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Irish Natural Capital Accounting for Sustainable Environments: Stage 1 Feasibility Report

Authors: Catherine A. Farrell and Jane C. Stout

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Rialtas na hÉireann
Government of Ireland

ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency (EPA) is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

The work of the EPA can be divided into three main areas:

Regulation: *We implement effective regulation and environmental compliance systems to deliver good environmental outcomes and target those who don't comply.*

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Advocacy: *We work with others to advocate for a clean, productive and well protected environment and for sustainable environmental behaviour.*

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We regulate the following activities so that they do not endanger human health or harm the environment:

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- large scale industrial activities (*e.g. pharmaceutical, cement manufacturing, power plants)*;
- intensive agriculture *(e.g. pigs, poultry)*;
- the contained use and controlled release of Genetically Modified Organisms *(GMOs)*;
- sources of ionising radiation *(e.g. x-ray and radiotherapy equipment, industrial sources)*;
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- waste water discharges;
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- Office of Environmental Sustainability
- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet regularly to discuss issues of concern and provide advice to the Board.

EPA RESEARCH PROGRAMME 2014–2020

Irish Natural Capital Accounting for Sustainable Environments: Stage 1 Feasibility Report

(2018-NC-LS-2)

EPA Research Report

Prepared for the Environmental Protection Agency as part of the INCASE project

by

Trinity College Dublin

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DISCLAIMER

This report is based on research carried out/data from March 2019 to February 2020. More recent data may have become available since the research was completed.

The EPA Research Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

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Executive Summary

Key Message

This interim report (February 2020) has been developed at the request of the Environmental Protection Agency (EPA) to review the rationale and direction of the INCASE (Irish Natural Capital Accounting for Sustainable Environments) project. It is written to reflect the work by the INCASE project team completed to date (between March 2019 and February 2020), specifically in reviewing natural capital accounting approaches, data requirements for the project, catchment selection, potential applications and feasibility.

Identifying Pressures

The natural world we live in underpins human existence. It can be thought of as our *stock* of natural capital that yields *flows* of goods and services. These goods and services include the basic requirements of daily living – food, water, clean air, etc. Ensuring that those services continue to flow for this generation and future generations is one of the fundamental aspects of sustainable development and the keystone of social and economic welfare.

In the Irish context, the Environmental Protection Agency (EPA) State of the Environment Report (EPA SOER, 2016)[1] highlights the need to integrate natural capital accounting (NCA, also referred to as green accounting) into our measures of prosperity so that we can track and measure our performance alongside related issues such as wellbeing and environmental health. Data behind natural capital accounts, as demonstrated in other countries such as the UK and the Netherlands, serve as a standardised data platform that can be used in a multi-disciplinary way. NCA can be used to identify trends in the quality of the environment, inform trade-offs, identify co-benefits and establish critical links between natural and other capitals (such as built and social capital) as well as identify knowledge gaps. Such an approach will help us to understand and, combined with the use of other appropriate tools, address the dominant pressures and their impacts – climate change, growth in human population, continued degradation of nature – on Ireland's environment.

The INCASE (Irish Natural Capital Accounting for Sustainable Environments) research project aims to apply NCA at a pilot (catchment) scale in Ireland. Significant pressures on at risk water bodies are well defined at the catchment level by the EPA, with agriculture identified as the most significant pressure in the River Basin Management Plans 2018–2021.[2] EPA reports from December 2019 indicate that water quality in Ireland continues to decline.[3]

Developing natural capital accounts at the catchment scale will inform how the accounts (asset extent, condition, supply and use of services, benefits, etc.) can be built using Irish data sources and provide valuable lessons on how best to scale up to the national level. INCASE will explore how NCA can be used to identify solutions through either investing in and renewing degraded natural capital stocks and flows (improving water quality, restoring ecosystems, etc.) and/or changing management practices and incentive schemes (e.g. developing payments for ecosystem services). Linking biophysical information (maps with qualitative and quantitative data) with economic data, the project will also explore how natural capital accounts can be used to develop better metrics for national accounting. Pioneering methods tested and refined at the catchment level by INCASE will contribute to scaling up to the national level, delivering effective and efficient use of project outputs to be of immediate use to policymakers. Developing a system of NCA fit for purpose will require addressing

1 https://www.epa.ie/irelandsenvironment/stateoftheenvironmentreport/ (accessed 6 March 2020).

2 https://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021 (accessed 6 March 2020).

3 http://www.epa.ie/newsandevents/news/pressreleases2019/name,67351,en.html (accessed 6 March 2020).

a range of challenges from high-level epistemological ones (can nature fit into accounting methods?) to practical data sharing and quality issues.

Policy

The new European Green Deal, published at the end of 2019,[4] specifically aims to protect, conserve and enhance Europe's natural capital and to protect health and wellbeing from environment-related risks and impacts. The Green Deal states that "all EU policies should contribute to preserving and restoring Europe's natural capital."[5] In addition, the development of standardised NCA practices is explicitly mentioned as part of the range of initiatives to pursue green finance and investment.

In Ireland, the Climate Action Plan published in 2019 sets a number of targets and highlights the need for an integrated approach to land use, taking into consideration the changing role and trends of sectors such as agriculture, forestry and energy in Ireland. Extending this to the marine will be necessary to deliver on policy and plans for both land and sea. NCA is one of the tools that can help to integrate a range of sectoral policy targets (relating to nature, environment, land use, society and economy) and decision making and align them with overarching Sustainable Development Goals (SDGs). Some preliminary work has been done on NCA under the European Union (EU) Mapping and Assessment of Ecosystem Services project[6] and the Central Statistics Office (CSO) is mandated by the EU to report a number of environmental accounts to the European Statistics Office (Eurostat) since 2011.[7] Other national level plans that refer to natural capital include the National Development Plan and the National Planning Framework (2018).

Following from emerging EU and national policy, NCA will be mandatory in coming years, and building the best approach and fit for the local, Irish context is essential. The INCASE project forms part of the network of EU and global projects (over 80 countries are engaged with NCA) that is working towards refinement and further development of NCA methods. As part of this network, Ireland is well placed to contribute to and lead in terms of the refinement of the process at national and EU levels. The potential uses and benefits of NCA include:

- allowing different sectors to communicate on a common data platform;
- facilitating shared understanding;
- informing better decisions around terrestrial and marine use; and
- working towards better indicators of sustainable development.

Solutions – Accounting for Nature

Natural capital as a concept brings discussions around nature and its contributions to human wellbeing into the language of traditional accounting and reporting. The underpinning concepts are nature (everything that occurs naturally – abiotic and biotic components) and capital (stocks or assets). In order to bring nature into an accounting system, a standardised approach must be developed to define what we are accounting for. This requires an understanding of what natural capital assets (ecosystems, geosystems and atmospheric systems) are, how they work, how they can be mapped and defined, and how they provide benefits to humanity.[8] Having a standardised accounting approach, based on principles set out in other accounting approaches such as the System of National Accounts (SNA), allows for repeatable, comparable datasets that can monitor changes over time, informing better indicators and/or metrics of sustainable use.

The United Nations (UN) System of Environmental–Economic Accounting (SEEA) framework is the most widely used and is considered the best practice

4 https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf (accessed 6 March 2020).

5 https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf (accessed 6 March 2020).

6 https://www.npws.ie/research-projects/ecosystems-services-mapping-and-assessment (accessed 6 March 2020).

7 A list of environmental accounts collated by the CSO (2020) are outlined in Appendix 1. These accounts became mandatory with the introduction of Regulation (EU) 691/2011, though the CSO has already developed a number of accounts as part of a Eurostat pilot project in advance of the regulation.

8 This is the fundamental approach to NCA – mapping the extent and condition of natural capital assets (stocks) and identifying the services that flow (provisioning, regulating, supporting and cultural, etc.) from those stocks. Identifying benefits and beneficiaries is also a key aspect.

approach to NCA. The SEEA (which forms the basis of the Organisation for Economic Co-operation and Development – OECD – definition of green accounting) incorporates the following two aspects: the SEEA-Central Framework (SEEA-CF) and the SEEA-Experimental Ecosystem Accounting (SEEA-EEA):

- The SEEA-CF covers physical accounts and flows of environmental assets (such as water), and monetary accounts (environmental transactions).
- The SEEA-EEA follows a geospatial approach whereby *stocks* of natural capital (assets) at a range of scales (e.g. the country or catchment scale) are measured. Knowledge of the extent and condition of natural capital assets allows for integration of the supply and use of services (*flows*) flowing from nature, which are then recorded as *benefits* to humanity, in an accounting framework.

Both aspects of the SEEA are designed to work together to build knowledge and information about natural capital assets, which can be used in reporting consistently and repeatedly alongside the SNA, enabling the tracking of changes in stocks and flows over time.

Previous and ongoing EPA projects (such as ESManage, ESDecide, Pollival and work by the Socio-economic Marine Research Unit – SEMRU) and other state- and semi-state- supported projects (National Parks and Wildlife Service – NPWS; National Mapping and Assessment of Ecosystems and Their Services – MAES – pilot project; Bord na Móna SEEA accounts; Coillte Corporate Natural Capital Accounts) provide a basis for INCASE in terms of how to develop natural capital accounts in the Irish context. These projects have identified the range of assets (stocks) and services (flows) as well as some of the benefits and beneficiaries of Ireland's natural capital. Applying the UN SEEA method, INCASE will build on previous work as well as on immediate synergies with projects such as the Ordnance Survey Ireland (OSI)/EPA land cover mapping project and Environmental Sensitivity Mapping (ESM) tool project and the CSO's work on environmental accounting, as well as European Innovation Partnership (EIP) projects supported by the Department of Agriculture, Food and the Marine (DAFM).

Once the process to build the accounts is established, some of the potential applications of NCA will be explored, with a particular focus by INCASE on integrated catchment management and water quality. Trade-offs between policy and land use (farming, forestry, infrastructure, energy, planning, etc.) at the catchment scale will be considered, reflecting the current discussions at the national level about land use and climate action and the need for evidence-based decision support tools for policymakers.

Feasibility of the INCASE Project – Building Catchment and National Contexts

The work to date by the INCASE project team has established that developing natural capital accounts at catchment and national scales is feasible. Critical steps include a review and assessment of the wide array and quality of data available in terms of outlining the basic requirements for NCA in Ireland and potential data gaps. Establishing the process steps to gather, collate, assess and align these data in a standardised way will be a key output of INCASE. Determining how available data can be used for various accounts follows from the data review.

The project will establish the necessary "learning by doing" platform and framework from which NCA can be implemented at the catchment scale and inform the basis for national-scale NCA, either during or beyond the lifetime of the INCASE project, as set out in national and EU targets. A number of challenges will be addressed, in terms of high-level concepts about NCA, valuation, the efficacy of the approach in general and basic aspects such as data share and data quality.

Given the experience of the project team in NCA and the SEEA approach in particular, and the insights from work by the steering committee, it is recommended that the INCASE project proceeds as outlined in the original project proposal while continuing to build on the work of INCASE to date.

1 Aims and Structure of This Report

The INCASE (Irish Natural Capital Accounting for Sustainable Environments) research project is an Environmental Protection Agency (EPA)-funded project that explores the application of natural capital accounting (NCA) at the catchment level in Ireland. Working to integrate national and sectoral plans, policy objectives and targets is at the core of NCA approaches and these are the main drivers for the INCASE research project.

This report is written based on the work of the INCASE project team completed to date (between March 2019 and February 2020), specifically in relation to reviewing NCA (or green accounting) approaches, the data available to construct natural capital accounts in Ireland and engagement with stakeholders (from local and national levels to international levels). Note, the report *does not* outline the process steps for implementation and development of NCA in Ireland, as that is one of the outcomes of INCASE, i.e. mapping out the process steps, specifically in relation to available Irish data review and assessment, building accounts (extent, condition, services, benefits), identification of data gaps, linking geospatial accounts with the economy, etc.

This report is structured as follows:

- Chapter 2 introduces the high-level aims and objectives of the INCASE project, the project team and the steering committee, and outlines synergies with other agencies and related projects. We also outline key concepts around natural capital and how NCA relates to national and financial accounts to assist in the development of better measures of sustainable development. An overview of the System of Environmental–Economic Accounting (SEEA) (including the SEEA-Central Framework – SEEA-CF – and the SEEA-Experimental Ecosystem Accounting – SEEA-EEA) is presented.
- Chapter 3 sets out the main policy drivers and support for NCA at the international, EU and national levels.
- Chapter 4 sets out basic data requirements for NCA and outlines the main motivation and support for the project in terms of synergies with other projects and data sources as well as the potential applications of NCA to inform integrated decision making across and within sectors (agriculture, climate, forestry, marine, etc.).
- Chapter 5 outlines the focus of the INCASE project in terms of integrated catchment management (ICM).
- Chapter 6 summarises the main conclusions and recommendations for the EPA review board based on findings from the INCASE project to date.

This report is a summary of the salient features to be considered as part of the EPA review and is supported by the following two documents with essential supporting information, which the reader can refer to if they require more detail and background:

- Appendix 1: a technical document detailing relevant supporting technical information for this report, including information on catchment selection and INCASE catchments, data sources and providers for the relevant SEEA-EEA accounts and SEEA-CF linkages, stakeholder engagement/support and an overview of workshops to date.
- The INCASE literature review: this literature review (a deliverable of Work Package 1 – WP1) provides a comprehensive overview of policy, drivers, natural capital approaches at the EU, global and corporate levels and some of the considerations in relation to NCA for the INCASE project. A framework for the INCASE project is outlined in Chapter 6 of the literature review.[9]

9 https://d8e6820e-0075-4425-94dd-b4a47c78039e.filesusr.com/ugd/94066f_401fbc642f1d420f95e4c7500bdb94cb.pdf (accessed 6 March 2020).

2 The INCASE Project

2.1 Aims and Objectives of the INCASE Project

Key Message

The INCASE project will provide a platform whereby the process of NCA, the outputs and steps in the process and potential applications can be developed in the Irish context. INCASE will inform the extent and condition of natural capital, the associated services and benefits, where investment and/or restoration will be required and where it should be prioritised at the catchment level to deliver on RBMPs, with a view to providing guidance on how the work is scaled up to the national level.

Applying the United Nations (UN) SEEA approach – the most widely used NCA approach at the EU level and globally – INCASE will pilot the development of a suite of relevant natural capital accounts at the catchment scale to provide a comprehensive view of the stocks of natural capital assets and the flows of services within each catchment. How these stocks and flows relate to society will also be investigated. Working at the catchment level, INCASE will inform, through a process of learning by doing, how best to develop catchment natural capital accounts, with a view to providing guidance on how to scale this up to the national level. Four catchments have been selected for INCASE, representing a range of conditions and characteristics (see section A1.1 in Appendix 1).

Whereas NCA has a range of potential uses and applications, the central focus of INCASE is to inform how NCA (specifically the SEEA approach) can assist with reporting and/or working towards water protection and management in the context of implementation of the Water Framework Directive (WFD) River Basin Management Plan (RBMP) for Ireland in the period 2022–2027. INCASE will link the NCA approach with the ICM approach already in use in RBMPs.

It should be noted that, although ICM was originally developed as the approach in Ireland for water management, the increasing awareness of the connectedness of our natural environment (water, habitats, soils, GHG emissions) and the co-benefits of considering all natural systems (eco-, geo- and atmospheric systems) together as a broader interconnected system highlights that catchments are landscape units where these systems align. Linking NCA with ICM thereby broadens the perspective of ICM as used and promoted by the EPA Catchments Unit, bringing focus to the dependencies between land use planning and environmental management in general.

The INCASE project runs from March 2019 to March 2023 and has the following main objectives and associated WPs:

- WP1: review NCA approaches, identify data sources and develop a framework to test NCA application in Ireland (completed February 2020).
- WP2: apply the SEEA approach at the catchment level;[10] develop natural capital accounts (extent, condition, services supply and use, benefits) for each of the four selected catchment areas.
- WP3a: based on the application of the NCA approach in WP2, develop tools for decision makers, including visualisation, quality assessment and framework development.
- WP3b: conduct economic impact assessments linking the outputs of WP1 and WP2 with the economy.
- WP4: stakeholder engagement will form a significant part of the project at all stages.

10 Four pilot catchment areas were selected in November 2019; see Table A1.3 in Appendix 1.

2.2 INCASE Project Team, Steering Committee and Supporting Network

Key Message

The INCASE project team and steering committee have the technical expertise and experience to deliver the different aspects of the project. Stakeholder support for the project will strengthen the outputs, maintain a relevant focus and inform applications and uses across and between sectors.

Taking a multi-disciplinary approach reflects that taken in other NCA initiatives in the EU region, in individual EU Member States and globally. The INCASE project team brings together different disciplines, organisations and expertise in an integrative way, with work by researchers from:

- Trinity College Dublin – Professor Jane Stout and Dr Catherine Farrell (terrestrial and restoration ecology);
- University College Dublin – Associate Professor Mary Kelly-Quinn, Dr Siobhan Atkinson (freshwater ecology) and Lisa Coleman (GIS specialist);
- University of Limerick – Dr Stephen Kinsella (macro-economy);
- National University of Ireland, Galway – Dr Cathal O'Donoghue (micro- and bioeconomy);
- IDEEA (Institute for the Development of Environmental Economic Accounting) Group[11] – Mark Eigenraam (Director – IDEEA Group) and Carl Obst (Director – IDEEA Group; and lead author – UN SEEA-EEA);
- Irish Forum on Natural Capital (IFNC) – Orlaith Delargy (Executive Co-ordinator).

In addition to the project team, the steering committee for the INCASE project comprises researchers with multi-disciplinary expertise and they have provided valuable support and insight to the INCASE project to date:

- EPA Catchments Unit – Paddy Morris;
- Former Head of EPA Catchments Unit – Donal Daly;
- Central Statistics Office (CSO) – Gerry Brady (Co-ordinator of the SEEA-CF accounts in Ireland);
- Former Director-General of the European Statistics Office (Eurostat) – Dr Walter Radermacher (presently at University of Sapienza, Rome);
- National Parks and Wildlife Service (NPWS) – Gemma Weir (Ecological Data Manager, Co-ordinator of Irish national Mapping and Assessment of Ecosystems and Their Services – MAES – pilot project);
- Department of Climate Change and Environment – Dr John O'Neill (Head of Climate Adaptation);
- Hutton Institute – Dr Paola Ovando (MDT[12] Fellow in NCA).

Both the project team and the steering committee have already established links with key stakeholders nationally and internationally. The project has also received the support from a number of key organisations (see Tables A1.5 and A1.6, Appendix 1), including:

- state agencies/departments, including the EPA Catchments Unit, CSO, NPWS, National Biodiversity Data Centre (NBDC), Geological Survey Ireland (GSI), Forest Service, Teagasc, Irish Water, Department of Agriculture, Food and the Marine (DAFM), Department of Communications, Climate Action and Environment (DCCAE), Department of Housing, Planning and Local Government (DHPLG), Bord Iascaigh Mhara (BIM), Bord na Móna, Coillte and local authorities;
- related projects, including Ordnance Survey Ireland (OSI)/EPA land cover mapping project, EPA Environmental Sensitivity Mapping (ESM) tool project, European Innovation Partnership (EIP) projects (Pearl Mussel Project and Bride Regenerative Farming Project), Kerry-Life project, ESDecide, Land2Sea and other related research projects.

11 www.ideeagroup.com (accessed 6 March 2020). IDEEA is based in Australia and has carried out seminal work on NCA globally, as well as worked with Bord na Móna and BIM in Ireland since 2018.

12 Macaulay Development Trust.

2.3 Natural Capital Accounting – Key Concepts

Key Message

Natural capital has unique features, which relate to the diversity of nature, the complexity of living systems, capacity, condition, non-linearity, feedback loops and resilience. An appropriate asset accounting model is therefore required for the purposes of accounting for natural capital assets and flows; one that can be standardised to allow for comparative and repetitive measurement and reporting at the national, regional, catchment, site or business level.

2.3.1 Natural capital – the foundation of all capitals

The International Integrated Reporting Council[13] defines the term "capitals" as referring to any store of value that an organisation can use in the production of goods and services, distinguishing six capitals for reporting purposes (as illustrated in Figure 2.1).

All types of capital are needed to support human welfare, and human capital combines with natural capital to create manufactured and/or financial capital. However, as Figure 2.1 illustrates, all other capitals rely on natural capital. This reflects discussions around the Sustainable Development Goals (SDGs) (see Figure 3.1) and, again, the nested approach clearly defines the role of nature as that which underpins all else.

2.3.2 Natural capital accounting – stocks and flows

From an accounting perspective, defining natural capital as an important and valuable capital or stock brings the discussion around nature into a common language more traditionally associated with economics. It also re-enforces the need to replenish and invest in nature's stocks to bring them to a level appropriate to sustain the present human population and future population scenarios [following from Brundtland, 1987,[14] and Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES)[15] and Intergovernmental Panel on Climate Change (IPCC)[16] reports in 2019]. Within the context of NCA, another key concept is that of services. The services that flow from nature to humans and our economy provide a wide range of benefits, including the provision of food, regulation of the climate and the landscapes and vistas that provide us with recreational use and, ultimately, health and wellbeing. These services flow from the stock of natural capital.[17]

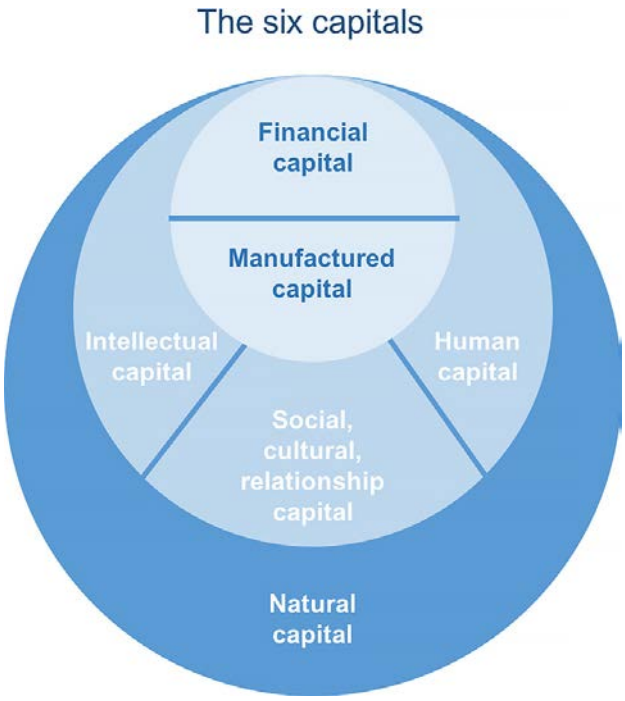


Figure 2.1. The six capitals. Copyright © December 2013 by the International Integrated Reporting Council ("the IIRC"). All rights reserved. Used with permission of the IIRC. Contact the IIRC (info@theiirc.org) for permission to reproduce, store, transmit or make other uses of this document.

13 https://integratedreporting.org/ (accessed 6 March 2020).

14 https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf (accessed 6 March 2020).

15 https://ipbes.net/global-assessment (accessed 6 March 2020).

16 https://www.ipcc.ch/srccl/ (accessed 6 March 2020).

17 The ecosystem is most widely used as the defined unit or asset of natural capital, reflecting the term as defined in the Convention on Biological Diversity (CBD) – a product of the biotic and abiotic components of nature, though the same approach can be taken with geosystems and atmospheric systems.

2.4 Linking National Accounts with Nature's Stocks and Flows – Extending the Boundary

Key Message

The INCASE project team (ecologists, economists and practitioners) and the combined guidance of the project steering committee (policymakers, catchment scientists, data managers, statisticians and environmental economists) will serve as a discussion platform for the potential role of NCA (specifically the SEEA) to link with the System of National Accounts (SNA) in Ireland; thereby working towards developing better metrics of sustainable development.

Accounting for nature – or taking nature into account – is recognised as a key feature of working towards and tracking sustainable development.[18] Because the traditional economic way of measuring stocks and flows has been well tested and widely used to date, a similar approach is now being taken with natural capital. The main system in development, upon which NCA approaches have formed or from which they have emerged, is the UN SEEA.[19]

A key aspect of the SEEA is that it builds on gross domestic product (GDP) by means of extending the boundary of the SNA. By extending the SNA framework and the traditional economy boundary, this helps to mainstream environmental information within regular discussions on economic and development policy. It also enables linkage of NCA with the SNA (or at an individual corporation scale, a company's financial accounts). Essentially, the main high-level motivation is the development of more reflective aggregates for prosperity and wellbeing than is currently achieved by the widely cited GDP.

From an economic perspective, the role of the SNA, and specifically the metric GDP, it is recognised that GDP is limited. A full balance sheet approach to economic sustainability would also imply a more nuanced approach to sustainability, one that is not likely to rely on a single number or metric. Similarly, for human capital, a broader perspective than that currently taken requires addressing difficult measurement questions, such as how to measure non-cognitive skills and non-market benefits, both individual and social, and understanding and measuring specific human capital and networks (consider the development of alternative welfare indices outlined in Chapter 2 in the INCASE literature review).

2.4.1 Natural capital, green and environmental accounts – what terminology?

The NCA approaches are often referred to as green accounting, environmental accounting and/or ecosystem accounting, though there are very clear differences in the terms and origins of use. Green accounting is essentially defined by the Organisation for Economic Co-operation and Development (OECD) as environmental accounting.[20] This definition by the OECD relates green accounting directly to the UN SEEA, although there is a broad body of work relating to green accounting in capital and welfare theories. In the wider lexicon, NCA is frequently used and provides a broadening of the context to all natural systems.

Developing a terminology for INCASE – one that works in the Irish context, though aligned with EU and international approaches – will be an output of the project.

18 This is alongside better measures of societal and human wellbeing.

19 https://seea.un.org/ (accessed 6 March 2020).

20 https://stats.oecd.org/glossary/detail.asp?ID=1146 (accessed 6 March 2020).

2.4.2 *SEEA fundamentals – central framework and experimental ecosystem accounting*

Key Message

The SEEA approach, and specifically the SEEA-EEA component, represents initial efforts to define a measurement framework for tracking changes in ecosystems and their outputs, and by extension other natural systems, linking those changes to economic and other human activity by means of the combination of the SEEA-CF and SEEA-EEA accounts.

There are two components of the SEEA: the SEEA-CF and the SEEA-EEA.

- The SEEA-CF covers physical accounts and flows of environmental assets and expenditure with a focus, for measurement purposes, on individual environmental assets, such as timber resources, land, mineral and energy resources, and water resources.[21]
- The SEEA-EEA is a geospatial approach whereby stocks of natural capital (assets) at a range of scales (e.g. country or catchment scale) are measured. Knowledge of the extent and condition of natural capital assets allows for integration of the supply and use of services (flows) flowing from nature, which are then recorded as benefits to humanity, in an accounting framework.

The SEEA-EEA constitutes an integrated statistical framework for organising biophysical data, complementary to that of the SEEA-CF, although it does not yet have the status of an international statistical standard.[22] Both aspects work together, enabling the tracking of changes in stocks and flows over time. The SEEA-EEA will be the main focus for INCASE WP2, linking SEEA-CF data collated by the CSO to develop benefits accounts (WP2) and economic linkages in WP3.

There are four key stages in the SEEA-EEA (Figure 2.2) to fully outline geospatial extent, condition and relationships of natural capital assets (stocks) as well as accounting for flows of services and benefits:

1. Asset extent – type, range and scale of natural capital assets. The output of this stage is a geo-referenced map, the scale depending on the spatial unit (county, catchment or farm) and an asset register or account (in the form of a table/ balance sheet).
2. Asset condition – quality of the asset. For example, a peatland may be drained, which would be of lower condition than one with no drains, which impacts on not only its capacity to sequester carbon but also its biodiversity. Condition of assets influences the ability of an asset to deliver one or more services and as the condition will vary over space and time, condition mapping is a key spatial component. At this stage, maps showing asset condition and pressures, and a risk register – highlighting areas of degradation – can be developed.

Figure 2.2. The core NCA framework. Source: IDEEA Group.[23]

21 A number of environmental accounts are collated by the CSO in Ireland and reported to Eurostat (listed in Appendix 1); https://www.cso.ie/en/statistics/environmentaccounts/ (accessed 6 March 2020).

22 The SEEA-EEA was separated out from the SEEA-CF aspects to allow for its refinement and development while the SEEA-CF could be implemented immediately.

23 https://ideeagroup.com/wp-content/uploads/EEA-101-Mar-2017.pdf (accessed 6 March 2020).

3. Services – identification of the services, whether within the system or as a product of the system. In the case of a peatland this may be carbon sequestration (a service) or emission (a disservice) and/or water attenuation. Similarly, services may rely on a combination and the interaction of multiple assets. Mapping services will be a product of the pressures and condition mapping in previous steps as well as using other relevant geo-spatial data.
4. Benefits – the benefits to humans and who the beneficiaries are. For example, the benefit may be climate regulation and/or flood control and the beneficiaries are either local, downstream (flood mitigation) or global (reduced carbon emissions to atmosphere). For many services there is a spatial correlation between potential beneficiaries and service availability.

2.5 Using Natural Capital Accounting to Inform Trade-offs, Co-benefits and Disservices

Key Message

Integrating NCA as a tool in decision making facilitates multiple analyses, including identification of trade-offs, disservices and co-benefits. The accounts present a standardised filter and a common platform on which to inform integrated and inter-sectoral decision making. INCASE will explore how this can work at the catchment level in Ireland.

The information organised within the context of NCA can provide an indication of impacts (both positive and negative) of economic and other human activity on the environment and therefore highlight the potential trade-offs among the different combinations of services that are generated from alternative uses of assets. With its potential to provide information on environmental impacts and trade-offs in natural capital use, NCA provides a framework for responding to the growing demands for information in policy areas such as sustainable development, resource use and land management. The SEEA framework can work as a filter (Figure 2.3) through which decision makers can weigh up the outcome/benefits (co-benefits and dis-benefits) of policies (see Chapter 4).

2.6 Questions for INCASE – Treating Systems the Systems Way

Key Message

The NCA systems must take account of the complexities and non-linearities of natural systems. An iterative approach will be taken by INCASE to inform discussions, nationally and at the EU level, around applications, valuation and effectiveness of NCA at different scales.

2.6.1 Systems thinking

In terms of natural capital, moving beyond the measurement of individual stocks of natural capital and taking the systems approach to nature (ecosystem, geosystem, atmospheric system) considers the interplay of different assets (for example, within a forest, there is an interplay between water, timber, soil and wildlife), making clear that, in order to measure environmental sustainability, more than the measurement of stock (the classic approach to capital accounting) is required. Ecosystems and, inter alia, natural systems in general are not a collection of different stocks but, more fundamentally, systems.

2.6.2 How then to account for nature?

Splitting nature into defined units/accounts (despite the assertion that essentially nature flows), recognising non-linearities, accounting for resilience and understanding how systems work together are aspects of nature that did not feature for discussion during the development of the traditional accounting approach to other “capitals”. Therefore, any NCA system must take cognisance of these paramount features, developing an approach that deals with realities and does not attempt to merely squeeze natural systems into “neat boxes”. This is a challenge for all NCA projects and it reinforces the contribution of the INCASE project to broaching this and other pertinent challenges/ assumptions around valuations (“can we put a price on

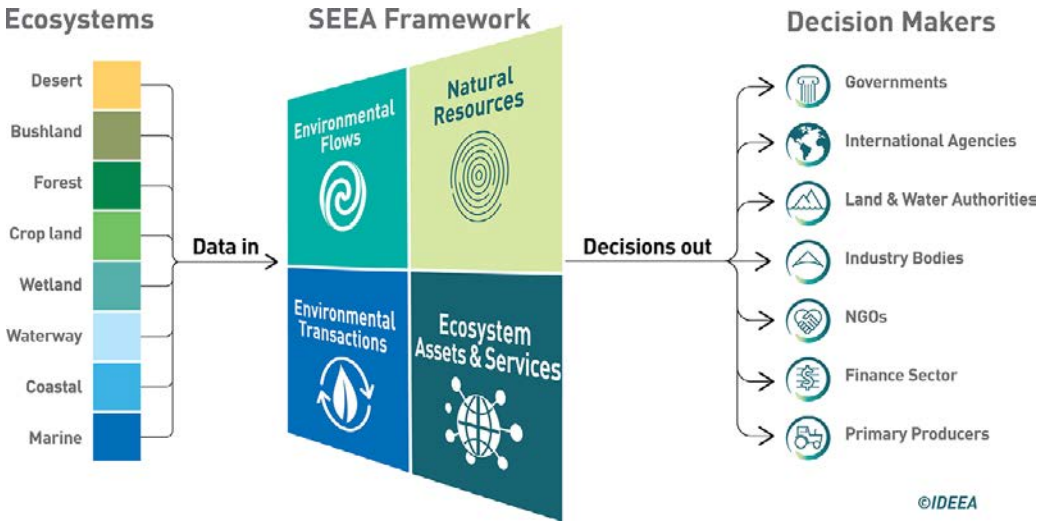


Figure 2.3. The SEEA framework provides a filter for standardised information. Source: IDEEA Group.[24]

nature?") and sustainability indicators ("is 42 really a valid answer?"[25]).

2.6.3 A filter for better decisions?

NCA is one tool that may be used in decision making, noting that decision making occurs at different spatial scales. NCA may prove to be a valuable system at a local, catchment level, while at the national level it may present different issues. Aggregated accounts give a broad picture, with no details on the complexity involving the interactions of geology, water, vegetation, biodiversity, climate and external and anthropogenic drivers (climate change, land use changes, regulations). Furthermore, spatial data aggregation may introduce bias.[26] Therefore, applications of NCA will have to be evaluated based on their own merit and at different scales. As a consequence, NCA must retain an iterative approach to ensure it can be honed as a useful, fit-for-purpose tool that can continue to evolve as data quality, understanding and learnings evolve.

2.6.4 Keeping it real

For multi-disciplinary approaches to bear fruit, they require a high level of self-awareness of potential inherent bias on the part of the individual components of the "multi". A critical analysis of ideas and issues over the course of the INCASE project is vital to develop a robust and defensible system, with practitioners that are aware of their own biases and possible shortcomings in the NCA system itself that is being tested by INCASE (as in other projects testing the SEEA approach and the issues being addressed in the ongoing SEEA-EEA revision process).[27]

2.7 Natural Capital Accounting for Businesses and Organisations

Key Message

Corporate NCA (CNCA) is becoming widespread as companies are required to identify and link dependencies and impacts on nature (through natural capital assessments or accounts) to financial accounts.

Corporate NCA (CNCA) applies similar principles to that of the UN SEEA in that the accounts are structured and standardised to align with financial accounting[28] at a business/organisation/site level,

24 https://ideeagroup.com/wp-content/uploads/IDEEA-Group-Ecosystem-Accounting-101-4pp.pdf (accessed 6 March 2020).

25 https://en.wikipedia.org/wiki/42_(number) (accessed 23 April 2020).

26 http://doc.teebweb.org/wp-content/uploads/2017/01/ANCA-Tech-Guid-8.pdf (accessed 6 March 2020).

27 https://seea.un.org/content/seea-experimental-ecosystem-accounting-revision (accessed 6 March 2020).

28 CNCA is an accounting tool developed to fit with the structure of a company/organisation's financial accounts as opposed to following the UN SEEA structure.

allowing for the accounts to be updated repeatedly and consistently. Employing a common language (as in CNCA) enables ease of communication and understanding between natural capital accounts and national income/financial accounts. Other frameworks, such as the Natural Capital Protocol,[29] are widely adopted by business and organisations to identify and link dependencies and impacts on nature (through natural capital assessments or accounts) to financial accounts.

29 Pioneered by the Natural Capital Coalition, recently named the Capitals Coalition https://naturalcapitalcoalition.org/ (accessed 6 March 2020).

3 Natural Capital Accounting Policy Drivers

Key Message

Policy at an international level reflects the main drivers for NCA, which are to arrest the further deterioration of the natural environment and ensure sustainable development for humans globally. By not taking nature into account in decision making, widespread ecological degradation has occurred, leading to local and global critical levels of biodiversity loss and global climate change with ongoing and repeated calls for transformative changes in human behaviour to prevent further degradation beyond critical thresholds (IPBES, 2019;[30] IPCC, 2019).[31]

3.1 International Policy – CBD to SDGs

NCA emerged between the 1960s and 1970s, when an increasing awareness of human impacts on nature and natural resources culminated in the 1987 Brundtland Commission Report *Our Common Future.* The first efforts to develop "environmental" accounts that would bring nature into the accounting framework, and which aligned with the long-established SNA, arose after the Earth Summit in Rio de Janeiro in 1992, and have been in development since.

In 1993, the first draft of the UN SEEA was published. Following from this, the Millennium Ecosystem Assessment (2000 to 2005) and The Economics of Ecosystems and Biodiversity (TEEB, established in 2008) initiatives highlighted the importance of recognising the value of natural capital, ecosystem services and the benefits that we receive from nature. Prior to this, nature – or natural capital – had never featured as something to be accounted for on balance sheets.

The present Convention on Biological Diversity (CBD) Strategic Plan for the period 2011–2020 has a set of strategic goals and targets (the Aichi Targets). Of these, Target 2 of Strategic Goal A is of note for NCA, which states that "by 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems."[32] Target 2 is reflected in the EU Biodiversity Strategy 2011–2020,[33] and the Irish National Biodiversity Action Plan 2017–2021 (DAHG, 2017).[34,35]

The Aichi Targets underpin Agenda 2030 for Sustainable Development and the SDGs (Figure 3.1), highlighting that nature is critical to human wellbeing and that the health of people and nature are inextricably linked. The Aichi Targets and SDGs both stress interdisciplinary issues, such as raising awareness about biodiversity, removing harmful subsidies that cause biodiversity loss, applying the ecosystem approach to understanding and conserving nature, and cross-sectoral planning to ensure sustainable development and use across agriculture, forestry, fishing, industry, infrastructure and other commercial enterprises.[36] These messages are reinforced by the 2019 IPBES report,[37] which demonstrated widescale biodiversity losses globally, and the IPCC report,[38] which indicates links between

30 https://ipbes.net/global-assessment (accessed 6 March 2020).

31 https://www.ipcc.ch/srccl/ (accessed 6 March 2020).

32 https://www.cbd.int/sp/targets/ (accessed 6 March 2020).

33 https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52011DC0244&from=EN (accessed 6 March 2020).

34 https://www.npws.ie/legislation/national-biodiversity-plan (accessed 6 March 2020).

35 https://www.npws.ie/sites/default/files/publications/pdf/National%20Biodiversity%20Action%20Plan%20English.pdf (accessed 6 March 2020).

36 https://www.cbd.int/sp/targets/ (accessed 6 March 2020).

37 https://ipbes.net/global-assessment (accessed 6 March 2020).

38 https://www.ipcc.ch/srccl/ (accessed 6 March 2020).

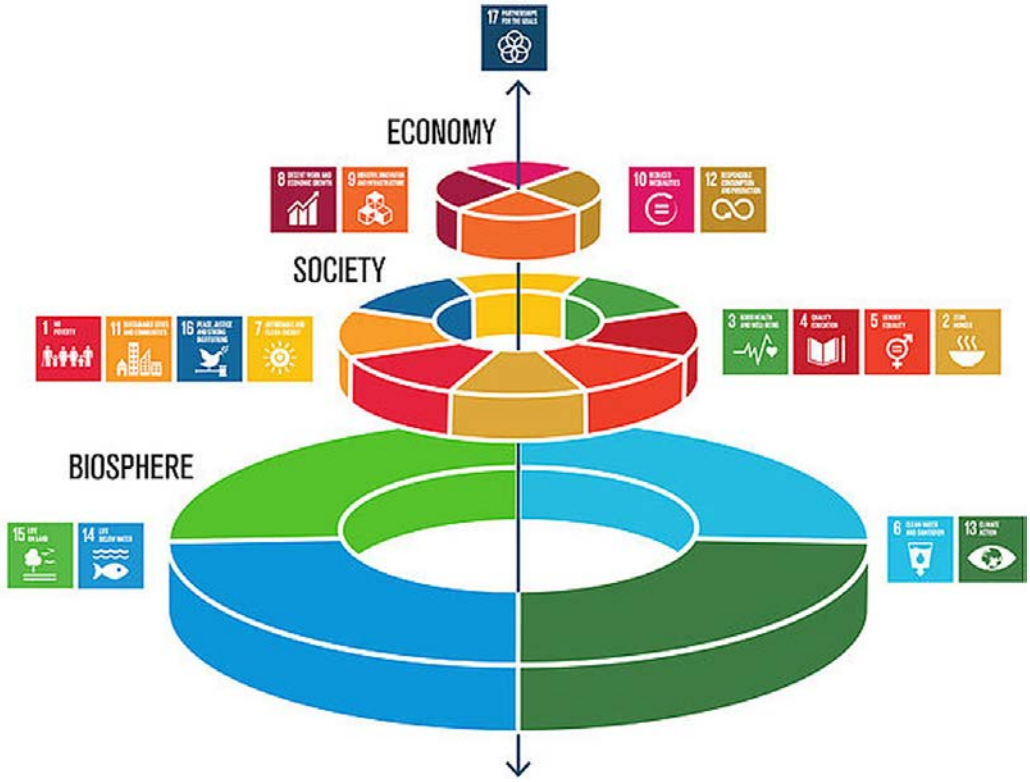


Figure 3.1. The SDGs wedding cake: the biosphere (nature) underpins economy and society. Reproduced with permission from Azote Images for Stockholm Resilience Centre (https://profesus.eu/sustainable-development/sdgs/).

land degradation and climate change. Both reports highlight the need for radical, transformative changes in human behaviours and systems if we are to achieve the Aichi Targets and SDGs. A new set of targets is under development for post 2020.[39]

3.2 EU and Ireland Policies – Towards a New Green Deal

Key Message

Policy at the EU and Irish levels enforces international thinking around NCA. At both levels, the target date of 2020 was set by which natural capital accounts are to be developed and integrated into national planning and sectoral policy/decision making. In particular, the EU Green Deal sets out the fundamental focus for all activity in the EU for the next decade.

3.2.1 EU Biodiversity Strategy

In May 2011, the European Commission adopted the EU Biodiversity Strategy, entitled *Our Life Insurance, Our Natural Capital: An EU Biodiversity Strategy to 2020*. The strategy is in line with the global commitments, in the context of the CBD (see Chapter 2 in the INCASE literature review for more detailed discussion on policy). Action 5 of Target 2 has the most resonance in terms of NCA: "map and assess the state and economic value of ecosystems and their services in the entire EU territory; promote the recognition of their economic worth into accounting and reporting systems across Europe."[40]

Specifically, this action relates to the MAES and the EU Knowledge Innovation Project Integrated NCA (EU-KIP INCA) projects, which have been ongoing in the EU since 2011. Note that a new EU Biodiversity Strategy is due in 2020, and this will most probably set stronger targets around NCA following from the communication around the EU Green Deal.

39 https://www.cbd.int/conferences/post2020 (accessed 6 March 2020).

40 https://ec.europa.eu/environment/nature/biodiversity/strategy/target2/index_en.htm (accessed 6 March 2020).

3.2.2 7th Environment Action Programme

The 7th Environment Action Programme (EAP) (EC, 2014)[41] builds on the significant achievements of 40 years of EU environmental policy and draws on several strategic initiatives in the field of environment, with particular reference to the protection, conservation and enhancement of the EU's natural capital (Article 2). The 7th EAP outlines that by 2020 the value of natural capital and ecosystem services, as well as the costs of their degradation, should be properly assessed and considered in policymaking and investments.[42] This requires actions in relation to sustainable development, NCA and public and private reporting on these topics, such as:[43]

- developing and applying alternative indicators that complement and go beyond GDP to monitor the sustainability of progress and continuing work to integrate economic indicators with environmental and social indicators, including by means of NCA;
- further developing and encouraging "payments for ecosystem services" schemes;
- putting in place incentives and methodologies that stimulate companies to measure the environmental costs of their business and profits derived from using environmental services and to disclose environmental information as part of their annual reporting. Encouraging companies to exercise due diligence, including throughout their supply chain.

3.2.3 European Green Deal 2019

The new European Green Deal, published at the end of 2019,[44] specifically aims to protect, conserve and enhance Europe's natural capital, and protect health and wellbeing from environment-related risks and impacts; it states that "all EU policies should contribute to preserving and restoring Europe's natural capital."[45] In addition, the development of standardised NCA practices is explicitly mentioned as part of the range of initiatives to pursue green finance and investment. The EU Green Deal essentially sets the tone for the next EU Biodiversity Strategy and EAP, clearly underlining the role of NCA in the next decade and beyond.

3.2.4 Ireland's National Biodiversity Action Plan 2017–2021

The National Biodiversity Action Plan 2017–2021 largely reflects the targets set out in the EU Biodiversity Strategy and Action Plan 2011–2020, with the work around NCA[46] supported by the following two actions:

1. Action: 1.1.10. Develop a natural capital asset register and national natural capital accounts by 2020 and integrate these accounts into economic policy and decision making.
2. Action: 1.1.11.[47] Initiate NCA through sectoral and small-scale pilot studies, including the integration of environmental and economic statistics using the framework of the UN SEEA.

3.2.5 The EPA view on sustainable development and natural capital accounting

The EPA State of the Environment Report 2016[48] presents an overview of the present status and trends in Ireland's environmental quality and health. While Ireland's environmental quality status is overall relatively good compared with other EU Member States, the authors recognise that maintaining that standard during a period of growth in the Irish

41 https://ec.europa.eu/environment/action-programme/ (accessed 6 March 2020).

42 https://ec.europa.eu/environment/action-programme/ (accessed 6 March 2020).

43 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013D1386 (accessed 6 March 2020).

44 https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf (accessed 6 March 2020).

45 https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf (accessed 6 March 2020).

46 Although a national pilot project was undertaken by the NPWS in 2016 to develop a national spatial framework for ecosystem services mapping and assessment using available national data, it has not been developed further since (see Appendix 1).

47 The performance indicators are the number of pilot studies initiated and the number of national accounts completed.

48 https://www.epa.ie/irelandsenvironment/stateoftheenvironmentreport/ (accessed 6 March 2020).

economy will be challenging. The report highlights that economic growth is clearly dependent on the environment, and in order to deliver steady and sustainable economic activity, the environment requires greater understanding and attention.

The report specifically highlights the need to integrate NCA into our measures of prosperity in a way that helps track and measure our performance alongside related issues, such as wellbeing and environmental health.

4 INCASE – Making Natural Capital Accounting the Norm

4.1 Natural Capital Accounting in Ireland – Working Locally, within a Global Network

Key Message

NCA has been widely adopted globally, specifically the SEEA method. The INCASE project builds on the work carried out on aspects of NCA and related topics to date in Ireland, bringing it together under the NCA framework. This will help to develop the best way forward for NCA in Ireland and therefore avoid ad hoc staggered steps, which would otherwise be unproductive.

Presently, more than 80 countries worldwide have adopted the SEEA approach,[49] with the SEEA-CF in mainstream use and SEEA-EEA gathering wider use as the method is becoming normalised.

In the EU, NCA has been well developed in the UK and the Netherlands in the period 2010–2020, with work progressing under the EU KIP-INCA,[50] MAES[51] and MAIA[52] (Mapping and Assessment for Integrated Ecosystem Accounting) projects. Discussions at Eurostat are ongoing as to how NCA will be implemented across the EU and these are largely being informed by these projects. The SEEA-CF has already been integrated into the national statistics offices' reporting across the EU, while the SEEA-EEA will become mandatory as the method is refined at the UN and EU levels (the next revision of the SEEA-EEA is due in 2020).[53]

While work is ongoing globally in relation to NCA, Ireland has taken preliminary steps, although a clear strategy on how to apply NCA at either the local scale or the national scale is lacking; this is despite the policy drivers and frequent use of the term natural capital in governmental publications (National Planning Framework; Green Economy Initiative), policy documents[54] and reports (SDG Voluntary Reporting)[55] as well as EPA publications.

A national forum on the topic of natural capital – the Irish Forum on Natural Capital – was established in 2014.[56] This has representation from state, semi-state and private organisations, serving as a discussion and learning platform around aspects of NCA. Research projects in Ireland are also informing how natural capital stocks and flows, with a view to developing more integrated policy and management approaches. These are largely funded by the EPA (Chapter 5, Table 5.1 in the INCASE literature review).

Work is also being carried out in the business community with both Coillte and Bord na Móna developing natural capital accounts for their land holdings. BIM,[57] Dublin Port Authority and others are also at the scoping stages. Coillte has applied CNCA, while Bord na Móna[58] (2018–2020) and BIM

49 https://seea.un.org/content/global-assessment-environmental-economic-accounting (accessed 6 March 2020).

50 https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm (accessed 6 March 2020).

51 https://biodiversity.europa.eu/maes (accessed 6 March 2020).

52 http://maiaportal.eu/home/ (accessed 6 March 2020).

53 https://seea.un.org/content/seea-experimental-ecosystem-accounting-revision (accessed 6 March 2020).

54 Protecting, conserving and enhancing our natural capital is explicitly referred to on p. 123 of the National Planning Framework (2018). Available online: https://www.housing.gov.ie/sites/default/files/publications/files/project_ireland_2040_npf_7mb.pdf (accessed 6 March 2020).

55 https://www.dccae.gov.ie/en-ie/environment/topics/sustainable-development/sustainable-development-goals/Pages/Voluntary-National-Review-2018.aspx (accessed 6 March 2020).

56 https://www.naturalcapitalireland.com/ (accessed 6 March 2020); both Professor Stout and Dr Farrell are founding members of the IFNC.

57 http://www.bim.ie/our-work/projects/exploring-natural-capital-solution-seminar/ (accessed 6 March 2020).

58 https://www.youtube.com/watch?v=F-CuHksINaY (accessed 6 March 2020).

(2019–2020) both applied the SEEA method, working with the IDEEA Group on these projects.

4.2 INCASE – Building a Centralised Data Platform

Key Message

In Ireland, there is a wealth of environmental data, as well as data on land cover and land use held by a range of agencies. INCASE will establish the process steps of NCA to bring data on natural capital stocks and flows of services into a centralised data platform, which can be used in a multi-disciplinary way to inform policy decisions at sectoral and inter-sectoral levels.

In order to apply the SEEA approach at the catchment level, the following steps and supporting information/ datasets are required at a minimum:

- asset extent: land cover data and/or habitat mapping at the national level;
- asset condition: pressures and condition indicators based on the Irish context;
- services: information on the range of services (provisioning, regulating, supporting, cultural);
- benefits (users): an understanding of activities and benefits created by assets within each catchment and which are beneficiaries;
- SEEA-CF accounts: the project team will work with the CSO to link the outputs of the SEEA-EEA with data gathered by the CSO to develop environmental accounts at the catchment level (where possible).

4.2.1 Data requirements for NCA

In terms of data, there are a number of basic criteria for the use of datasets (see Appendix 1) that must be adhered to for NCA. There is a wide array of datasets and systems in operation across agencies, state departments and academic institutions in Ireland, which will facilitate building the accounts[59] (Appendix 1). The basic data requirements for the INCASE project will include data on land cover (OSI/EPA land cover maps); Corine (Co-ordination of Information on the Environment) land cover (EU); land use (DAFM and Teagasc); catchments (EPA); soils, aquifers and bedrock (GSI); water use (Irish Water); water quality (EPA); forest cover (Forest Service and Coillte); peatlands (Derived Irish Peatland Map – DIPM; Bord na Móna; Coillte); habitats and species (NPWS and others);[60] CSO environment accounts and planning data (local and regional authorities). A number of other datasets are also available at the catchment scale[61] to create a more detailed output at a finer level. As well as the required data, the level of technical expertise within these organisations is also a major strength to bring the natural capital accounts together.

Once the data are collected, they are brought together using computer modelling tools, such as the EnSym tool,[62] to create a seamless geospatial database, from which accounting tables are developed. Bringing the data into a centralised platform and establishing the level and quality of data required for each account will be a central aspect of the INCASE project (WP2). Building a data platform/structure fit for INCASE, but also to exist beyond the project – one that is modular and open source to facilitate development over time – will help progress co-ordinated and efficient NCA in Ireland. INCASE will provide insights as to how that may be achieved. It should be noted that one of the recommendations in the SEEA-EEA Technical Guidance[63] notes is the need to establish a national spatial data infrastructure (NSDI) that would support integration of environmental and socio-economic data.

4.2.2 Synergies with ongoing projects

The INCASE project will work to develop synergies with existing projects, not least the EPA/OSI land cover

59 Different data are required for asset extent, condition and services/benefits accounts. Bringing available data together and evaluating quality and relevance, as well as gaps, will form a significant part of the INCASE work.

60 EPA, Teagasc, Coillte, Forest Service, local authorities, NBDC, Heritage Council, etc.

61 The NPWS collated, reviewed and assessed over 300 spatial datasets for use in their national pilot implementation of the EU MAES project in 2016.

62 https://ensym.biodiversity.vic.gov.au/cms/ (accessed 6 March 2020); developed by the Victoria state government (Australia) with members of the IDEEA Group.

63 Section 3.6.1: Developing a NSDI.

mapping project, which will deliver a solid database for developing natural capital accounts. The land cover maps are due for completion across Ireland in 2020.

At the national level, the Environmental Sensitivity Mapping (ESM) tool developed recently as part of an EPA research project has obvious immediate, potential synergy with the INCASE project. Combining the outputs of INCASE (mapping data showing extent and condition of natural capital assets, services, etc.) with the ESM tool (which aims to inform better planning decisions in Ireland) would provide a better information system for planners in Ireland, particularly for the purpose of identifying the natural capital asset network of stocks and flows of services throughout that network. Following from this, planners can work to ensure maintenance and management of those stocks and flows with regard to wider issues, such as climate change and biodiversity loss, though this requires further integrated sectoral plans at the catchment and national levels.

By extension, the same datasets may be used for development of payment for ecosystem services schemes and contribute to the Common Agricultural Policy (CAP) reform in Ireland. Other synergies can also be developed with the recent work on EIP projects at the catchment level (e.g. the Pearl Mussel Project in the Caragh catchment and the Biodiversity Regeneration in a Dairying Environment – BRIDE – Regenerative Farming EIP).

4.3 Applying Natural Capital Accounting in Ireland

Key Message

Stakeholder engagement is a central part of the SEEA approach and will inform the process at the catchment level, but it will also inform potential applications and uses by other agencies at the national and catchment levels. Overall, the approach is viewed as an important step to integrate policy as well as provide a standardised platform for a range of sectors and applications.

Integrating datasets and expertise into Ireland in a multi-disciplinary way will create a platform to enable the efficient and effective delivery of environmental targets (along with other tools) locally and nationally as well as contribute to better reporting measures on sustainable development. While this is one of the main motivations for NCA, collating data in such a standardised format can enable better informed decision making around land use and potential trade-offs (see Chapter 2). Based on stakeholder engagement and discussion to date (see Appendix 1, Tables A1.5 and A1.6), as well as the examples from other countries, there is a range of potential applications that may develop at either the catchment level or the national level. Overall, the approach is viewed as an important step to integrate policy as well as provide a standardised platform for a range of sectors and applications. Some of the applications discussed to date (outlined in Table 4.1) include:

- ICM: this is the main focus of the INCASE project. Water quality relies on integrated and informed decisions around land use (forestry, agricultural, mining, industry, infrastructure, etc.) and a full set of natural capital accounts will inform discussions and help enable integrated decisions around activities in a catchment.
- CSO environmental accounting: the CSO already reports to Eurostat on a number of SEEA-CF accounts (see Appendix 1); building the SEEA-EEA aspect will align information on natural systems with the accounts already reported to Eurostat and those in the future.
- Planning urban and rural development: population growth is one of the main challenges in Ireland. Developing serviced urban settlement while mitigating rural decline and balancing climate action targets on planting, etc., will benefit from NCA. Irish initiatives such as the ESM tool could be linked with NCA to enable better information for planning in the form of a robust baseline for future plans.
- Marine: following from the WFD and ICM, quality of the marine environment is strongly linked to activities on land (and the Marine Strategy Framework Directive – MSFD – and the Common Fisheries Policy – CFP). BIM is exploring how to apply NCA to the seafood industry and the outputs will feed directly into the INCASE catchments that have immediate contact with fisheries. Work is also ongoing in the Marine Institute in relation to ecosystem assessment.

Table 4.1. An overview of further potential applications

Relevant natural capital asset/service	Relevant agency/ organisation	Potential NCA application	Potential policy link
Aggregates (geosystem service)	EPA; GSI	Valuation of mineral resources; trade-offs with other land use	LULUCF and forestry
Carbon stores	DCCAE; EPA	Map high carbon stores, sinks and sources; LULUCF reporting	Climate action; CAP; forestry; peatland strategy; carbon tax
Climate regulation (creating carbon sinks)	DCCAE; EPA	Where to restore carbon sinks; offset losses	Climate action; CAP; forestry; peatland strategy
Coastal protection	Local authorities; NPWS; OPW	Reducing coastal erosion; managing coastal habitats	Natura 2000; planning and development
Energy (potential spaces for wind, solar, geothermal)	DCCAE; SEAI	Space for renewables	Climate action; energy
Flood mitigation	DHPLG; local authorities; OPW; RAs	Flood prevention; NWRMs	Floods Directive; WFD; planning and development
Groundwater	GSI; Irish Water	Protection of groundwater	Drinking water
Habitat	ENGOs; NBDC; NPWS; local authorities	Restoration planning; nature networks/conservation	Natura 2000; Birds and Habitats Directives; Wildlife Act
Landscape	Heritage Council	Conservation of cultural and natural landscape features	Landscape policy
Marine food production	BIM; DAFM; Marine Institute	Sustainable development	MSFD; CFP
Planning (space)	DHPLG; local authorities; RAs	Urban and rural planning	Planning Framework Ireland; Regional and County Development Planning
Pollination	DAFM; Teagasc	Reducing pollinator decline	Pollinator Plan; CAP
Soil	DAFM; Teagasc	Protection of soils	Soils Directive
Terrestrial food production	DAFM; Teagasc	Sustainable development	CAP; Natura 2000
Timber	Coillte; Forest Service	Sustainable development	CAP; forestry
Water	EPA; IFI; Irish Water; LAWPRO	Protection of fisheries; habitats	WFD; Natura 2000
Water (drinking)	EPA; Irish Water; LAWPRO; NFGWS	Protect and restore water sources	WFD; drinking water

More details can be found in Table A1.5 (in Appendix 1); these applications will be developed further as the natural capital accounts are built for each catchment area.

ENGO, environmental non-governmental organisation; IFI, Inland Fisheries Ireland; LAWPRO, Local Authority Waters Programme; NFGWS, National Federation of Group Water Schemes; OPW, Office of Public Works; RA, regional authority; SEAI, Sustainable Energy Authority of Ireland.

- CAP reform: developing payment for ecosystem services schemes for landowners can be facilitated by using the information provided by NCA, targeting work to maintain and/or restore natural capital stocks and flows. This would build on a number of ongoing EIP projects co-ordinated by DAFM and some of the reforms proposed under the EU CAP.
- Forestry: the Irish government has set ambitious targets around planting trees as part of its Climate Action Plan. Managing planting/natural regeneration to ensure trees are planned for the right soils, linking native woodland networks and long-term carbon stores/sinks will be critical for those targets to be realised.
- Peatland management: peatlands cover up to 20% of the Irish landscape and deliver a range of services at the catchment level (water filtration, regulation of water flows, biodiversity) and globally (carbon). Co-ordinating and tracking peatland rewetting using NCA will have multiple benefits for climate, water, people and biodiversity (as in the Figile catchment – see Appendix 1).
- Biodiversity: mapping the extent and condition of natural assets and linking these, and their constituent parts, to the multiple services that they provide to humans will enable the interactions between biodiversity and humans to be better understood and enable outcomes from planning decisions to be modelled for coherent planning

for sustainable biodiversity networks. Planning for nature will enable the linking of wildlife corridors with green and blue infrastructure initiatives within local authorities and regional planning objectives.[64]

- European networks*:* there are obvious synergies between INCASE and the EU INCA, EU MAES and EU MAIA projects. Working as part of a European network will enable the development of NCA in Ireland to benefit from lessons learned across Europe as well as work to reform EU directives and policy instruments relating to land use.
- Other potential applications: Land Use and Land Use Change (LULUCF) reporting (as in the Netherlands), SDG reporting, developing carbon tax schemes and creating public awareness. Development of novel market mechanisms that allow win–win solutions at maximum efficiency for environmental outcomes and local communities will also be explored, e.g. reverse auctions.[65]

A Wetland Trade-off – To Drain or Not to Drain

A wetland may be drained for agriculture or maintained for its water flow regulation/filtration/carbon sequestration and/or biodiversity. Draining the wetland will result in a loss in asset value and flows of services from the wetland because of a change in the condition of the asset and potential disservices in the form of silt and sediment run-off. However, the potential crops grown – or subsidies paid – will also provide a market value. Weighing up the value of both choices in the context of the wider landscape and short- and long-term policies can be assisted by NCA. Equally, NCA can be used to identify co-benefits. These include carbon sequestration benefits, as well as benefits for water quality (filtration of sediment and attenuation of ammonia), biodiversity and flood mitigation (natural water retention measures or NWRM) as a result of restoration of peatlands as an Irish wetland example. The opposite occurs in terms of peatland drainage/cutting – disbenefits and disservices – but with short-term market value (benefit) for the cut peat.

64 https://ec.europa.eu/jrc/en/publication/enhancing-resilience-urban-ecosystems-through-green-infrastructure-enroute-progress-report (accessed 6 March 2020).

65 https://www.catchments.ie/using-reverse-auctions-to-support-delivery-of-catchment-off-sets-in-wessex-uk/ (accessed 6 March 2020).

5 Natural Capital Accounting at the Catchment Level in Ireland

Key Message

Having a selection of different catchment types allows us to consider a range of issues in the Irish context, particularly through the lens of the pressures, policies and solutions required for ICM. Four catchments will be studied by INCASE, each presenting a particular scenario and a set of questions around land use, water, biodiversity and climate action in the context of human use, policy context and general environmental management.

5.1 Integrated Catchment Management and Catchment Services

The main focus of the INCASE project is to apply NCA at the catchment level. The catchment unit is proposed as the delineation of the areas based on the principles of the ICM approach applied by the EPA and the Catchment Services framework (see Chapter 6 in the INCASE literature review). These approaches have many parallels with NCA and specifically the SEEA approach.

Working from both the top down and the bottom up, the ICM framework fits with the systems and systems-thinking approaches, while the catchment services concept links two components of natural capital (ecosystem and geosystem services) with social and economic services provided by people living in the catchment. This is the approach taken in preparing RBMPs as part of the implementation of the WFD, recognising otherwise hidden values and services provided by the catchment and the integral relationship between the catchment and people. It promotes an integrated management approach – bringing land cover and land use topics, such as biodiversity, agriculture and water quality, together, in a similar way to NCA.

5.2 INCASE Catchment Selection

Four catchments were selected for the INCASE project to reflect the range of characteristics of land and water (biological, physical, chemical), such as soils, climate, bedrock, aspect and altitude, as well as habitats, land uses and pressures in Ireland as identified in the RBMP 2018–2021 (farming, forestry, energy, infrastructure, industry, human settlement, rural development, urbanisation, etc.). The main considerations for catchment selection are listed in Table A1.1, Appendix 1, with the following aspects highlighted by the EPA Catchments Unit:

- The accounts are to be built around reliable datasets available nationally to allow for national scaling up.
- Catchments that capture the flow from “mountains to sea” should be considered.
- Stakeholder engagement and synergies/linkages with existing projects should be considered to maximise data inputs and opportunities for wide-ranging stakeholder engagement.

The four catchments selected are (see Figure A1.1):

1. Caragh, County Kerry: largely a peatland catchment and an important nature conservation area with a focus on a range of species, including freshwater pearl mussel.
2. Bride, County Cork: largely an agricultural catchment. Agriculture, urban diffuse pollution, forestry, hydro-morphological changes and wastewater treatment facilities are significant pressures in this catchment.
3. Figile, County Offaly: considerably impacted by the peat extraction industry, there is large-scale transition towards renewable energy sources as well as peatland rehabilitation in this catchment.
4. Dargle, County Wicklow: the catchment is a mix of expanding urban settlement, agriculture, forestry, moorland/heathland and peatland.

6 Conclusions and Recommendations

Key Message

A logical framework has been outlined for the INCASE project to proceed, following an iterative process of data collation, analysis and stakeholder engagement. INCASE will provide the basis for the adoption of NCA as a normalised activity in Ireland, building on previous and existing work to enable and inform integrated, inter-sectoral decision making.

6.1 Aims and Approach of the Project – Are They Sufficient?

Much of the work completed in countries to date (consider the UK Natural Capital Committee[66] – UK-NCC – and the UK Office of National Statistics[67] – UK-ONS – work, as well as the work of the EU MAES and KIP-INCA projects) take the same approach as that outlined in the INCASE project. In terms of NCA, key motivations of the INCASE project reflect those of the EU KIP-INCA, MAES and MAIA projects and are to:

- build on and bring value to work completed to date (bringing datasets together from wide-ranging agencies and research projects);
- collaborate with and strengthen synergies with existing projects; while working to
- build a shared platform of information whereby a standardised and coherent information set on natural capital (extent, condition assessment, services and benefits) can be aligned with national accounts; and
- inform future standardised approaches to data collection, data sharing and effective data use and reporting; by
- establish the process steps for NCA at the catchment level, identifying challenges and developing solutions.

6.2 INCASE Steps – Informing the Process

NCA is essentially a network of activities (a system) that are set out in a number of steps merely to group the tasks and process steps against a targeted outcome at each step (consider the SEEA-EEA accounts; see Figure 2.2). Establishing a clear process in the Irish context – considering data, people and applications – is fundamental to INCASE. Following the standard approach to NCA, as outlined in Chapter 6 of the INCASE literature review, the INCASE project will use an approach of reflexive realism, focusing on a close link between theory (the guidance notes and previous case studies) and quantifiability in a process of iteration. The key steps for INCASE are as follows:

- data: carry out a review of data quality and potential for use in WP2/3; establish data share agreements; build a data platform/process whereby the process is mapped clearly;
- asset extent: develop maps of the extent and type of natural capital assets in each catchment;
- condition: explore data available (quality and reliability) for use as condition indicators and to map pressures for each asset, in each catchment;
- services: link maps and supporting data on asset extent, type and condition to identify services and flows of services within each catchment;
- benefits: link data (what can be used and what sources are there?) on benefits and beneficiaries with activities in each catchment (WP2/WP3);
- policy relevance: work with stakeholders at each step to clarify and ensure relevance/focus of the research and fit-for-purpose outputs.

Each of these steps must be considered not only against the backdrop of the specific character and questions of each catchment but also in the context of how the process can be developed and refined in the national context. This is clearly a learning process, as

66 https://www.gov.uk/government/groups/natural-capital-committee (accessed 6 March 2020).

67 https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/uknaturalcapitalaccounts/2019 (accessed 6 March 2020).

it is work that is pioneering, requiring feedback loops with stakeholders (local and national) and decision makers at every level and in each iterative step.

Establishing the core accounts as outlined in the SEEA-EEA, combined with knowledge of the pressures and management issues in a particular area (following from the ICM approach), will direct and inform discussions around how best to use the outputs to integrate policy development and land use, as well as inform potential trade-offs (including consideration of disservices and co-benefits) specific to an area/ catchment. Linking the outputs of the SEEA-EEA with the work by the CSO on the SEEA-CF will help to build a broader, richer picture of the catchment from a natural capital accounts perspective and maintain relevant focus.

6.3 Working through Challenges

There will be challenges for INCASE, as recognised by the project team and the steering committee, and these range from high-level epistemological questions to focused questions on data sharing, data quality and suitability. INCASE is an essential and prudent step in "learning by doing", working through challenges at the catchment level, to inform how NCA can be effectively and efficiently scaled up to the national level. Certain aspects of NCA may only be appreciated at the catchment scale and may not be feasible at national scale and vice versa. This is the value in "doing the learning" within INCASE. Some of the following highlighted challenges[68] are generally common to other projects across the EU and globally in applying NCA:

- Data: is the quality of data at the catchment level enough? What about the national level – will catchment learnings be relevant? Where will data be stored? How can data be continually maintained and updated?
- Condition indicators: what metrics exist for the range of natural capital assets? Are we measuring what is required in 2020 to develop condition accounts? What about beyond 2020? What cross checks can we use for indicators in general?
- Valuation: what is the best approach? Whose value is important? What data are available and who sets the benchmarks for assets and services where no market exists? What are the consequences of creating market values around nature?
- Decision making: developing a transparent NCA process and valuations[69] – how can NCA inform decision making? Who makes the decisions?
- Relevance: how can NCA policy be made relevant and not "just another system"? How best to make NCA value adding (bringing efficiency and effectiveness to data use and relevance)?
- Linking with the SNA: can NCA inform sustainability indicators? Can nature be reduced to one number or indicator? How do we go *Beyond GDP*?[70] Can NCA help?

Setting out the challenges for INCASE creates an awareness of potential shortcomings and considerations for building NCA to suit the Irish context. The ongoing revision of the SEEA-EEA is exploring these issues with input from those working on NCA in the EU and wider areas. INCASE may identify further issues specific to Ireland, which may or may not arise in other countries. This is of significance in relation to the ongoing work by Eurostat and the UN SEEA-EEA revision process to develop guidance for national statistics offices.

6.4 Feasibility of the INCASE Project

Key Message

Developing the INCASE project for the selected catchments will fulfil the main objective of INCASE, which is to develop a framework whereby NCA can be implemented at the catchment level, providing learnings and insight as to how to apply NCA at the national scale. Potential applications will be developed for different sectors (climate action, agriculture, etc.) over the course of INCASE.

68 Challenges raised by Irish stakeholders to date include data quality, transparency of process, valuation, policy linkages and applications; see Table A1.5 in Appendix 1.

69 Different sectors and communities operate different value systems, which need to be considered.

70 https://www.oecd.org/social/beyond-gdp-9789264307292-en.htm (accessed 6 March 2020).

The INCASE project is considered feasible, at the catchment level, based on considerations of the following:

- the structure and support of an expert, experienced and multi-disciplinary project team and steering committee;
- a strong motivation based on a number of policy drivers at international and national levels;
- an awareness from the outset of challenges posed for the project;
- the range, standard and quality of data (based on a preliminary review) available to construct the accounts at the catchment level;
- the technical expertise in different agencies supporting the project in relation to technical and policy aspects;
- the support of a range of stakeholders locally, nationally and internationally.

The project team proposes that the INCASE project proceeds as outlined in the original project proposal.

Working at the catchment level, INCASE will apply the SEEA method, collaborating with stakeholders (local and national) to drill into the detail of the four selected catchments. How NCA can work with ICM to inform the story of pressures, policy and solutions within each catchment will be determined by linking the natural capital accounts at the catchment scale to water quality, highlighting the dependency of land use at the catchment scale with environmental management in general. Lessons learned will inform the scaling up of NCA to the national level.

Given the EU Green Deal and other policy instruments due in 2020 (EU Biodiversity Strategy and new CBD targets), Ireland will be well placed in terms of developing and agreeing the best approach for NCA in Ireland and the EU following from the learnings and outputs of INCASE. The INCASE project will help to position Ireland as one of the leaders in NCA development and thinking, securing a role in steering the approach adopted across the EU.

Abbreviations

BIM	Bord Iascaigh Mhara
CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
CFP	Common Fisheries Policy
CNCA	Corporate Natural Capital Accounting
Corine	Co-ordination of Information on the Environment (EU)
CSO	Central Statistics Office (Ireland)
DAFM	Department of Agriculture, Food and the Marine
DCCAE	Department of Communications, Climate Action and Environment
DCU	Dublin City University
DHPLG	Department of Housing, Planning and Local Government
DIPM	Derived Irish Peatland Map
EAP	Environment Action Programme (EU)
EIP	European Innovation Partnership
EPA	Environmental Protection Agency
ESM	Environmental Sensitivity Mapping
ESRI	Economic and Social Research Institute
EU	European Union
EUNIS	European Nature Information System
Eurostat	European Statistics Office (EU)
GDP	Gross domestic product
GSI	Geological Survey Ireland
HAR	Habitat asset register
ICM	Integrated catchment management
IDEEA Group	Institute for the Development of Environmental Economic Accounting Group
IFNC	Irish Forum on Natural Capital
INCASE	Irish Natural Capital Accounting for Sustainable Environments
IPBES	Intergovernmental Panel on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
KIP-INCA	Knowledge Innovation Project Integrated Natural Capital Accounting
LPIS	Land Parcel Identification System
LULUCF	Land Use and Land Use Change
MAES	Mapping and Assessment of Ecosystems and Their Services (EU)
MAIA	Mapping and Assessment for Integrated Ecosystem Accounting
MSFD	Marine Strategy Framework Directive
NBDC	National Biodiversity Data Centre
NCA	Natural capital accounting
NPWS	National Parks and Wildlife Service (Ireland)
NSDI	National spatial data infrastructure
NWRM	Natural water retention measures
OECD	Organisation for Economic Co-operation and Development
OPW	Office of Public Works
OSI	Ordnance Survey Ireland
RBMP	River Basin Management Plan
SAC	Special Area of Conservation

SDG	Sustainable Development Goal
SEEA	System of Environmental–Economic Accounting
SEEA-CF	SEEA-Central Framework
SEEA-EEA	SEEA-Experimental Ecosystem Accounting
SNA	System of National Accounts
UK-ONS	Office of National Statistics (UK)
UN	United Nations
WFD	Water Framework Directive
WP	Work Package

Glossary[71]

Atmospheric system and services	The physical and chemical system in the atmosphere consisting of wind, sunshine and precipitation and the outputs (services) from atmospheric systems that contribute to human wellbeing. Examples include wind energy, solar energy and rainfall
Catchment services	The benefits received by ecosystems and humans from resources and processes that are supplied by catchments. Catchment services are delivered within catchments but are not necessarily bound by the geographical area of a catchment. Catchment services comprise atmospheric, ecosystem, geosystem and human system services
Ecosystem	All the organisms living in a community and the abiotic (non-living) factors with which they interact
Ecosystem accounting	Refers to the SEEA-EEA
Ecosystem services (provisioning, regulating, supporting, cultural)	The outputs from ecosystems that have a benefit and value to human wellbeing
Environmental accounting	Refers to national accounting (physical and monetary accounts of environmental assets and the costs of their depletion and degradation) and corporate accounting (either by means of environmental auditing or by costing of environmental impacts caused by the corporation). Environmental accounting comprises the activity around the generation of the SEEA-CF accounts
Geosystem	The underground environment that consists of subsoil, bedrock, minerals, oil, natural gas and groundwater. It does not include soil and the ecosystem associated with soil or groundwater that provides the abiotic support to ecosystems such as fens
Geosystem services	The outputs from geosystems that contribute to human wellbeing specifically resulting from the subsurface. Examples include aggregates, minerals, energy from fossil fuels, pollutant attenuation provided by subsoils, geological heritage sites, landscape geomorphology (including associated cultural values), groundwater used for drinking, geothermal energy and carbon storage
Green accounting	As defined by the OECD, this is environmental accounting (see above) and in a broader sense is also accepted as the SEEA approach[72]
Integrated catchment management	ICM is based on the concepts of (1) catchments as biophysical units in which natural resources use and ecological and water protection takes place, (2) integration of local community and scientific involvement and (3) appropriate organisational structures and policy objectives
Natural capital	The stock of renewable and non-renewable natural resources (e.g. plants, animals, air water, soils, minerals) that combine to yield a flow of benefits to people

71 Note: a glossary of terms will be developed for the INCASE project; in the meantime, definitions presented here are from EPA, EU MAES, IFNC and Natural Capital Coalition publications in the main report.

72 There is also a body of work around green accounting in relation to capital and welfare theories (https://link.springer.com/article/10.1007/s10640-008-9223-y; accessed 6 March 2020). The nuances and terms will be explored in WP3 of INCASE.

Natural capital accounting	NCA is a way of organising information about natural capital so that the state and trends in natural assets can be documented and assessed in a systematic way by decision makers. NCA is often used interchangeably with the terms environmental accounting and green accounting though they have different origins and meanings
SEEA-Central Framework	SEEA-CF covers physical accounts (stocks) and flows of environmental assets with a focus, for measurement purposes, on individual environmental assets, as well as transactions (such as taxes and subsidies) around the environment
SEEA-Experimental Ecosystem Accounting	SEEA-EEA is a geospatial approach whereby stocks of natural capital (assets) at a range of scales (e.g. country or catchment scale) are measured. Knowledge of the extent and condition of natural capital assets allows for integration of the supply and use of services (flows) flowing from nature, which are then recorded as benefits to humanity, in an accounting framework

Appendix 1 Technical Supporting Document for Stage 1 Feasibility Report

A1.1 INCASE Catchment Selection

A1.1.1 NCA approach and integrated catchment management

The approach of the INCASE project is to apply the SEEA method at the catchment level. This will involve developing the core framework accounts of the SEEA-EEA and linking them with SEEA-CF accounts to develop a more complete set of NCA.

The catchment, in the context of the ICM approach, as applied by the EPA, is the landscape unit on which the INCASE assessment of NCA is based. This approach, which has many parallels in approach and philosophy with the NCA/SEEA approach, is used as the basis for catchment management in Ireland.[73] Specifically, ICM is:

- A *philosophy* – it fosters an organisational culture and associated attitudes that view (1) co-operation and collaboration as essential and (2) interactions between natural resources and human activities or responses in a holistic way.
- A *process* – an overarching planning framework and implementation process that reflects the philosophy of ICM and provides the "vehicle" through which ICM is delivered. The process needs to provide a flexible, adaptive, ongoing and dynamic integrated mechanism, which co-ordinates the activity of many people, both in the public sector and the community.
- An *outcome* – the planning and implementation of sustainable resource use practices, which will vary from place to place, depending on conditions and needs, and the achievement of planned environmental outcomes, which are based on environmental, regulatory, economic and social considerations.

While ICM was developed as a framework for water management, the increasing realisation of the connectedness of our natural environment, which is a "system" comprising several critical "realms" – (1) water; (2) air and atmosphere; (3) ecosystems; (4) geosystems; and (5) land/landscapes – means that ICM can be used as framework for considering not only water management but also environmental management issues such as carbon sequestration, biodiversity improvement, soil protection and flood mitigation. As such, it helps provide a framework for the natural capital approach and NCA.

A1.1.2 Catchment selection

From a catchment perspective, in Ireland the significant pressures on at risk water bodies have been clearly identified and set out in the RBMP (2018–2021). Agriculture is the most prevalent pressure and it is also the largest use of land. The significant pressures impacting on the 1460 water bodies that are at risk of not meeting their WFD objectives, with the percentage of at risk water bodies in brackets, include agriculture (53%), hydro-morphology (24%), urban waste-water (20%), forestry (16%), domestic waste-water (11%), urban runoff (9%), peat (8%), extractive industry (7%) and mines and quarries (6%). Almost half (47%) are subject to a single significant pressure, with the remaining 53% subject to more than one significant pressure.[74]

Catchments for the INCASE project have been selected to represent the range of soils, habitats, land-use/pressures and geographical range in Ireland. Maximising data inputs and linkages to other projects was factored into the selection criteria. Each catchment essentially presents a particular scenario and a set of questions around land use, water,

73 The 2018-2021 RBMP has the following text on page 1: "A new approach to implementation known as 'integrated catchment management' is being used to support the development and implementation of the RBMP, using the catchment (an area that contributes water to a river and its tributaries, with all the water ultimately running off to a single outlet) as the means to bring together all public bodies, communities and businesses" (https://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021; accessed 6 March 2020).

74 https://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021 (accessed 6 March 2020).

biodiversity and climate action in the context of human use and management. Having a selection of different catchment types will allow INCASE to consider a range of issues in the Irish context, particularly through the lens of the pressures, policies and solutions required for ICM.

Initial discussion with the EPA Catchments Unit in relation to catchment selection for the INCASE project was carried out between June and August 2019. In general, it was agreed that the catchments selected should cover a broad range of conditions (physical character, ecology, land use, etc.), given that the purpose is to apply NCA at pilot scales with a view to informing its application across all catchments. A list of decision considerations was developed by the INCASE project team (Table A1.1) with the following specific criteria from the EPA Catchments Unit:

- the natural capital accounts to be built around reliable datasets that are available nationally to allow for national scaling up; therefore, the basic required data should be available for all catchments;
- consider catchments that capture the flow from "mountains to sea";
- consider stakeholder engagement and synergies/linkages with existing projects to maximise data inputs and opportunities for wide-ranging stakeholder engagement.

Following this, a list of potential catchments was developed by the INCASE project team. This list was presented to the EPA Catchments Unit and the INCASE steering committee at a workshop on 11 November 2019 (Table A1.2).

At this workshop the shortlist was agreed and those catchments form the basis for developing natural capital accounts. Four catchments (Figure A1.1) were selected to reflect the range of characteristics of land and water (biological, physical, chemical), such as soils, climate, bedrock, aspect and altitude, as well

Table A1.1. Decision considerations for INCASE catchment selection

Feature of consideration	Comments
Catchment size	Consider catchments on the smaller scale to test the approach, with mountains-to-sea coverage
Overlap with other relevant research/application/practitioner/live projects	Select catchments with active EIP, EPA and/or related EU projects to maximise synergies/data inputs
Dataset availability	Are the basic necessary datasets available at the appropriate quality – land cover, LPIS, geology, water quality, etc.; are there more detailed data for other ongoing projects?
Soils, bedrock geology, subsoil geology	Poorly draining soils, peat, limestone, granite, etc.
Aquifers	Productive or poorly productive?
Climate	Rainfall, temperature, etc.
GSI landscape unit	Range of landscape forms
Land cover	Pasture, tillage, forest, heath, peat, water
Land use	Intensive farming (dairy), intensive farming (other), extensive farming, organic farming, HNV land, peatland extraction, forestry (native), forestry (non-native), mineral/aggregate extraction/mining, industries (2016 census), rivers (%), lakes (%)
Population (employment)	Increase or decline; rural or urban?
Transport	Commuter flows, motorways, rail corridors
Energy	Wind potential and windfarms, solar potential and solar farms, large-scale combustion (i.e. EPA licensed), anaerobic digestion/biogas, etc.
Water	Surface water abstraction for drinking water; groundwater abstraction for drinking water; abstraction for farm irrigation (large scale); WFD Status 2010–2015; WFD Status 2016–2018; high status waters – river (%); high status waters – lake (%); are any blue dots (Q5 highest status rivers/lakes) present?; number of lakes (WFD monitored); downstream estuarine status (i.e. estuary – indicative of N and P carrying capacity)
Protected areas	Natura 2000 sites, NHAs, national parks, nature reserves, etc.
Biodiversity	Ecosystems, habitats, condition (management), species, etc.
Potential ecosystem, geosystem and atmospheric system services	For example, food and water; aggregates; air filtration; provisioning, regulating, supporting, cultural

NHA, Natural Heritage Area; LPIS, Land Parcel Identification System.

Table A1.2. Catchment selection workshop inputs and outputs (11 November 2019)

Category	Comments
Inputs	Overview SEEA-EEA; overview EPA catchments; catchment selection choices/desired outputs
Outputs	Short list of catchments for INCASE project; overview of catchment character; overview of natural capital assets/services; general sense of data available
Present INCASE P/T	Jane Stout, Mary Kelly-Quinn, Siobhan Atkinson, Carl Obst, Mark Eigenraam, Catherine Farrell
Present EPA Catchments Unit	Paddy Morris, Jenny Deakin
Present INCASE S/C	Donal Daly (retired, EPA), Gemma Weir (NPWS), John O'Neill (DCCAE)
Other stakeholders present	Nova Sharkey (CSO), Liam Lysaght (NBDC)

P/T, project team; S/C, steering committee.

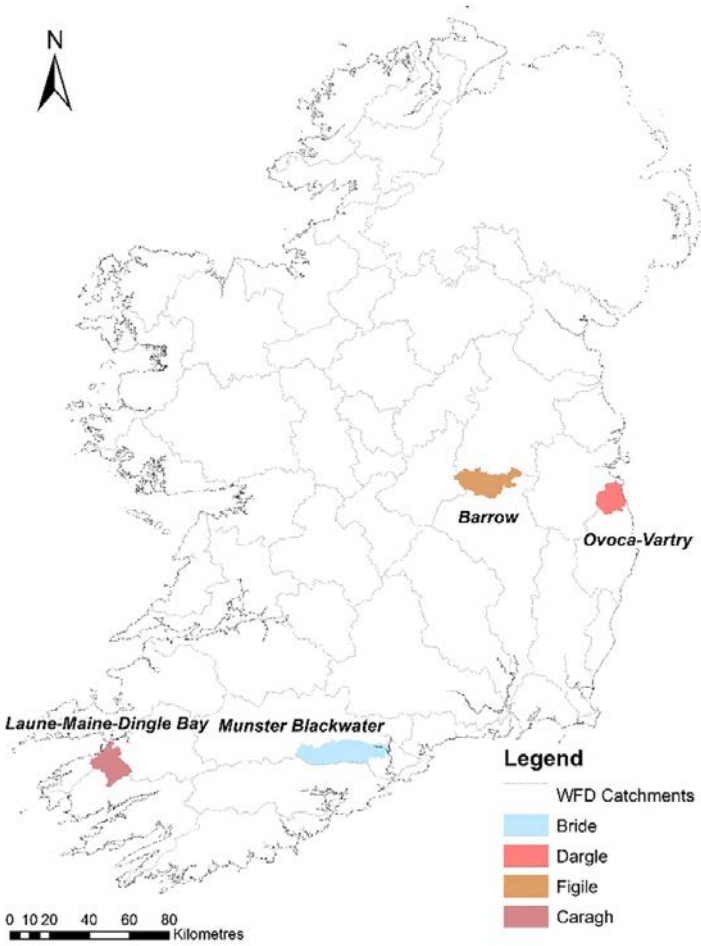
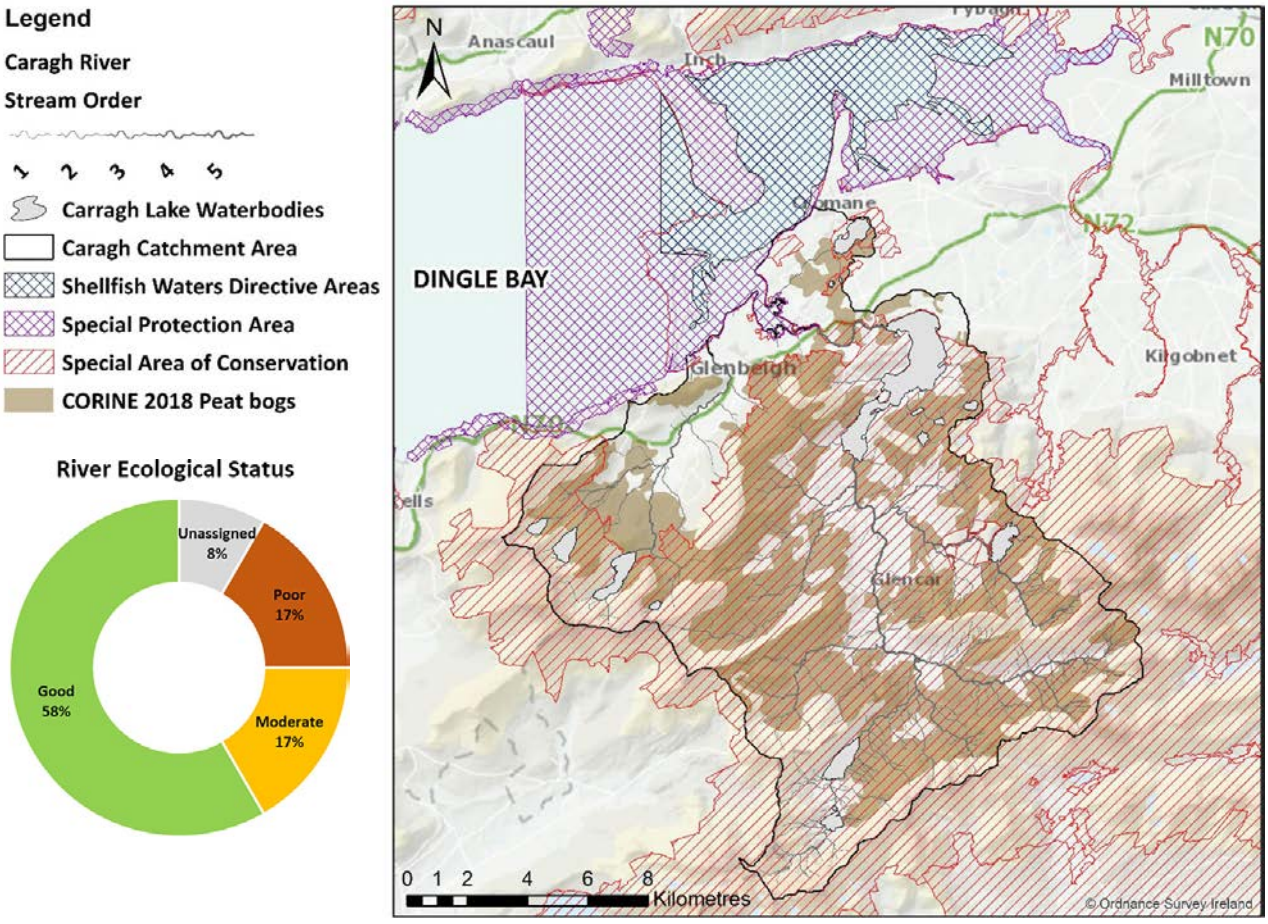


Figure A1.1. Outline map of Ireland showing locations of the INCASE project sub-catchments and the main catchments of which they are a part.

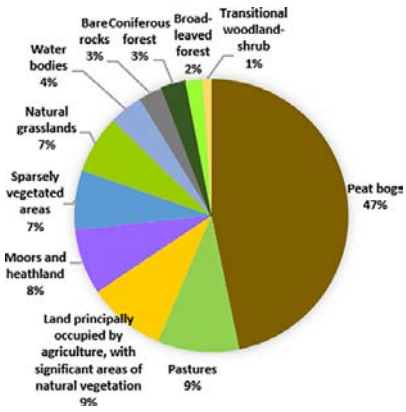
as habitats, land uses and pressures in Ireland as identified in the RBMP 2018–2021 (farming, forestry, energy, infrastructure, industry, human settlement, rural development, urbanisation, etc.). The basic catchments are illustrated in the following pages with an overview of catchment details in Table A1.3.

A1.1.3 Caragh catchment, County Kerry: nature and water quality



- catchment area: 229.65 km^2;
- three WFD Areas for Action;
- three Special Areas of Conservation (SACs): 190.6 km^2 (83% of catchment area);
- two nature reserves;
- the Caragh River flows into Castlemaine Harbour SPA and protected shellfish waters.

Corine Land Cover 2018



Catchment Story

The Caragh is a largely peatland catchment and is an important nature conservation area with a focus on a range of species, including the freshwater pearl mussel. Several of the lakes are significant habitats for char. The dominant pressures are hydromorphological changes, agriculture and forestry. As a coastal catchment flowing into protected shellfish waters and Castlemaine Harbour Nature Reserve, the land-to-sea connection is particularly important here. The Ring of Kerry and the Wild Atlantic Way are within the catchment, highlighting its recreation and tourism value.

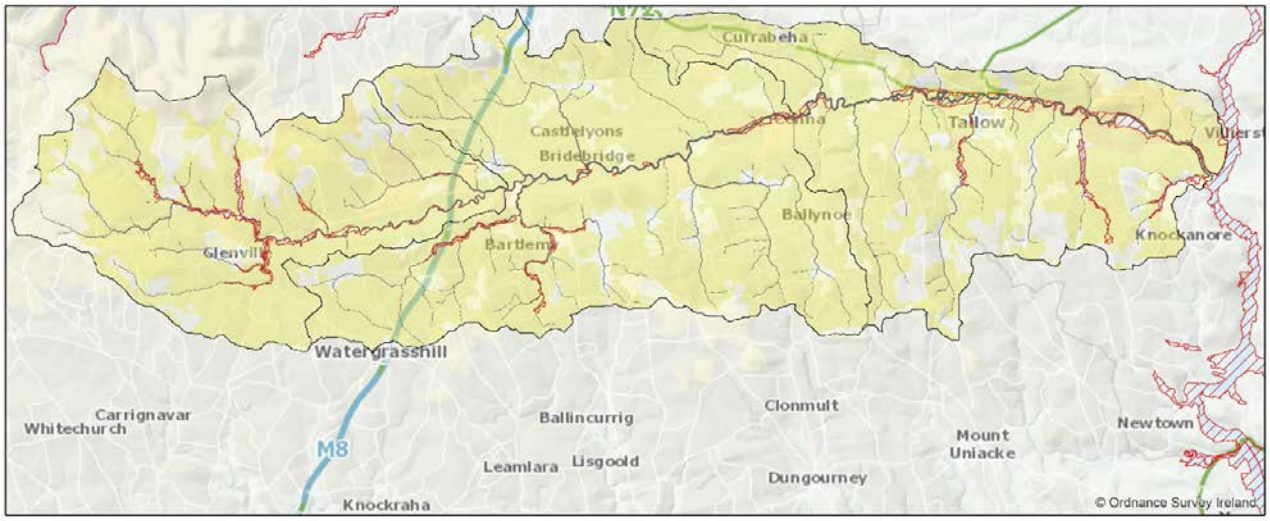
(Potential) Natural Capital Assets

Agroecosystems; forestry; freshwater; riparian vegetation; blanket bog; heathland; coastal habitats; quarries.

Stakeholders (preliminary list)

KerryLife project; Pearl Mussel Project, EIP; Inland Fisheries Ireland (IFI); BIM; NPWS; Tourism operators; farming community; EPA; Marine Institute; BIM; Coillte; Dingle Hub project; Local Authority Waters Programme (LAWPRO); anglers; Kerry County Council.

A1.1.4 Bride catchment, Counties Cork and Waterford: regenerative farming



Legend

Bride Stream Order

1 2 3 4 5

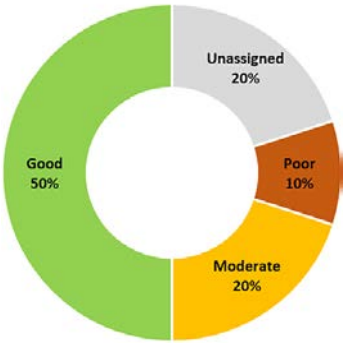
Bride Catchment Area

Special Area of Conservation

CORINE 2018 Agricultural Areas

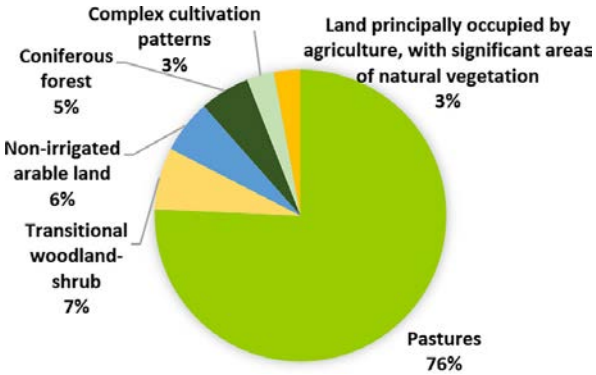
- Non-irrigated arable land
- Pastures
- Complex cultivation patterns
- Land principally occupied by agriculture, with significant areas of natural vegetation

River Ecological Status



- catchment area: 427.15 km^2;
- one WFD Area for Action;
- Blackwater River (Cork/ Waterford) SAC;
- protected salmonid river.

Corine Land Cover 2018



Catchment Story

The Bride catchment is a largely agricultural catchment. Agriculture, urban diffuse pollution, forestry, hydromorphological changes and wastewater treatment facilities are significant pressures in this catchment placing the water bodies at risk of not meeting their WFD status objectives. The Lower Munster Blackwater Estuary/Youghal Harbour has been identified as a potentially dependent transitional water body that is currently at risk of not meeting its WFD status objectives and thus the land-to-sea connection is important here. The Bride Project, an agri-environment project that aims to design and implement a results-based approach to conserve and restore habitats in lowland intensive farmland is currently under way in this catchment. The project will see farmers receive payment for the implementation of a range of habitat improvement measures.

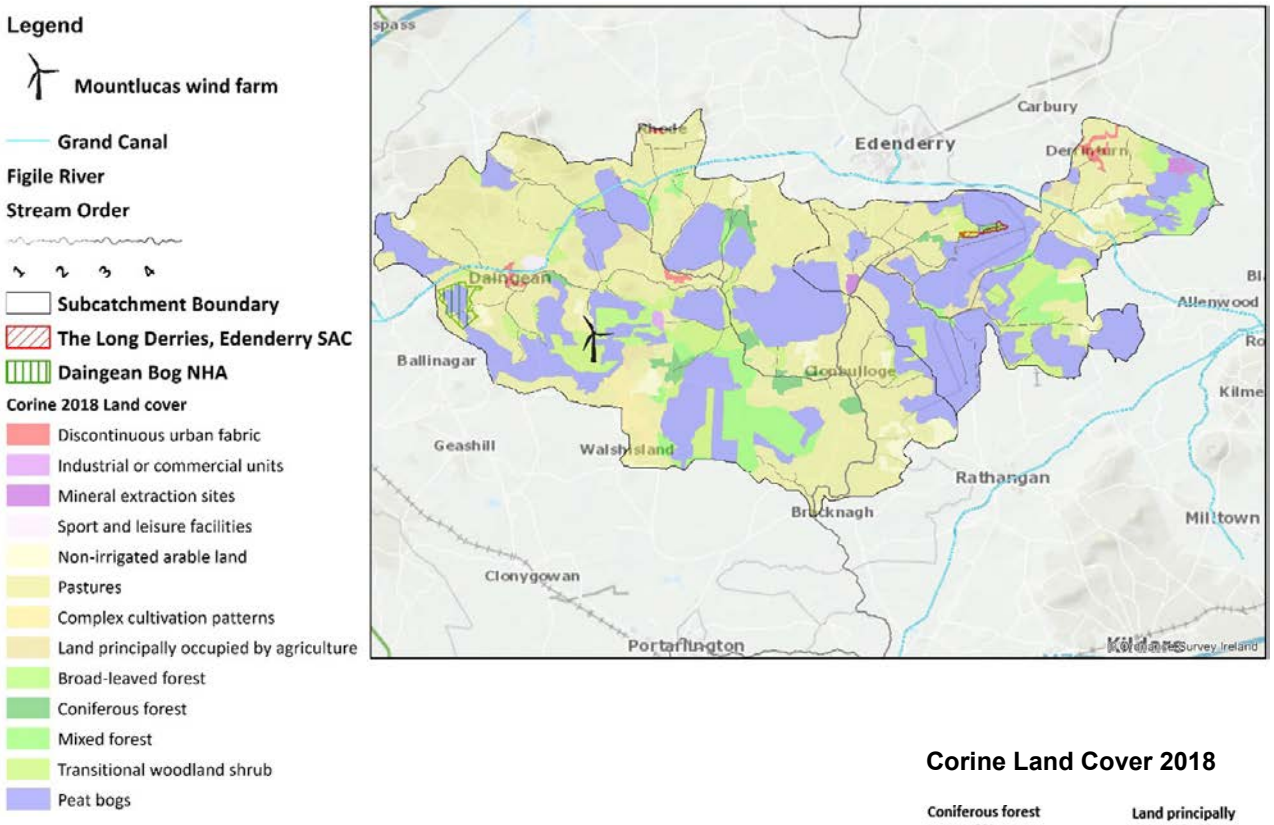
(Potential) Natural Capital Assets

Agroecosystems; forestry; freshwater; groundwater (drinking), riparian vegetation; quarries, wind/ renewables potential.

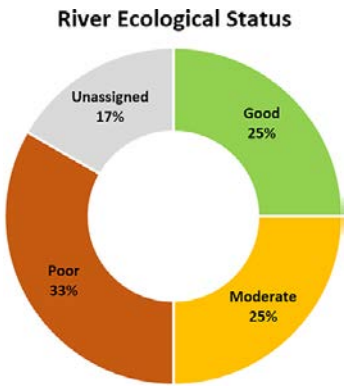
Stakeholders (preliminary list)

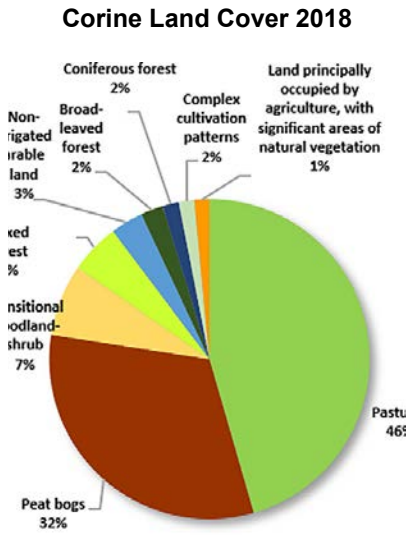
Farming communities; BRIDE project (Donal Sheehan); DAFM; Teagasc; EPA; NPWS; Inland Fisheries Ireland (IFI); Local Authority Waters Programme (LAWPRO); anglers; Waterford County Council; Cork County Council.

A1.1.5 Figile catchment, County Offaly: industrial peat and just transition



- catchment area: 301.4 km^2;
- Daingean Bog Natural Heritage Area;
- the Long Derries, Edenderry SAC.





Catchment Story

The Figile catchment is considerably impacted by the peat extraction industry. Sediment and ammonia issues caused by extensive peat harvesting, hydromorphological changes, agriculture, urban wastewater, industry and domestic wastewater are significant pressures in this catchment, placing the water bodies at risk of not meeting their WFD status objectives. Industry in this catchment is currently undergoing a transition from energy provision through peat to renewable energy (wind). A just transition plan will be implemented here to ensure no workers or communities are affected in the transition from peat to more sustainable forms of energy generation.

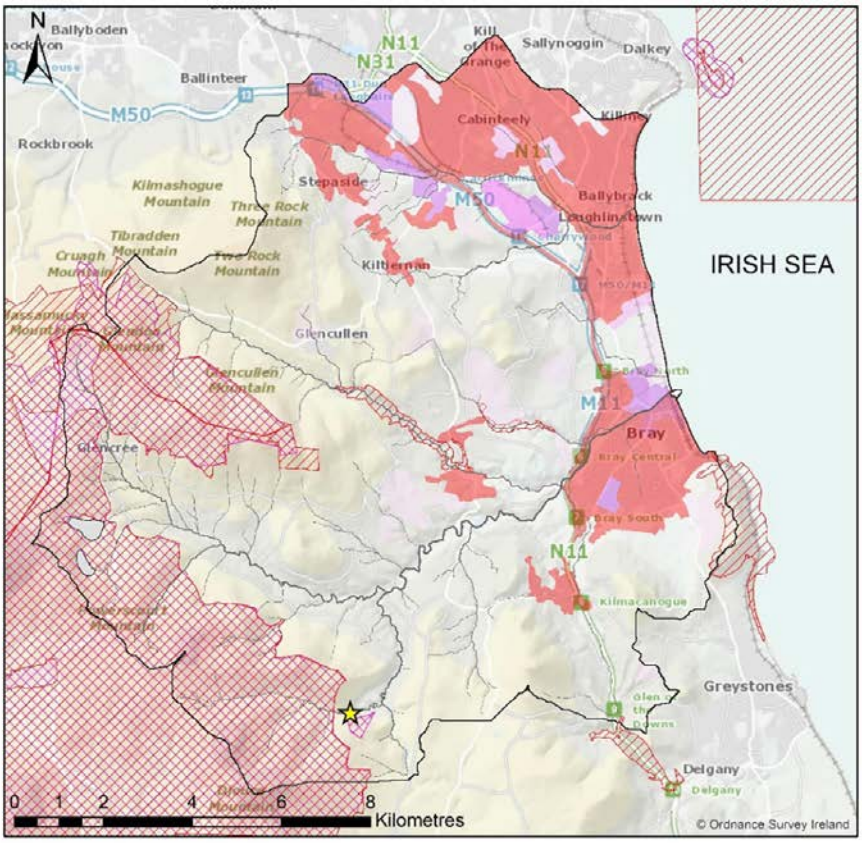
(Potential) Natural Capital Assets

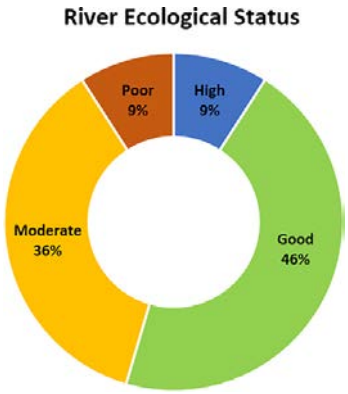
Agroecosystems; forestry; peatlands; freshwater; groundwater (drinking); riparian vegetation; industrial cutaway; renewable energy; geothermal potential.

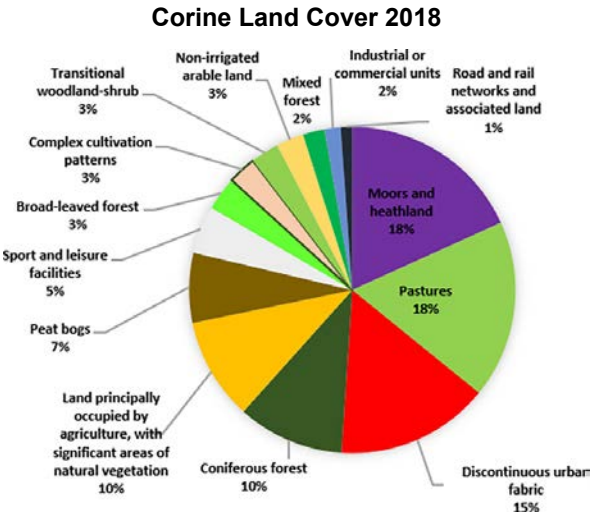
Stakeholders (preliminary list)

Bord na Móna; Coillte; Offaly County Council; Teagasc; Sustainable Energy Authority Ireland; Department of Agriculture Food and the Marine; Inland Fisheries Ireland (IFI); EPA; local communities.

A1.1.6 Dargle catchment, Counties Dublin and Wicklow: urban expanison and tourism







- catchment area: 176.9 km^2;
- four WFD Areas for Action;
- five SACs;
- two nature reserves;
- Wicklow Mountains National Park.

Catchment Story

Within the Dargle catchment are a mix of urban areas, agriculture, forestry, moorland/heathland and peatland. The catchment encompasses a relatively large urban area (towns include Bray, Cabinteely, Kilmacanogue and Stepaside). Urban diffuse pollution, sewer overflows, urban wastewater treatment and forestry as well as hydromorphological issues as a result of culverting and flood protection are significant pressures in this river catchment, placing the water bodies at risk of not meeting their WFD status objectives. As it is close to Dublin, the towns in this catchment are likely to be important for commuters working in the city. Tourism is significant in this catchment, with Powerscourt House and Gardens, Powerscourt Waterfall, Bray Head, the Great Sugar Loaf Mountain, The Wicklow Way and Wicklow Mountains National Park offering popular attractions for visitors to the area.

Stakeholders (preliminary list)

Bray UDC; Wicklow County Council; DLR County Council; Coillte Nature; Office of Public Works (OPW); NPWS; farming community; Heritage/ Biodiversity Officers; EPA; Inland Fisheries Ireland (IFI); Dublin Mts Partnership; anglers.

(Potential) Natural Capital Assets

Agroecosystems; forestry; freshwater; riparian vegetation; moorland, heathland and peatland; gravel. (aggregate)

Table A1.3. Catchment details (to be developed further over the course of the INCASE project)

Catchment	Dargle	Caragh	Bride	Figile
Size (km^2)	176.84	229.65	427.15	301.4
County	Wicklow	Kerry	Cork	Offaly
Policy questions in catchment	Urban expansion; tourism increase (impacts on upland and coastal habitats); can upland bogs reduce flooding and/or store carbon?; management of forested uplands (water quality; carbon; biodiversity); farming on uplands; fisheries; nature conservation (Wicklow National Park)	Largely peatland catchment (~60%); nature conservation area with focus on range of species, including freshwater pearl mussels (Natura 2000 sites); carbon storage in peatlands; water quality in catchment; aquaculture in Dingle Bay; farming impacts	Largely agricultural catchment (73%); dairy with mixed farming; rural with pockets of settlement; drains into Youghal Bay; small-scale forestry	Just transition; peat to renewable energy; domestic turf cutting; subsistence farming; poverty area; water quality; forestry and carbon; changing land use; peatland restoration
Stakeholders: list in development	Bray UDC; Wicklow CC; Coillte Nature; OPW; NPWS; farming community; Heritage/ Biodiversity Officers; EPA; Irish Water; IFI; Mountain biking trails (Trails Ireland); Dublin Mts Partnership; Marine Institute/BIM	KerryLife project; PMP EIP; IFI; BIM; NPWS; Tourism operators; farming community; EPA; Marine Institute; BIM; Coillte? Dingle Hub project; LAWPRO	Farming communities; BRIDE project (Donal Sheehan); Teagasc; EPA; NPWS	Bord na Móna; Coillte; Offaly CC; Teagasc; SEAI; DAFM; IFI; EPA; local communities; CWF
Potential data providers	OSI land cover; Wicklow CC; DAFM; Teagasc; NPWS; Irish Water; GSI; CSO; EPA; DCU; MI; BIM, Met Eireann	Kerrylife land cover; PMP EIP; NPWS; Kerry CC; Teagasc; DAFM; Irish Water; GSI; CSO; EPA; DCU; BIM; MI; Met Eireann	Teagasc; DAFM; BRIDE project; Coillte/FS; Cork CC; Irish Water; GSI; CSO; EPA; DCU, Met Eireann, NPWS	Bord na Móna; Coillte; Offaly CC; Teagasc; SEAI; DAFM; IFI; EPA; Irish Water; GSI; CSO; DCU, Met Eireann, NPWS
Impacts/ measurable changes in condition	Wildlife disturbance; loss of habitat; soil erosion; coastal erosion; flooding; trampling; fragmentation; improved habitat condition/water quality indicators	Wildlife disturbance; loss of habitat; soil erosion; coastal erosion; flooding; trampling; fragmentation; improved habitat condition/ water quality indicators	Wildlife disturbance; loss of habitat; soil erosion; coastal erosion; flooding; trampling; fragmentation; improved habitat condition/water quality indicators	Loss of habitat; soil erosion; rehabilitation of industrial cutaways NWRM ICM; improved habitat/water quality; carbon off sets/stores/ sequestration
Assets	Urban, agri, forestry, freshwater, riparian; artificial; peatland; quarries; gravel aquifers	Agri; forestry; freshwater; riparian; blanket bog; heathland; coastal; quarries	Agri; forestry; freshwater; riparian; heathland; coastal; quarries	Agri; forestry; peatlands; freshwater; riparian; artificial; quarries
Story	Condition; pressures; accounting identify pressures; habitat connectivity and buffers; ICM	Farming with nature (high nature value); protect habitats and species; importance of spatial location; tourism; rural development; aquaculture; carbon and climate change; PES	Intensive farming; regenerative farming = improved practices; PES (improved resilience of the system); artisan foods; carbon in agri-systems; improved salmonid habitat	Subsistence agriculture; industrial peatland converted to renewable energy; just transition; WFD NWRM; aquaculture
Benefit	Tourism value; planning urban space; flood mitigation; managing uplands for urban benefits; link to jobs; coastal protection; health; wellbeing; clean water	Aquaculture (shellfish) benefit; FPM benefit; farmers benefit; WFD benefit	Agri-biomass; WFD; farming; nature	Carbon; habitat; species; water quality; biomass (aquaculture)
Services (preliminary list)	Amenity; carbon; food; flood regulation habitat; recreation; timber	Agriculture biomass; carbon; fish; health; habitat/species conservation; flood regulation; sediment retention; timber; water filtration	Food; flood regulation minerals; timber	Carbon storage; energy; food; sediment retention; timber; water purification; flood mitigation

CC, County Council; DCU, Dublin City University; IFI, Inland Fisheries Ireland; LAWPRO, Local Authority Waters Programme; MI, Marine Institute; OPW, Office of Public Works; PES, Payment for Ecosystem Services; PMP, Pearl Mussel Project; SEAI, Sustainable Energy Authority of Ireland; UDC, Urban District Council.

A1.2 Data requirements for INCASE

The topic of data falls under INCASE WP1, specifically Task 1.2. This is an overview of the main data sources for applying the SEEA-EEA approach for the INCASE project. This section outlines:

- an overview of data availability based on consultation with potential data providers and a workshop held on 11 November 2019;
- a background to the importance of spatial data;
- the basic data requirement for NCA;
- the different datasets needed for different accounts.

A1.2.1 INCASE data workshop

Between June and December 2019, a range of data sources and providers were identified. A workshop was convened in November 2019 to bring data providers together (Table A1.4). Each organisation's representative outlined the data available and capacity for data sharing with INCASE and these are outlined in section A1.2.2.

A number of projects in particular show strong linkages (along with those outlined in Table 5.1 of the INCASE literature review) and these are the OSI/EPA land cover projects, the Irish MAES project and the recently developed ESM tool. There are also obvious linkages with ongoing data collection by the EPA, NPWS, NBDC, DAFM, Teagasc, GSI, Irish Water, CSO, etc.

A1.2.2 The role of spatial data in NCA

Physical ecosystem accounting – core accounts

For INCASE, four catchment areas were selected and the core SEEA-EEA accounts will be developed for each (listed below). While each catchment has its own characteristics, the purpose of INCASE WP2 is to apply the SEEA-EEA methodology and test the approach in a range of the following conditions:

- extent of potential natural capital assets;
- condition of assets to be based on indicators,[75] either individual or aggregate. For example, water quality indicators may be Q values (an aggregate) or specific levels of N/P in the system depending on the policy question/pressure;
- flows of services to beneficiaries/users (and non-users) – these will vary between catchments and asset condition/capacity;
- spatial relationships – how natural capital assets relate to each other but also other capitals.

Benefits of spatial approach to NCA

The main motivation for NCA is outlined in the main report but it is useful to highlight the benefits of using geo-spatial data to collate data on land cover, natural systems and flows. Some of the benefits are outlined as follows**:**

- Information about localisation of natural capital assets and services can have high policy relevance, as national averages can hide crucial differences in levels of stocks and flows in different locations.

Table A1.4. INCASE data workshop inputs and outputs (11 November 2019)

Inputs	Overview SEEA-EEA; overview sub-catchment choices (following previous workshop)
Outputs	Engagement with data providers; identify synergies with other projects; applications
Present INCASE P/T	Jane Stout, Mary Kelly-Quinn, Siobhan Atkinson, Carl Obst, Mark Eigenraam and Catherine Farrell
Present EPA Catchments Unit	Paddy Morris
Present INCASE S/C	Donal Daly (retired EPA) and Gemma Weir (NPWS)
Other stakeholders present	EPA mapping (Kevin Lydon by weblink); Liam Lysaght NBDC; NPWS (Paul Duffy); CSO (Nova Sharkey +3); Stuart Green (Teagasc), Monica Lee and Taly Hunter Williams (GSI), Geraldine Kavanagh (OSI); Ainhoa Gonzáles del Campo (ESM/UCD)

P/T, project team; S/C, steering committee; UCD, University College Dublin.

75 Note that indicators may not align with *capacity* to deliver services.

- The environmental importance of natural capital assets and their services is location specific.
- Spatial accounts provide information on flow of assets or services across different spatial areas, such as carbon and water.
- Spatial accounts require a large number of data and work, but this is important for policymaking and analysis.

A1.2.3 Data quality requirements to apply SEEA-EEA (WP2)

The basic criteria for data used in building NCA are as follows. Data should be:

- consistent across space and time;
- spatially explicit and disaggregated;
- regularly gathered;
- accessible/not cost-prohibitive;
- beware of bias from data availability, i.e. information on one service may undermine the presence or significance of other services;
- good meta-data should back up data (EU-INSPIRE Directive – metadata standards and accessible to public).[76]

A1.2.4 Asset extent account

Asset extent requires data on land cover and the natural capital assets to be present (geosystem, ecosystem, atmospheric system). This stage essentially involves collating the data that are available and using local classification systems that are used nationally. INCASE will use a combination of data to inform the extent accounts, with the land cover data in development by OSI and EPA as well as Corine and Land Parcel Identification System (LPIS) probably being the most relevant at the national level.

Note that the classification used in the OSI/EPA land cover mapping is based on an adapted version of Level 2 of the Fossitt Classification System, known as Fossitt 2B. It is designed to allow for classification using remote sensing of aerial or satellite imagery. For a number of classes, it was possible to achieve Level 3 of the Fossitt classification. This is of relevance for INCASE and will influence the quality and detail of outputs.

European data available

- Corine: 44 classes at 25 hectare and 100 m MIN width; data for 2006 and 2012 freely available;
- Copernicus (European Space Agency) – new satellites launched between 2014 and 2017;
- EUNIS (European Nature Information System) – comprehensive pan-European system to facilitate the harmonised description and collection of data across Europe through the use of criteria for habitat identification, hierarchal, EUNIS 2017 REVIEWED;
- MAES ecosystem types for Europe – MAP 2017; at 1-hectare resolution; mapped by interpreting Corine land cover data on the basis of EUNIS.[77]

Potential sources of data for extent account

- Corine as above; available from the EPA Geoportal site;
- EPA Geoportal;[78]
- EPA catchments;[79]
- Derived Irish Peatland Map – Dr John Connolly (Dublin City University – DCU);
- EPA/OSI land cover;[80]
- Forest service;[81]
- GSI;[82]

76 Note: must be able to distinguish original dataset from manipulated data; and that manipulation can be repeated.

77 Note: INCASE could use a combination – but requires translation between datasets (look-up tables). To be discussed over the course of the project.

78 https://gis.epa.ie/ (accessed 6 March 2020).

79 https://www.catchments.ie/data/#/?_k=v6nafu (accessed 6 March 2020).

80 National classification – Fossitt Levels 1/2/3. Example of Caragh catchment available online: http://www.arcgis.com/apps/webappviewer/index.html?id=32cb36ee28584e3b86e921f0af57036f&extent=–1100183.9743,6798892.9563,–1095960.8285,6801049.9137,102100 (accessed 6 March 2020).

81 https://www.agriculture.gov.ie/forestservice/forestservicegeneralinformation/foreststatisticsandmapping/forestmapviewer/ (accessed 6 March 2020).

82 https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx (accessed 6 March 2020).

- Irish Water;[83]
- Land parcel datasets (LPIS) – available from DAFM;
- Teagasc Soils;[84]
- NPWS designations – SAC/SPA/Natural Heritage Area (NHA), etc.;[85]
- NPWS MAES pilot, SENSE spatial framework and indicators and intermediate products (habitat asset register, grassland, woodland and ecological networks, legally protected and policy relevant species coincidence maps);[86]
- NPWS habitat and species monitoring survey data;[87]
- NPWS habitat and species national distribution reporting (Article 17 Habitats Directive);[88]
- semi-state bodies: Bord na Móna, Bord Iascaigh Mhara, Coillte and others;
- Note: NPWS collated, reviewed and assessed over 300 spatial datasets for use in their national pilot implementation of the EU MAES project in 2016, which are documented in the report.

A1.2.5 Condition accounts

Condition accounts require data on the quality of the natural capital assets recorded in the asset extent accounts. This will vary depending on "what is measured" in the environment. For example, water quality is a widely recorded metric by the EPA and therefore will be a good indicator of freshwater quality. Other condition assessments are available for Natura 2000 sites and the EIP Pearl Mussel Project has developed condition scoring for farms in the Caragh catchment. One of the challenges of INCASE will be to source and/or develop condition indicators and apply suitable indicators across the range of assets (peatlands, woodlands, grassland, etc.). This is to be developed in WP2.

Potential sources of data for condition accounts

- EPA catchments WFD reporting data;[89]
- catchment projects: Pearl Mussel Project and Kerrylife; Bride Regenerative Farming EIP; others;
- site designations: Natura 2000 sites, NHAs, proposed NHAs, wildfowl sanctuaries, refuge for fauna, national parks, nature reserves;
- NPWS habitat and species distributions and condition assessments (including Article 17 reporting);
- NBDC;
- MSFD reporting data;
- other policies and strategies – Glas and DAFM (LPIS and Generic Land Management – GLAM – system);
- forest data from Forest Service;
- DIPM and peatland data from Dr John Connolly (DCU);
- Urban – green/blue infrastructure (note: defined urban areas are already used in national statistics);
- ESM project – environmental sensitivity mapping;
- Met Éireann weather data;
- national data: floods (OPW), risks etc.;
- heritage council: hedgerows, habitat maps, etc.;
- EPA Geoportal;[90]
- semi-state bodies: Bord na Móna, Bord Iascaigh Mhara, Coillte and others*;*
- other agencies, such as GSI, Irish Water and Teagasc.

A1.2.6 Services (biotic and abiotic) accounts

In terms of developing services accounts, again, this will be teased out in the INCASE project WP2, but some considerations are outlined here:

83 https://www.water.ie/water-supply/water-quality/map/ (accessed 6 March 2020).

84 http://gis.teagasc.ie/soils/map.php (accessed 6 March 2020).

85 https://www.npws.ie/maps-and-data (accessed 6 March 2020).

86 https://www.npws.ie/research-projects/ecosystems-services-mapping-and-assessment/story-map-viewer-and-data-downloads (accessed 6 March 2020).

87 https://www.npws.ie/maps-and-data/habitat-and-species-data (accessed 6 March 2020).

88 https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17 (accessed 6 March 2020).

89 https://www.catchments.ie/data/#/?_k=v6nafu (accessed 6 March 2020).

90 https://gis.epa.ie/ (accessed 6 March 2020).

- services: local mainly, except for atmospheric and some aspects of water;
- market products – can cover provisioning services;
- regulating – may need proxies such as flood risk and water quality;
- cultural – visitor numbers, tourism information;
- note: natural systems are generally spatially explicit (with the exception of climate/atmospheric systems).

Potential sources of data for services accounts

- CSO – census data, environment accounts, DAFM data, forest, fishing, air data;
- DAFM – supply and use of agricultural, forestry, food products and outputs;
- Land use data – LPSIS/GLAM agricultural/forested land in receipt of payments;
- EPA Geoportal;[91]
- EPA catchments;[92]
- ESM Project – environmental sensitivity mapping;
- DIPM and peatland data from Dr John Connolly (DCU);
- other agencies, such as Coillte, Bord na Móna, BIM, NBDC, GSI, Irish Water, Teagasc and NPWS;
- local sources – catchment dependent;
- other EPA projects;
- SDGs reporting;[93]
- Tourism Ireland.

A1.2.7 Spatial relationships

In general, spatial relationships are hard to measure but are important from the perspective of the flow of services. Aspects of natural capital assets that are relevant include size, proximity, connectivity of natural capital assets/features, settlement and use within catchments. The potential introduction of statistical bias through spatial data aggregation or disaggregation will need to be duly considered.[94]

Potential sources of data for spatial relationships accounts

- CSO – census data, environment accounts, DAFM data;
- land use data – LPIS agricultural/forested land in receipt of payments;
- EPA Geoportal;[95]
- EPA catchments;[96]
- ESM project – environmental sensitivity mapping;
- urban planning – planning data;
- other agencies such as Coillte, Bord na Móna, BIM, NBDC, GSI, Irish Water, OPW and Teagasc.

A1.2.8 Benefits and beneficiaries (links WP2 and WP3)

Developing the accounts for benefits requires building a picture of what benefits are received, directly related to the asset extent and the flow of services. Building these accounts requires an iterative process and, in general, the accounts will develop in tandem as opposed to in isolation. Some work has been done by other EPA projects on valuation (Semru projects, Pollival, etc.) and identifying benefits; these will be a source of guidance in building the benefits accounts at the catchment level. Some considerations in building the accounts are as follows:

- Beneficiaries – where, when, who? These are different for different groups and different services; consider studies that explore relationships, etc.[97]
- Whose value is it? This is what is important for decision makers.
- A classification/method needs to be chosen. Work through the logic and record how you got there.

91 EPA APIs may be useful to hook services/models off – if EPA make changes, INCASE/NCA models will also update (noted by EPA). Available online: https://gis.epa.ie/ (accessed 6 March 2020).

92 https://www.catchments.ie/data/#/?_k=v6nafu (accessed 6 March 2020).

93 https://irelandsdg.geohive.ie/app/89cd3819501e4900bdd5c311686ab0e7 (accessed 6 March 2020).

94 http://doc.teebweb.org/wp-content/uploads/2017/01/ANCA-Tech-Guid-8.pdf (accessed 6 March 2020).

95 https://gis.epa.ie/ (accessed 6 March 2020).

96 https://www.catchments.ie/data/#/?_k=v6nafu (accessed 6 March 2020).

97 See https://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/4417/W08-6_Ostrom_DLC.pdf?sequence=1 (accessed 6 March 2020).

Potential sources of data for benefits accounts

- CSO – census data, environment accounts, DAFM data;
- outputs of other EPA projects (see Table 5.1 in the INCASE literature review);
- land use data – LPIS agricultural/forested land in receipt of payments;
- EPA Geoportal;[98]
- EPA catchments;[99]
- ESM Project – environmental sensitivity mapping;
- urban planning – planning data;
- other agencies such as Coillte, Bord na Móna, BIM, NBDC, GSI, Irish Water, OPW and Teagasc.

A1.3 Irish National Ecosystem and Ecosystem Service Mapping Pilot (MAES) Project 2016

There are obvious parallels between the NPWS National Ecosystem and Ecosystem Service Mapping Pilot (MAES) pilot project and the INCASE project and some of the features of MAES are highlighted here to carry forward lessons learned from the work in 2016:

A1.3.1 General considerations for data management

- INCASE should consider at the outset the framework or structure for the INCASE data. This is a first step towards national accounting and so it should be structured to facilitate expanding/regular updates to the data.[100]

A1.3.2 Data considerations

- NPWS sourced, collated, reviewed and assessed over 300 datasets for the project.[101] These data were from a variety of different sources, were at varying spatial and temporal resolutions and were in a number of co-ordinate reference systems. The majority of data were collated up to autumn 2015 and additional species distributions were collated up to February 2016, so it is possible that there are datasets or projects that became available only after this period and which were not included. Full details of the data temporal extent and creation date for outputs are detailed per resource in the associated metadata.
- Based on the approach adopted previously by JNCC,[102] the project adopted the SENCE[103] (Spatial Evidence for Natural Capital Evaluation) GIS model approach, which combines spatial data based on an understanding of the key factors that influence patterns in the underlying structures, process and functions so that the probable service output can be inferred or predicted.
- The project identified key data gaps, one of which was the absence of a seamless national habitat map for Ireland. To address this gap, the project developed a habitat asset register (HAR) using a combination of data sources, but iteratively superseding coarse data with higher thematic and spatial resolution data. Datasets used include LPIS, Corine and Article 17 reporting (together comprising 84% of data) while the remainder was provided by Forest Cover, DIPM, WFD and OSI. The HAR, other supporting spatial data and the ecosystem service indictors are all freely available through the NPWS website.
- Once data collection had been completed, an audit of applicable data was undertaken, collating information regarding who owns the data, any licence restrictions, whether or not metadata were provided and what the scale and coverage of the data were.
- For data integration, vector data were rasterised to 50 m for the whole country. Hence, all relevant detailed data available nationally were utilised but discrete data (only available at the local level), although relevant, were not included, as it would

98 https://gis.epa.ie/ (accessed 6 March 2020).

99 https://www.catchments.ie/data/#/?_k=v6nafu (accessed 6 March 2020).

100 The INCASE project team will need to discuss the best place to “house” INCASE, particularly in light of data agreements and future use.

101 All datasets were assessed and considered for use in creation of intermediate layers and in use in the ecosystem service indicators.

102 https://jncc.gov.uk/ (accessed 6 March 2020); Joint Nature Conservancy Council, UK.

103 https://www.envsys.co.uk/news/introducing-sence/ (accessed 6 March 2020).

skew results, e.g. wetlands surveys, hedgerows and one-off county-level habitat maps.
- INCASE could work with the NPWS National MAES pilot data, add in any supplementary datasets (including Article 17 data, new land cover maps, peatland maps, anything from Copernicus Sentinel), such as on land cover/land use, and build on what was done in the 2016 project, continuing to valuation. Working at the catchment level would work with the extra information available for some catchments, as MAES work was to 50 m resolution.

A1.3.3 Services and condition indicators

- The project carried out focused workshops at the national level to identify the ecosystem services and indicators that should be prioritised based on pressure/policy and also on the data available; all outcomes, including detailed indicators and weightings of the key factors applied were documented. INCASE will have to determine the ecosystem services to focus on based on data, catchment and required outputs.
- The NPWS national MAES pilot project worked with the Common International Classification of Ecosystem Services (CICES), as it is somewhat standard in the EU now; there is potential to add in new services. MAES fell short on cultural services and did not tackle valuation at all – this was beyond the scope of the project.
- Note: an outcome for INCASE could be to identify what condition indicators we need to measure to inform NCA nationally.

A1.4 SEEA-Central Framework Accounts Collated by CSO, Ireland

While there had been some reporting on similar topics in the 2000s by the Irish Economic and Social Research Institute (ESRI), following the adoption of Regulation (EU) 691/2011 into Irish legislation, the CSO in Ireland submits data for each of the six required environment accounts ("Regulation modules", listed in the following sections). Other accounts are compiled on a voluntary basis (i.e. these are not legally required presently but it is expected that these will also become statutory). These include forest accounts; water accounts; environmental subsidies; resource management expenditure accounts; land cover and land use; and potentially environmentally damaging subsidies

At the national level, the CSO official statistics inform decision making across a range of areas, including construction, health, welfare, the environment and the economy. At the European level they provide an accurate picture of Ireland's economic and social performance and enable comparisons between Ireland and other countries. The mandate of the CSO is outlined under the Statistics Act 1993.

A1.4.1. Regulation modules

- Air emission accounts.
- Environmental taxes.
- Material flow accounts.
- Environmental goods and services.
- Environmental protection expenditure accounts.
- Physical energy flow accounts.

A1.4.2 Voluntary modules

- Environmental subsidies and similar transfers.
- Potentially environmentally damaging subsidies.
- Forest accounts.
- Inland waters.
- Land cover and land use.
- Resource management expenditure accounts.

A1.4.3 Other environment statistics and accounts

- Energy statistics regulation.
- Waste statistics regulation.
- Agriculture statistics.
- Agri-environment indicators.
- Joint forest sector questionnaire.
- Fishery statistics.

A1.5 Stakeholder Engagement

Stakeholder engagement is a key part of INCASE and WP4 is designed specifically around communications. Furthermore, throughout WP1, WP2 and WP3, delivery of the aims and objectives relies on collaboration with national and local stakeholders. To date, the INCASE project team has met and discussed NCA and potential applications with a range of

stakeholders (Table A1.5). This will continue over the course of the project. Overall, the approach is viewed by stakeholders who have engaged with INCASE to date as an important step to integrate policy as well as provide a standardised platform for a range of sectors and applications.

A1.5.1 INCASE stakeholder management plan

An outline stakeholder management plan is presented here at national, catchment and international levels.

National level

A number of workshops were convened to date for INCASE. These include the catchment and data workshops (11 November 2019 – see section A1.2.1) and a stakeholder workshop convened on 22 January 2020. Other engagement has been at one-to-one level with data holders in relevant organisations. The general approach is as follows:

- one-to-one meetings with national and local (catchment level) stakeholders (Catherine Farrell attended two workshops in November 2019 held locally in relation to after-use of industrial peatland areas in midlands – related to Figile catchment);
- catchment selection and data workshops (11 November 2019; outlined previously);
- stakeholder workshop on 22 January 2020 (see Table A1.6);
- presentation at national conferences and workshops;
- development of IFNC events around INCASE;
- end-of-project workshop in 2023.

Catchment level

- A specific stakeholder plan to be developed for each INCASE catchment.
- Direct contact with local stakeholders (relevant to catchments).
- Liaison with the local authority in each INCASE catchment area (Wicklow, Offaly, Cork, Kerry).
- Organise catchment workshops to include local stakeholders in the development of the NCA and also to relay information.

International level

- Input and/or observe on EU MAIA, MAES and INCA projects.
- Presentation at international conferences and workshops.
- Attendance of Natural Capital events (in the EU and internationally where relevant).

A1.5.2 Stakeholder workshop January 2020

Table A1.5. List of INCASE project stakeholders engaged with to date (February 2020)

Category	Organisation
Academic	DCU
	GMIT
	NUIG (SEMRU)
	TCD
	UCD Geography (ESM Tool), Biology and Planning
Businesses	BITC
	Devenish Foods
Irish related projects	Bride Regenerative farming EIP
	Pearl Mussel Project EIP
International agencies, projects	UK-ONS
	Cambridge Conservation Initiative UK
	EU MAIA
Local authorities	Dún Laoghaire Rathdown CC
	Offaly CC
	Tipperary CC
	Wicklow CC
NGOs	BirdWatch Ireland
	Community Wetlands Forum
	Irish Wildlife Trust
Research agencies	Marine Institute
	Teagasc
State agencies	CSO
	EPA Catchments Unit
	GSI
	LAWPRO
	NBDC
	NPWS
	OSI
	Water Forum
State departments	DAFM
	DCCAE
	DHPLG
Semi-state bodies	BIM
	Bord na Móna
	Coillte
	Irish Water

BITC, Business in the Community; CC, County Council; GMIT, Galway-Mayo Institute of Technology; LAWPRO, Local Authority Waters Programme; NUIG, National University of Ireland, Galway; SEMRU, Socio-economic Marine Research Unit; SWAN, Sustainable Water Network Ireland; TCD, Trinity College Dublin; UCD, University College Dublin.

Table A1.6. INCASE stakeholder workshop inputs and representation (22 January 2020)

Category	Comments
Inputs	Overview INCASE project; introduction to NCA/SEEA; overview INCASE catchment choices (Caragh, Bride, Figile, Dargle); break-out groups to discuss potential applications of NCA and relevance to organisations present
Outputs	Engagement with data providers and potential users of INCASE outputs and NCA in general; identify applications/challenges/other data sources; increased awareness of NCA
INCASE project team	Jane Stout, Mary Kelly-Quinn, Cathal O'Donoghue; Siobhan Atkinson, Carl Obst (via video from Australia), Orlaith Delargy and Catherine Farrell
INCASE steering committee	Paddy Morris (EPA Catchments), Donal Daly (retired, EPA) and Gemma Weir (NPWS)
Organisations/projects represented (48 in attendance)	Academics (DCU, NUIG, TCD, UCD), BIM, Bord na Móna, Business in the Community (BITC), BWI, Climate Advisory Council, Climate Oireachtas Committee, Community Wetlands Forum, DAFM, Devenish Foods, EIP Projects (Pearl Mussel Project), EPA, GSI, IFNC, Irish Water, Kerry-Life project, local authorities (Offaly and Dún Laoghaire Rathdown), Marine Institute, NPWS, SEAI, Teagasc
Others engaged in workshop development/ feedback	Coillte, DCCAE, DHPLG, DIT, Forest Service, GMIT, IFI, IWT, NBDC, OSI, LAWPRO, Tipperary CC, Water Forum
Applications proposed on 22 January 2020	A range of applications were discussed reflecting those highlighted in Chapter 3 and Table 4.1, including: • Carbon: development of carbon taxation schemes; LULUCF reporting; de-stocking national herd • Agriculture: development of "nature standard" for landowners;[104] reform of agricultural payments; obvious links to HNV farming, bio-economy and circular economy development • Land use/planning*:* integrated decision making for land use planning; planning for biodiversity, forestry, peatland rewetting; marine planning; county development plans • Public awareness: developing a common language between government, business and the public
Issues raised for discussion on 22 January 2020	A range of issues were raised; these are summarised here but should be considered throughout INCASE: • General: NCA is viewed as a useful tool for a range of applications; should already be in use; need to incorporate/flag uncertainty in the process (inputs and outputs) • Policy: there is no policy as yet around NCA; need to link applications to be policy relevant; use NCA to develop policy coherence and systems approach to cross cutting policy topics such as climate action and land use (relevant for DAFM and also LULUCF reporting) • Scale: need different targets for catchment and national applications • Catchments: need to link land with marine for INCASE catchments • Data: need national approach to collection/sharing of data; consistent, reliability of inputs; centralised and streamlined process required; systematic recording and use; build in capacity to add new data layers; CSO would be a good "home" for NCA; the NBDC could also play a role • Condition: need a common scale for condition assessments • Valuation: should be explored but be cognisant of value systems other than monetary; most commentators are in general "uncomfortable with monetary valuation of nature" • Applications: outputs and trade-offs should follow transparent process • Benefits of NCA: potential to build incentive schemes around positive behaviours towards nature; can create a common agenda for policy and public awareness • Building awareness: use NCA to highlight dependencies on nature at a range of levels – community, business, corporate, governmental and international; NCA could provide a common framework/ language; telling a common story • Links with sustainable development: should link with work by EPA/CSO/ESRI in relation to social and economic wellbeing

BWI, Birdwatch Ireland; CC, County Council; DIT, Dublin Institute of Technology; GMIT, Galway-Mayo Institute of Technology; HNV, High Nature Value; IFI, Inland Fisheries Ireland; IWT, Irish Wildlife Trust; LAWPRO, Local Authority Waters Programme; NUIG, National University of Ireland, Galway; SEAI, Sustainable Energy Authority of Ireland; TCD, Trinity College Dublin; UCD, University College Dublin.

104 Developing a standard similar to the household building energy rating but for landowners/organisations, to be based on NCA.

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL
Tá an Ghníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaol a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: *Déanaimid córais éifeachtacha rialaithe agus comhlíonta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.*

Eolas: *Soláthraímid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírithe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.*

Tacaíocht: *Bímid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaol atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaol inbhuanaithe.*

Ár bhFreagrachtaí

Ceadúnú
Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaol:
- saoráidí dramhaíola *(m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola)*;
- gníomhaíochtaí tionsclaíocha ar scála mór *(m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta)*;
- an diantalmhaíocht *(m.sh. muca, éanlaith)*;
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe *(OGM)*;
- foinsí radaíochta ianúcháin *(m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha)*;
- áiseanna móra stórála peitril;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil
- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíriú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a ídíonn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Uisce
- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uiscí idirchriosacha agus cósta na hÉireann, agus screamhuiscí; leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaol
- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil *(m.sh. tuairisciú tréimhsiúil ar staid Chomhshaol na hÉireann agus Tuarascálacha ar Tháscairí)*.

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn
- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil
- Taighde comhshaoil a chistiú chun brúnna a shainaithint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta
- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaol in Éirinn *(m.sh. mórphleananna forbartha)*.

Cosaint Raideolaíoch
- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas
- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaol ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaol *(m.sh. Timpeall an Tí, léarscáileanna radóin)*.
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosc agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta
- Feasacht chomhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil
Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:
- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

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Irish Natural Capital Accounting for Sustainable Environments: Stage 1 Feasibility Report

Authors: Catherine A. Farrell and Jane C. Stout

Identifying Pressures

The natural world we live in can be thought of as our stock of natural capital that yields *flows* of goods and services. These include the basic requirements of daily living – food, water, clean air, etc. – alongside more intangible services such as amenities and recreation. Ensuring that nature is preserved and restored so that these goods and services continue to flow for this generation, and future generations, is fundamental to human health and wellbeing.

In the Irish context, the 2016 EPA State of Environment Report highlights the need to integrate natural capital accounting (NCA, also referred to as *green accounting*) into our measures of prosperity, to track and measure our performance alongside related issues such as societal wellbeing and environmental health.

NCA is an approach that can help us to understand and address the dominant pressures and their impacts – climate change, growth in human population, continued degradation of nature – on Ireland's environment. The INCASE (Irish Natural Capital Accounting for Sustainable Environments) project will work at catchment level, where significant pressures on *at-risk* water bodies have been well defined by the EPA and have informed the River Basin Management Plan 2018–2021.

Informing Policy

The European Green Deal, published at the end of 2019, specifically aims to protect, conserve and enhance Europe's natural capital and protect health and wellbeing from environment-related risks and impacts. The Green Deal states that "all EU policies should contribute to preserving and restoring Europe's natural capital", and the development of standardised NCA practices is highlighted as one of a range of initiatives to pursue green finance and investment.

In Ireland, the Climate Action Plan, published in 2019, sets a number of targets and highlights the need for an integrated approach to land use, taking into consideration the changing roles of agriculture, forestry, marine and energy, etc.

NCA can be used to identify trends in the quality of the environment, inform trade-offs, identify co-benefits and establish critical links between natural and other capitals (such as built and social capital), as well as identifying knowledge gaps. NCA can therefore assist in the integration of a range of sectoral policy targets (relating to nature, the environment, land use, society and the economy) and decision-making, aligning them with overarching Sustainable Development Goals.

Developing solutions

INCASE will apply NCA using the United Nations System of Environmental-Economic Accounting (SEEA) at a pilot (catchment) scale in Ireland to inform how Ireland's natural capital accounts (asset extent, condition, supply and use of services, benefits, etc.) can be built. Developing a system of NCA that is fit for purpose will require a range of challenges to be addressed, from high-level issues (*Can nature fit into accounting methods? Is 42 the answer?*) to practical data sharing and quality issues.

INCASE will explore how NCA can be used to identify solutions, through investing in and renewing degraded natural capital stocks and flows (improving water quality, restoring ecosystems, etc.) and/or through changing management practices and incentive schemes (e.g. developing payment for ecosystem services schemes). Linking biophysical information (maps with qualitative and quantitative data) with economic data, the project will inform how natural capital accounts can be used to develop better metrics for national accounting. Pioneering methods, tested and refined at catchment level by INCASE, will be developed with a view to scaling up to national level, delivering immediately useful and effective project outputs for policymakers and other stakeholders.

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