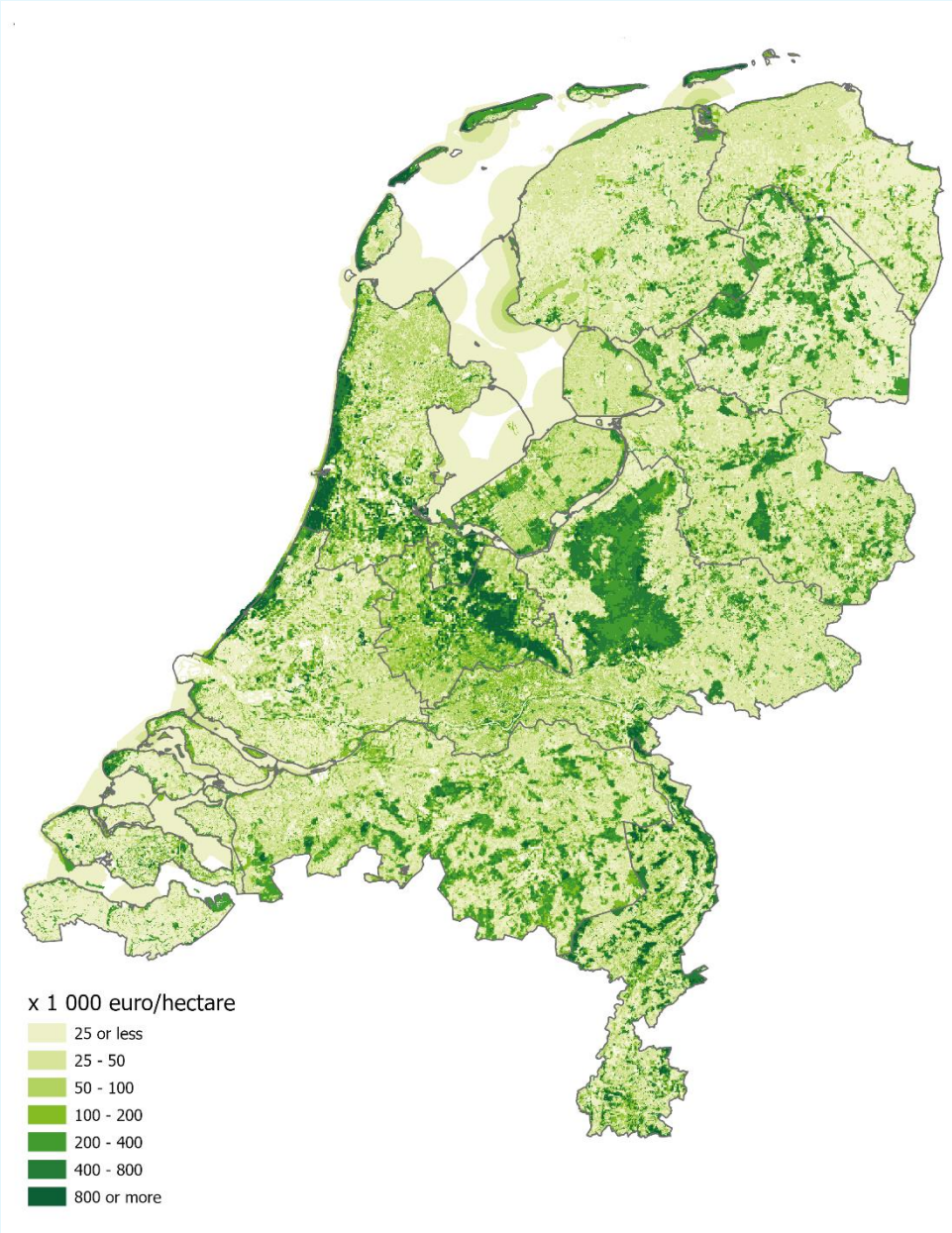
Figure 4.1: Value of Annual Soil Organic Carbon Storage and Sequestration Service (2,013 Pesos Per Hectare)



Source: INEGI (2021).

The Netherlands provides estimates of values with the possibility of seeing the values attributed to individual ecosystem types or disaggregated to province level in the accounts. It has produced a map where it is possible to view the contribution of ecosystems to the green quality of life in the Netherlands, on a euro/hectare/year basis. It has also produced a table of the top 15 ecosystem types with the highest average monetary value, with parks and coastal dunes in first and second place followed by semi-natural woodland.

Figure 4.2: Value of Ecosystem Capital in the Netherlands based on 10 Ecosystem Services, 2018



Source: CBS (2021).

Monetisation, i.e. estimating values for different ecosystem types, can directly inform action. For example, in Australia a Bill to establish a 'nature repair market' has been put to parliament to make it easier for businesses and individuals to invest in nature. This legislation will establish a 'nationally consistent framework for measuring, monitoring, reporting, verifying and publicly tracking biodiversity projects' (DCCEEW, 2022: 10). One international expert we spoke to in Australia sees natural capital accounting and the UN SEEA-EA guidelines as being the obvious and most suitable foundation for these efforts.

Natural capital accounting can also be used to inform national/global sustainability assessment measures, such as 'genuine savings' or 'inclusive wealth accounts', which are informed by both physical and monetary natural capital accounts. For example, the World Bank CWON 2021 report examines the underlying value of a nation's wealth, taking into account human, produced, and natural capital, and noting where assets are being managed sustainably or unsustainably. The report represents the world's most comprehensive accounts to date of the wealth of nations that comprises not only what was made by people (produced capital) but also the wealth embedded in people themselves (human capital), and the wealth offered by nature (natural capital) (World Bank, 2021).

The OECD argues that 'valuation of ecosystem services and assets in monetary units is of primary importance to make consistent comparisons between SEEA natural capital accounting and standard economic measures, such as GDP or produced assets, as recorded in the system of national accounts (SNA)' (OECD, 2021; p22).

4.7 Combining Environmental with Other Data

Canada, Mexico, the Netherlands and the UK combine environmental data with other datasets to enhance the understanding of developments in their economy or society.

Canada's national statistics office, Statistics Canada, collates a quality-of-life hub, bringing together information and statistics on prosperity, health, society, the environment and good governance in Canada. The environmental statistics include air quality; drinking water; walkable communities; access to public transit; conserved areas; Canadian species index; water quality in rivers; greenhouse gas emissions; marine and coastal ecosystems; and natural capital.

Mexico has measured ecologically adjusted net domestic product since 1998. Known in Mexico as 'PINE', this statistic adjusts net domestic product for depletion of natural resources and environmental degradation. The figures for these are drawn from modules of the environmental economic accounts. PINE is used to assess the sustainability of economic growth.

The Netherlands' national statistics office (Centraal Bureau voor de Statistiek) brings together a range of economic, social and environmental statistics in order to understand the progression of 'broad prosperity' or well-being over time. Some of the environmental statistics included are exposure to managed natural assets within protected areas; quality of inland bathing waters; nitrogen deposition; urban exposure to Particulate Matter (e.g. PM2.5); and percentage of population experiencing 'environmental problems'. The broad prosperity indicator has revealed some interesting results where the ranking of a province in respect of narrow or broad prosperity varies significantly. Friesland has the second-lowest per capita GDP in the Netherlands but has one of the highest life satisfaction ratings. In contrast, the Greater Rijnmond, a highly urbanised area, has relatively high income but is at the bottom of the ranking for indicators of subjective well-being, and health, work and leisure time. Some attribute these results to environmental quality in those provinces.

In the UK, the ONS is developing a statistic on inclusive income. The aim is to complement rather than replace national accounts-based measures of economic progress. The Gross Inclusive Income (GII) measure expands the definition of 'the economy' to include unpaid household production and additional ecosystem services from natural capital. GII will include investment in, as well as ecosystem services from, all natural capital assets identified in the SEEA environmental economic accounts. The UK's natural capital accounts do not yet disaggregate changes into investment and capital consumption and therefore more research is required to properly reflect its natural capital in GII. Net inclusive income builds on GII by accounting for depreciation in produced, human, and natural capital (ONS, 2022b), while adjusted inclusive income could, for example, reflect externalities amongst other adjustments.

4.8 Regularity of Statistics

The regularity of statistics can influence their uptake by policy- and decision-makers and their use in environmental management. The UK produces its natural capital and ecosystem accounts on an annual basis. Other countries such as the Netherlands produce their ecosystem accounts on a three-yearly basis. Most countries that have produced ecosystem accounts have not yet achieved regular production, having produced their accounts on a pilot or project basis (CBS, 2021).

Consultation with international statisticians and experts brought different perspectives on this issue. Three-yearly data is less attractive to policy- or decision-makers to include in their analyses because, at a given point in time, a statistic could be as much as five years out of date.[17] Economic national accounts, such as GDP, are produced on an annual or even quarterly basis despite some underlying data being available less regularly; for example, population data is five-yearly. It was noted by a number of statisticians we consulted with, that public or media interest is diminished for statistics that are seen as old news. There were some concerns from other experts that data may not change significantly on an annual basis but this was countered by concern that, for effective management, more regular data is required. Payments for ecosystem services, in particular, are likely to require data more often than every three years.

Other requirements related to monitoring and reporting greenhouse gas emissions, under the EU Land Use, Land-use Change and Forestry (LULUCF) regulations, will introduce a requirement for 'geographically explicit land use conversion data' (EU, 2023; 26). The European Commission notes the intention to enhance 'the quality of monitoring, reporting and verification (MRV) of emissions and removals, thanks to new land monitoring technologies, techniques, and equipment, such as digital mapping and Earth observation, and datasets generated by the EU's Common Agriculture Policy' in support of carbon farming schemes and land management practices (EC, Undated). Pragmatically, synergies could be exploited between these reporting requirements and natural capital accounts.

4.9 Use of Data

It is too early to assess the impact of environmental economic accounting on environmental outcomes. Nevertheless, in some countries, the use of environmental data in decision-making is encouraged or required under national policy or legislation. On the other hand, where the use of statistics is not anchored either in policy or legislative frameworks, or in official guidance on appraisal and evaluation practices, statistics can be underutilised. This can lead to duplicated analytical effort where additional methodologies are developed to reflect nature in policy, planning and decision-making.

In the UK, Treasury guidance for the appraisal and evaluation of policies, programmes and projects (*The Green Book: Appraisal and Evaluation of Central Government*) contains an explainer and recommendations on natural capital (HM Treasury, 2022). It strongly advocates the use of the natural capital approach and, if a screening test is passed, directs policy-makers towards detailed guidance on the DEFRA website, 'Enabling a Natural Capital Approach (ENCA)'. DEFRA also published an 'insights' paper on nature and natural capital based on the ONS 2023 paper, 'Nature at work for people and the economy' (DEFRA, 2023b). The paper included the following among its ten insights:

- Nature should be seen as a large economic sector in its own right.
- Nature works for many sectors of the economy and society, but this contribution is not visible within conventional accounts.
- Natural capital is a major source of national wealth.
- The economic value of nature depends on its location, on demand and on population, as well as on its extent and condition.

[17] This can occur where three-yearly reporting is coupled with a two-year time lag to publication of statistics. From an interview with Carl Obst (2023).

- Nature is a significant health-service provider.
- Nature in urban areas is especially valuable (DEFRA, 2023b: 3).

In the Netherlands, a 'policy compass' provides guidance to policy-makers on formulating social intervention, revising existing policy, or creating a new policy file. The policy compass contains five steps: (1) what is the problem? (2) What is the intended purpose [of the intervention]? (3) What are the options for achieving the goal? (4) What are the consequences of [choosing] those options? And (5) what is the preferred option? Guidance for the fourth step includes identifying the consequences of the intervention for the environment, how the options impact broad prosperity, including natural capital, and how the options affect the achievement of the Sustainable Development Goals. The Netherlands also provides guidance for social cost benefit analysis that includes consideration of impacts on biodiversity through the lens of ecosystem services as well as a system of calculating biodiversity points (KCPR, 2023).

The Netherlands collects a substantial amount of environmental data that it uses in many different ways. A website that provides a 'Compendium for the Living Environment' is a collaboration between the national statistics office (CBS), the Netherlands Environmental Assessment Agency (Planbureau voor de Leefomgeving or PBL), Wageningen & Research, and the National Institute for Public Health and the Environment, which brings together data on the environment, nature and space (Government of the Netherlands, 2023). The website also provides visitors with an explanation and interpretation of the data.

Much of this data is used to monitor progress on the Netherlands' 'National Environmental Vision' (*Nationale Omgevingsvisie* or NOVI); PBL produces a biennial assessment of this strategy's progress. Indicators include marine fauna; waste generation and treatment; greenhouse gas emissions; housing construction in unfavourable locations for soil and water; nature quality; red list species; soil acidity; and scattered buildings in valuable landscapes (Kuiper *et al.*, 2023). Environmental data, including data on nature, is also mandated for inclusion in cost benefit analyses prepared to inform decisions on policy or expenditures/investments. In 2013, guidelines for including the impact on nature in cost benefit analyses were published jointly by PBL and the Netherlands Bureau for Economic Policy Analysis (Romijn & Renes, 2013). These were further developed in supplementary guidelines published in 2018 to recommend the use of biodiversity points. Biodiversity points measure the impact of an intervention on the amount and quality of biodiversity in a standardised way. They are not expressed in monetary terms and consequently do not affect the calculated monetary net benefits. The biodiversity points are calculated by multiplying three components:

- 'The area of natural or semi-natural ecosystems affected (in hectares or square kilometres);
- The ecological quality of each area;
- A weight factor per type of ecosystem, reflecting the contribution of the ecosystem to species richness at national, European or global level, which depends on the species present in the ecosystem and their threat level' (Bos & Ruijs, 2019: 8).

The second and third elements are not derived or drawn from the natural capital accounts, which seems like a missed opportunity. It is noted that biodiversity points allow positive impacts on biodiversity to be taken into account whereas a regulatory compliance check can only reflect negative impacts. However, use of natural capital accounts would also allow the consideration of both positive and negative impacts.

4.10 Collaboration

The development of natural capital accounts in many of the cases examined benefitted from collaboration with international experts, other agencies and/or academics.

For example, in Mexico, the NCAVES pilot on the valuation of ecosystem services revealed

> *the need to work in close coordination and collaboration with the experts in environmental economics, ecology and geospatial information within a more formal structure. Although since the beginning of the project there has been an interinstitutional working group … the experience and knowledge of experts could also be broadened and include factors such as the SHCP [Ministry of Finance and Public Credit], the Ministry of Economy and the Bank of Mexico (INEGI, 2021: 169).*

4.11 Conclusion

Natural capital accounting and environmental economic accounting in particular is a relatively new discipline. Nevertheless, examination of just a selection of countries demonstrates a wealth of experience that can offer useful insights to inform the further development of natural capital accounting in Ireland. It is clear from the countries featured that the usefulness and use of natural capital accounting does not appear spontaneously but requires intention and support from central government in order to develop.

In summary, other countries' experience in natural capital accounting highlights the need for policy clarity and guidance alongside the accounts.

This experience points to the importance of a supporting policy framework and leadership from the 'parent' department. In the UK, DEFRA and the ONS jointly led the early development of natural capital accounting methodology with valuable guidance from the natural capital committee set up by DEFRA. This leadership continued with DEFRA leading on the integration of natural capital accounting with the UK's environmental policy and legislation. In Canada, the Ministry of Environment and Climate Change co-sponsored the statistics agency's successful request to the Treasury to fund the new CoE programme. In the Netherlands, the Ministry for Agriculture, Nature and Food Safety funded the early development of natural capital accounts.

Adopting the UN SEEA-CF and SEEA-EA reduces the workload in the development of natural capital accounts and ensures comparability. Australia, Canada, Mexico, the Netherlands and the UK follow UN SEEA guidance as far as local conditions and data availability allow.

There are value and insights to be gained by combining natural capital accounts with other economic, geographic or social data to provide greater insight into the sustainable economic progress and any inequalities in a country.

A key conclusion from international case studies is that measurement alone without policy clarity and enabling governance will not have any impact on decision-making.

Chapter 5

A Guide For Action

5.1 Introduction

This report has described what natural capital accounting is and identified opportunities and risks in its further development. Through in-depth engagement with key stakeholders and experts, the Council concludes that now is a unique opportunity to make significant progress on accounting for nature in the Irish policy system.

The Council has delved into the opportunities – and risks – in developing natural capital accounting in Ireland. It has outlined the potential uses of natural capital accounting for underpinning work on nature restoration and nature-based solutions and for supporting the further development of Payment for Ecosystem Services (PES) schemes for farmers. There is further potential for using natural capital accounting in national and local planning and in enabling more sustainable finance and investment. The Council has argued that the full potential of natural capital accounting will be realised only by working hard to integrate it into the wider system of national accounting. This will further enhance Ireland's Well-Being Framework.

There is, however, an overarching risk, expressed clearly at the roundtables held as part of this National Economic and Social Council (NESC) work. This risk is that, despite ongoing efforts in the Central Statistics Office (CSO) and others to develop natural capital accounting, and its relevance to policy in many areas, natural capital accounts will not be widely used in practice and will remain peripheral to policy- and decision-making. Fear was expressed that the accounts would not be developed quickly enough to underpin nature restoration at the scale required. There was also a strong sense that the urgency and need for action may not yet be sufficiently understood in the wider policy system.

This report provides the clarity of purpose that the Council believes has been stalling progress. It has outlined Ireland's approach to natural capital accounting and its purpose and role in supporting a range of policy requirements.

With clarity comes insight into what we need to do. The rest of this chapter outlines three areas of action that can be taken to develop natural capital accounting and to help embed it into the wider policy-making system. The three areas are:

- Capacity-building;
- Spotlight on Payment for Ecosystem Services (PES) schemes; and
- Support for integration.

5.2 Capacity-Building

Completing the full System of Environmental-Economic Accounting for Ecosystem Accounts (SEEA-EA) is a considerable challenge given the scale of the task in assessing and monitoring ecosystems. For some uses, biophysical and monetary data will be required, whereas more specific uses require spatial data to inform nature- restoration management and land-use decisions. Monetisation could be usefully explored on a modular basis. The development of marine ecosystem accounts are already underway at the University of Galway with the CSO and the Marine Institute. Another consideration is how to produce frequent and timely natural capital accounts as well as a schedule of modules.

While the Council acknowledges different perspectives on the use of monetary valuation in natural capital accounts: as the System of Environmental-Economic Accounting (SEEA) framework includes biophysical and monetary valuations, both data types are expected to be developed. Some have pointed out that, for some audiences, monetary value enhances the decision-making ability. If natural capital values (including in monetary terms) were produced, investment may be more readily made. Others note that even when economic values are known, this does not increase levels of conservation; for example, in the fishing sector, where that knowledge exists but does not prevent over-fishing.

The development of natural capital accounting requires timely and detailed spatial mapping. Unlike greenhouse gas emissions, ecosystems are place-based and require comprehensive analysis of their condition through direct monitoring by ecologists, but also through maps. The National Land Cover Map could be updated every three years by Tailte

Éireann to monitor changes; accepted statistical methods (reporting to the European Union (EU) under Land Use, Land-use Change and Forestry (LULUCF) regulation) could be used to fill gaps in the interim.

Consideration about how to introduce ecological insights and understanding into the wider policy system is vital for natural capital accounting and for unlocking the potential of nature-based solutions. Increased ecological capacity is needed across the public sector and in government departments, mirroring recent investments made in increasing capacity for economic analysis across the public sector, and in the growth of climate-policy capacity.

Capacity-building is required at the national and local level in order to ensure that natural capital accounts are used effectively and appropriately within decision-support systems. At the national level, the Irish Government Economic and Evaluation Service or a leading government department could play a role in providing training for staff across Government in how to use the natural capital accounts. This could be supported by the participation of the CSO and other experts. At the local level, the Climate Action Regional Offices or the Local Government Management Agency could play a role in arranging training events such as workshops for Local Authority staff. Local Authorities are adept at responding to signalling and building capacity, but as one roundtable participant noted, they may need to be 're-tooled and resourced' over time.

Guidance on how natural capital accounts will be used in practice could be produced for departments and agencies. If used to inform large projects, the Public Spending Code would need to include guidance. Reviewing data gaps and priority ecosystem accounts can help to advance the designing and monitoring PES on the wider scale that is required to support the transition in agriculture and land use. A risk register of ecosystems would be valuable for informing this.

To support the CSO and natural capital accounting, the development of data-sharing/access protocols and data standardisation could be expanded across departments and agencies. The Council welcomes the Government's commitment to deliver appropriate guidance to relevant bodies in key sectors on the use of natural capital accounting expected in the forthcoming National Biodiversity Action Plan 2023-2030 (NPWS, forthcoming). Where feasible, the Council would welcome early training for key departments and agencies in natural capital accounting in order to build capacity.

There are noted capacity challenges in the ecological skills necessary to both undertake ecosystem assessments and to provide guidance to the policy system. The Chartered Institute of Ecology and Environmental Management has observed that ecological vacancies are not being filled due to the limited numbers of ecologists working in Ireland, further hampered by a noted lack of full recognition of ecology as a distinct and fully valued profession (CIEEM, 2022).

An important number of considerations lie in how data and natural capital accounts are accessed and used by policy-makers and wider stakeholders. A place-based approach to natural capital accounting could help inform national and local decision-making. Consideration on how to develop the spatially based approach to data and use it for communication purposes and linking to other data would be very useful.

Natural Capital Ireland (NCI) has identified the lack of a central information hub, consolidating all the data on natural systems in Ireland, as a problem for the development of natural capital accounting. This is, in part, both a collaboration challenge and a collating one. Ireland has data scattered across agencies, departments and individuals – it is not yet an integrated system as this takes time to develop. To address this, the CSO is working to increase collaboration with stakeholders.

A central dashboard for Irish nature (such as Ireland's Marine Atlas and the Netherlands' Atlas of Natural Capital) has been proposed by NCI to ensure open and equal access for all (NCI, 2021b). Stakeholders also pointed to the development of a national data hub with the suggestion that such a role could be carried out by the National Biodiversity Data Centre (NBDC), but that this role would need to be adequately supported.

Collaboration will be important to support the work of the CSO and links to the policy system. Networks are needed across different disciplines and departments and public, private and academic sectors. A series of policy stakeholder events to share good practice and ways to use natural capital accounts would be useful on an all-island basis, to increase north–south collaboration.

The NBDC is ideally placed to have a central role in gathering, collating and presenting natural capital accounting data. As part of ongoing restructuring and development, it is timely that the Centre considers how best to support the use and capacity-building of natural capital accounting in Ireland. With recently strengthened governance, the NBDC seeks to make information on biodiversity more accessible for decision-making, encouraging the public and private sector to take evidence-based action to assist its conservation. The role of the NBDC is to acquire, collate, manage, validate and make available data regarding Ireland's biodiversity. It is experienced in collating and working with state bodies, civil society and citizens in bringing biodiversity data together in one place. It includes citizen-science approaches to data collection and this has potential for natural capital accounting in the future.

There are novel ways of communicating data and maps of ecosystems to build awareness. The All-Ireland Pollinator Plan is cited as an excellent example of a data-driven, shared-island initiative that was accessible, with its language being embraced by the general public. Some stakeholders singled it out as an effective communication and practice tool and approach that was co-created with a wide range of practitioners and communities, with a variety of guidelines for sectors. It was praised by roundtable participants as they considered it have 'co-created a language' for particular groupings. In another example, Scotland uses illustrative/informative mapping to help public understanding, such as Scotland's Natural Treasures map (Metzger *et al.*, 2018). This uses the language of national natural capital 'treasures' in a positive way to signal value.

While collating and informing natural capital accounting is a significant part of making them accessible to, and used by, the policy system, the Council also considered how health and well-being, and the love and cultural appreciation of nature, may provide better means of communicating with the wider public. Some stakeholders saw potential in communicating nature as a 'public good', which could help to link natural capital accounting with an increased public awareness of the contribution of nature to people as one participant noted, it 'takes you away from economic analogy and appeals more to the heart'. This public good approach was recently proposed in Northern Ireland (NIEL, 2023b).

Actions to Develop Capacity	
1.	Support the CSO in continuing to build comprehensive natural capital accounts, including ecosystem accounts, as soon as possible.
2.	Increase awareness of the potential of natural capital accounting across the policy system, including departments, agencies and local authorities, through workshops and online information.
3.	Develop a key role for the NBDC in mobilising and sharing the data required for natural capital accounting.
4.	Develop an action plan to increase the availability of specialist ecology and environmental experts in Ireland to meet Ireland's growing biodiversity and natural capital accounting needs.
5.	Support further development of data-sharing/access protocols and data standardisation across departments and agencies to build integrated natural capital accounts, ultimately benefitting from synergies across EU and international reporting requirements.
6.	Commission research on a place-based approach to local citizen engagement using spatial data on ecosystems and ecosystems services.
7.	Ensure that sufficient and timely mapping is undertaken to support natural capital accounting, including land-cover and ecosystem mapping.
8.	Develop pilot natural capital accounts in a small number of local authorities and cities for targeted areas, e.g. for nature-based solutions and green infrastructure development, in order to assess feasibility, data availability and resource requirements.
9.	Commission research to identify potential opportunities for the future development of sustainable finance, informed by natural capital accounting in Ireland.

5.3 Spotlight on Payment for Ecosystem Services Schemes

The development of PES schemes to recognise and reward farmers for caring for nature is viewed as urgent, as outlined in the Council's earlier report on agriculture and land use (NESC, 2023b). Understanding natural capital accounting as a tool that can tell the story of Ireland's agricultural just transition may help to further unlock its progression into policy.

The Council considers that the progression of ecosystem accounts, as part of natural capital accounting, will be critical for the development of PES schemes, which would be strengthened and guided by the availability of better and timely data. Further, the development of other nature-based solutions to help support climate adaptation will require more ecosystems data to allow monitoring of changes over time.

Exploration of the information that would be most useful for progressing PES for farmers and helping with the development of nature-based solutions is needed. There are public and private interests in ensuring the development of PES, with careful attention to safeguarding ecosystems, and in supporting income diversification for farmers. With the availability of timely, accurate and in-depth data on ecosystem services, the transition for agriculture and wider land-use sectors could be progressed and policy development could be supported through increased knowledge and capacity.

The Council recognises the alignment between bioeconomy development and natural capital and welcomes the recommendation in the National Bioeconomy Action Plan 2023-2025 to develop an agreed approach to natural capital accounting (Government of Ireland, 2023a) and apply it to bioeconomy development.

The Council believes that the frequency of data gathering is a key consideration in how quickly natural capital accounting in Ireland can reach its full potential. This is particularly the case for farm data. One roundtable participant noted that the last national soil survey was conducted in the 1980s and that this data is badly needed now. Regarding resourcing soil surveys, another stakeholder noted that the United States has a budget of €100 million per annum for soil surveys and estimated that a scaled-down cost for Ireland would be approximately €1 million per year. The importance of soil analysis has been recognised by the Department of Agriculture, Food and the Marine (DAFM) with the establishment of the National Agricultural Soil Carbon Observatory and a farm-level, soil-sampling pilot programme (Government of Ireland, 2023b).

Careful consideration is required when accessing local- and farm-level data, so that it is accessible and used. Citizen science and farmer data such as the AgriSnap app for photo-tagging (DAFM, 2022) were highlighted by stakeholders as useful but also difficult to access due to legislation such as GDPR (General Data Protection Regulation). However, this could be overcome; for example, through adapting the approach currently taken in how payments for habitat quality are assessed in the Agri-Climate Rural Environment Scheme (ACRES) Co-operation project, using a tailored ecological scorecard.

It will be important to consider the broader application of data gathering (for example, the measurement of soil carbon) in more locations, engaging directly with the relevant specialists in each domain. New methods will emerge through the use of technology, and stakeholders felt that the lack of appropriate methods should not be a barrier to progress. Ecosystem accounts are being developed at farm level in the Farm Zero C project, which will help to inform wider practice (Carbery, 2023).

Actions to Spotlight PES Schemes
10. Increase ecological training for farm advisors and ecological expertise within farm-advisory services to support the provision of bespoke ecological information and expertise to farmers.
11. Further enable the development of integrated PES using new data on ecosystems and ecosystems services, as part of natural capital accounting.

5.4 Support for Integration

In bringing clarity to natural capital accounting and how it can be used, the Council has provided the basis for further policy integration. To address the risk that future accounts produced will not be used effectively, international experience points to the importance of a policy and governance framework to drive and use natural capital accounts. Policy focus and leadership will help to expand the use of the accounts beyond our EU and United Nations (UN) reporting commitments, which the CSO and Eurostat already envision.

This report has identified some key points of entry for natural capital accounts to impact decision-making at the national, local and initiative/project level. These will require guidelines on the use of natural capital accounting as well as on the timing of future reporting. An annual reporting schedule would be beneficial, drawing on the experience of greenhouse gas emission reporting that has become enshrined in Irish law, policy and practice but that is clearly not sufficient, given the fact that Irish emissions remain high.

Identifying which department will take the lead is an important step and would help to reinforce the ecosystem accounting targets and commitments in the forthcoming National Biodiversity Action Plan 2023-2030 (NPWS, forthcoming).

The are multiple potential areas that would give purpose to natural capital accounting, as outlined in Section 3.3. The Council believes that the integration of natural capital and natural capital accounting should be included in the design and preparation of Ireland's future national nature-restoration plan, and will likely be required within two years of the EU Nature Restoration Law being enacted. This clear policy focus underpinned by natural capital accounting, coupled with our agriculture and land-use challenge, would crystallise thinking and galvanise action. The Council believes that the development of the National Biodiversity Action Plan will provide appropriate motivation for early action and will help to accelerate natural capital development. An integrated approach that seeks to deliver multiple environmental, social and economic benefits will help reduce the risk of unintended consequences.

The Council welcomes the commitment in the forthcoming National Action Plan on Biodiversity 2023-2030 to develop and implement systems and standards for natural capital accounting and hopes that the policy system can work to ensure this can be delivered as soon as possible (DHLGH, 2022). Additional resources have been announced that convey the intention to increase investment in nature restoration through the Infrastructure, Climate and Nature Fund (DoF, 2023). The commitment to establish an expert group on natural capital accounting in the Draft National Biodiversity Action Plan 2023-2030 (DoF, 2023) is also welcomed. The actions recommended by the Council could usefully inform the work of that expert group, once established.

The recently published Irish Natural Capital Accounting for Sustainable Environments (INCASE) research project highlights the value of using ecosystem accounts in decision-making.

> *There is no time to lose in addressing urgent environmental issues, developing integrated land use planning and making informed decisions. Despite gaps in biophysical datasets, ecosystem accounting needs to be not just developed, but actively used to address policy gaps and conflicts (Stout et al., 2023: 33).*

Natural capital accounting can inform decision-making and complement or improve existing accounting structures through, for example, the Public Spending Code and future taxonomy requirements, and in national accounts as part of reporting on Ireland's economic, social and environmental progress. Guidelines could be developed for considering nature in all relevant decision-making processes.

There are growing opportunities for green finance and investment for which natural capital accounting can provide the necessary information and monitoring. Capacity-building is also of increasing concern to the private sector, as reflected by the development of the Natural Capital Protocol and the Task Force on Nature-related Financial Disclosures (Capitals Coalition, 2023).

There is potential for natural capital accounts to be used to inform green infrastructure planning, particularly for nature-based solutions. Local authorities can use natural capital accounts as a tool for decision-making but also for community engagement, given the spatial focus, particularly that of ecosystem accounts.

Looking to the future, a central question to be considered is: what are the stories of Ireland's environmental, social and economic progress that the use of this tool can better equip Ireland to tell? With more accurate analysis and oversight of the changing state of Ireland's natural resources and ecosystems provided in accessible formats, used alongside economic and social data, our decision-makers can inform us about our progress with greater certainty.

In the longer term, as a country, Ireland wants to tell a story of our progress that brings nature more clearly into view. The use of natural capital accounts at the national level was noted by stakeholders as important and usable, given that policy-makers are adept at using CSO data in other economic, environmental and social areas. Using natural capital accounts in the future to create a natural capital indicator in the National Well-Being Framework would help further integrate environmental, economic and social aspects (Government of Ireland, 2021b; 2023d). This will help provide a broader assessment of Ireland's future progress and level of 'thriving' (Cahill & FitzGerald, 2023).

This is also an area rich with potential for shared-island collaboration. Natural capital accounting has the potential to inform the protection and enhancement of natural systems collaboratively so that both jurisdictions can 'deliver widespread and multiple benefits for the environment itself, for people and for the economy' (NIEL, 2023b: i).

Actions to Support Integration
12. Develop guidelines, e.g. in the Public Spending Code, for the inclusion of nature in decision-making processes, using methodologies and data developed under natural capital accounting.
13. Progress the valuation of ecosystem services and assets in monetary units to enable comparisons between SEEA-EA and standard economic measures in the United Nations (UN) System of National Accounts (SNA) and between other countries using the same methodology.
14. Undertake a risk register of ecosystems in Ireland with available data, identifying data gaps for future assessments.
15. Ensure that indicators for biodiversity and natural capital are included in future iterations of the National Well-Being Framework as data becomes available.
16. Commit to annual reporting on natural capital alongside existing biodiversity data and indicators, to support closer management of the crisis in biodiversity and nature, when data becomes available.
17. Identify the appropriate Government department to lead to drive the adoption of natural capital accounting in policy- and sectoral decision-making.
18. Convene an all-island conference to share experiences and approaches for the development of natural capital accounting in Ireland.

5.5 Maximising Natural Capital Accounting in Ireland

Natural capital accounting is considered in this report as recognising and valuing nature in public policy, providing a valuable economic metaphor for policy decision-making. It is not a matter of 'putting a price on nature', as some might view the term 'natural capital', but rather it is making the most out of an accounting framework that, in bringing natural capital into view, can help make visible in public policy what has been hidden for too long.

While it is appropriate to have short-term goals and longer-term ambition for policy use and integration, especially given the substantive shift required to recognise nature considerations in policy in new and transformative ways, the Council recommends a significant step change in the current approach to accounting for nature. As this report has outlined, other countries, encouraged by the UN, the World Bank Group and the Organisation for Economic Co-operation and Development (OECD), are demonstrating how natural capital accounting can be shaped for national policy needs.

While the focus on nature's value is firmly on its contribution to people and ecosystem services for the purpose of this report, the Council recognises that the importance of nature is profound and deep-rooted in Ireland. The work of the Citizens' Assembly on Biodiversity Loss, the Children and Young People's Assembly on Biodiversity Loss, and recent Oireachtas deliberation, can help highlight what policy responses are needed to shape public debate and action. Natural capital accounting is only one, albeit important, part of what is required in a heightened policy response.

The Council acknowledges that many perspectives exist on how to protect and restore nature, including the recognition of nature's importance in its own right – a rights-of-nature approach – as well as its role as a public good and a significant part of the population of Ireland's well-being. The recognition and integration of natural capital accounting also does not preclude other perspectives being developed and used in public policy.

The Council recognises that natural capital accounting 'is not the silver bullet for nature protection and restoration' as one roundtable participant pointed out, but it is a very useful tool and information system that has the potential to unlock further biodiversity action. As an economic metaphor, the audience for natural capital accounting largely comprises decision-makers who can bring compatible data for informed decision-making together with other environmental, economic and social information. Natural capital and natural capital accounting have the potential to inform other approaches to nature in society; for example, in the area of well-being. Looking to the future, being able to provide a fuller picture of the environment through greater integration of social, economic, human and natural capitals, is a worthy goal that aims to link planetary health with our health and well-being.

The Council believes that there is a real opportunity to maximise the effectiveness of natural capital accounting for Ireland. This report and recommendations can be an important input to ongoing policy developments and can help to underpin EU and national policy commitments, as Ireland works to develop a national nature-restoration plan.

APPENDIX

Attendance List: Roundtables

Facilitator Deirdre Joyce

NCI/rapporteur, Iseult Sheehy

NCI/rapporteur, Emer Ní Dhúill

Atlantic Technological University, Dr James Moran

Biodiversity expert, Shirley Clerkin

Birdwatch Ireland, Oonagh Duggan

Bord Iascaigh Mhara (BIM) , Ronan Cooney

Burrenbeo Trust, Brendan Dunford

Central Statistics Office (CSO) , Alan Cahill

Chambers Ireland, Shane Hughes

Citizens' Assembly on Biodiversity Loss, Dr Aoibhinn Ní Shúilleabháin

Climate Change Advisory Council, Phillip O'Brien

Coillte Nature, Ciaran Fallon

CSO, Sylvie Clappe

CSO, Nova Sharkey

Department of Agriculture, Food and the Marine (DAFM), Corina Roe

Department of Agriculture, Food and the Marine (DAFM), Niall Ryan

Department of the Environment, Climate and Communications (DECC), Gerry Clabby

Department of the Environment, Climate and Communications (DECC), Marc Kierans

Department of the Environment, Climate and Communications (DECC), Niamh Gibbons

Department of An Taoiseach, Lena Jacobs

Department of An Taoiseach, Conor O'Raghallaigh

Department of An Taoiseach, Laura Devaney

Department of Finance, Mike Fahy

Department of Public Expenditure, NDP Delivery and Reform, Laura Kevany

Department of Public Expenditure, NDP Delivery and Reform, Laura Durack

Dublin City University, Dr Diarmuid Torney

Eastern and Midland Regional Assembly, Dr Owen Douglas

Environmental Protection Agency (EPA), Fiona O'Rourke

Environmental Protection Agency (EPA), Mary Gurrie

Fáilte Ireland, Geraldine Ann Cusack

Irish Co-operative Organisation Society (ICOS), T.J. Flanagan

Irish Creamery Milk Suppliers Association (ICMSA), John Enright

Irish Environmental Network, Fintan Kelly

Irish Farmers' Association (IFA), Geraldine O'Sullivan

LIFE on Machair, Catherine Farrell

National Parks and Wildlife Service (NPWS), Deirdre Lynn

National Water Forum, Matt Crowe

NESC Director, Dr Larry O'Connell

NESC Project Lead, Dr Jeanne Moore

NESC Project Team, Gemma O'Reilly

NESC, Noel Cahill

NESC, Dr David Hallinan

NESC, Dr Helen Johnston

NESC, Niamh Garvey

NESC, Anne-Marie McGauran

National Parks & Wildlife Service (NPWS), Gemma Weir

Social Justice Ireland, Michelle Murphy

Trinity College Dublin (TCD), Prof. Jane Stout

Trinity College Dublin (TCD), Prof. Yvonne Buckley

Trinity College Dublin (TCD), Francesco Martini

Trinity College Dublin (TCD), Cian White

Trinity College Dublin (TCD), Dr Martha O'Hagan Luff

Teagasc, Stuart Green

University College Dublin (UCD), Craig Bullock

University College Dublin (UCD), Prof. Mark Scott

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Publications

Council Reports					
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1	Report on the Economy in 1973 and the Prospects for 1974	1974	14.	Population Projects 1971-86: The Implications for Social Planning—Dwelling Needs	1976
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