Natural Capital Accounting for Better Policy Decisions:

Climate change and biodiversity

Proceedings and Highlights of the 3rd Forum on Natural Capital Accounting for Better Policy Decisions

26-27 November 2018, Paris, France

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WAVES is a World Bank-led global partnership that aims to promote sustainable development by ensuring that natural resources are mainstreamed in development planning and national economic accounts.

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Table of Contents

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- Forum Participants – see Appendix 1.2
- Authors, not all of whom were participants at the Forum, and are listed in each chapter

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Preface

It is with great pleasure that we present this publication that has resulted from the discussions and written contributions to the 3rd Policy Forum on Natural Capital Accounting for Better Decision Making, held in Paris, from 26th to 27th November 2018.

The Forum brought together users and producers of natural capital accounts for the third time, providing a platform for lesson sharing and for identifying ways to improve decision making through natural capital accounting (NCA).

This publication provides a record of the 2018 meeting and follows on from the publications of the previous two fora in 2016[1] and 2017[2]. It highlights the production and uses of NCA for making policy decisions on climate change and biodiversity as well as how governments, business and international organizations can work together to produce and use NCA.

The 3rd Policy Forum brought together more the 100 people from many organizations all wanting to understand and use natural capital accounting in government and business decision making. A feature of the 3rd Policy Forum was that it part of a "Natural Capital Week" held jointly with the 'Government Dialogue on Natural Capital"[3] and the "Combining Forces Initiative"[4]. The work presented highlighted a variety of ways that natural capital approaches, and accounts in particular, can be used to inform the decision-making processes of governments, business and the community more generally. This publication brings together this material and builds the evidence base needed to embed the use of NCA in decision making around the world.

[1] See https://www.wavespartnership.org/en/knowledge-center/forum-natural-capital-accounting-better-policy-decisions-taking-stock-and-moving

[2] See https://www.wavespartnership.org/en/knowledge-center/2nd-policy-forum-natural-capital-accounting-better-policy-decisions-applications

[3] See https://naturalcapitalcoalition.org/projects/government-dialogue-on-natural-capital/

[4] See https://naturalcapitalcoalition.org/projects/combining-forces-on-natural-capital/

1. Report of the 3rd Forum on Natural Capital Accounting for Better Policy (Paris, 26-27 November 2018)

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1.1 Introduction

On 26 and 27 November 2018 in Paris, France, The World Bank, the United Nations Statistical Division (UNSD), the Dutch Ministry of Foreign Affairs, and the Natural Capital Coalition co-hosted the *3nd Policy Forum on Natural Capital Accounting for Better Policy*. This report summarizes the key lessons learned during the Forum. It briefly explains the background to the forum, presents the main highlights of the presentations, and summarizes the discussions and conclusions of the Forum. The presentations can be obtained from the web[5].

1.1.1 Background

The 3rd NCA Policy Forum has built on the success of the previous Policy Forums, held in November 2016 and 2017 in The Hague and co-hosted by the Dutch Ministry of Foreign Affairs and World Bank.

The 3rd Forum brought together the work of the World Bank and UNSD with the "Government Dialogue on Natural Capital"[6] and the "Combining Forces Initiative"[7], with the combined meetings being known as "Natural Capital Week"[8]. All three are important international initiatives, and all seek to create enabling environments for better decision making by mainstreaming considerations of natural capitals. With much in common, each also plays particular roles: the NCA Policy Forum concentrates on accounting and bringing together NCA producers and users; the Government Dialogue links diverse governments involved in various natural capital approaches; and Combining Forces links business and governments.

During the two-day meeting of the 3rd Policy Forum, 134 participants shared knowledge and experiences, exploring how NCA and complementary natural capital approaches can contribute to climate change and biodiversity. As for the previous two Policy Fora, the topics for discussion were identified by account producers and users in advance of the meeting –

[5]See https://www.wavespartnership.org/en/forum-natural-capital-accounting-better-policy
[6] See https://www.government.nl/documents/reports/2018/02/09/government-dialogue-on-natural-capital-counting-on-nature
[7] See https://naturalcapitalcoalition.org/wp-content/uploads/2017/11/Natural-Capital-Coalition_Combining-forces_20172411.pdf
[8] See https://naturalcapitalcoalition.org/event/natural-capital-week/

very much a demand-driven approach. Thus, for the 3rd Policy Forum, participants wished to explore how NCA production, analysis and communication of results can better address climate change and biodiversity challenges, as well as critically assessing how governments and businesses could benefit from collaborating more on these two key global agendas.

Before moving to the summary and conclusions of the 3rd Forum is worthwhile revisiting the main conclusions of the 1st and 2nd Policy Fora.

A highly collaborative spirit was engendered by 41 participants of the 1st Policy Forum in 2017. They drafted ten 'living principles of policy-fit NCA'. Their papers, presentations and discussions on what NCA has done in 12 countries and globally, were edited and published.[9] The 1st Policy Forum concluded that:

- NCA helps the whole policy cycle –analysis, dialogue, decision-making and implementation, and not just the monitoring that has been the dominant use of NCA to date.
- There are good cases of NCA influencing policy in countries rich and poor alike.
- More needs to be done to link NCA producers with a wide range of policy users.

The 2nd Policy Forum was held in 2018 and focused on how countries and other organization could use NCA for achieving the UN Sustainable Development Goals (SDGs). More co-hosts joined WAVES and MFA in 2017 – the United Nations Statistical Division (UNSD), Gesellschaft für Internationale Zusammenarbeit (GIZ, the German development agency) and the Natural Capital Coalition. Sponsors included the European Commission and DFID (the UK development agency). Sixty participants came from 20 countries and included NCA users and producers as well as representing various sectors. Like the 1st Policy Forum, the papers and discussion where published in two volumes[10],[11]. The key takeaways from 2nd Policy Forum were:

- The SDGs present a great opportunity to demonstrate the usefulness of NCA for policy and decision making
- Businesses Several countries and business are using NCA to help manage or monitor other holistic challenges like green growth, development strategies, environmental risks (e.g. flooding) and land use planning
- Businesses and governments want credible and trusted information to support decision making

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[9] Policy Forum on Natural Capital Accounting for Better Policy Decisions: Taking Stock and Moving Forward: https://www.wavespartnership.org/en/knowledge-center/forum-natural-capital-accounting-better-policy-decisions-taking-stock-and-moving

[10] 2nd Policy Forum on Natural Capital Accounting for Better Policy Decisions: Applications for Sustainable Development (Part 1 - Takeaways). https://www.wavespartnership.org/en/knowledge-center/2nd-policy-forum-natural-capital-accounting-better-policy-decisions-applications

[11] 2nd Policy Forum on Natural Capital Accounting for Better Policy Decisions: Applications for Sustainable Development (Part 2 – Case Studies).

- There were differences in the way governments and business used NCA. In business it was mainly for internal business decisions rather than for public disclosure
- While the System of Environmental-Economic Accounting for ecosystems was still experimental, it is on track to be standardized in the next few years, which should help it be mainstreamed

The challenge clearly identified at the 2nd Forum was to integrate government and business policy work, not merely to share data. Here, the SDGs offer a framing possibility, and perhaps a means for building trust. How business can contribute data in confidential contexts was identified as an issue.

1.1.2 Objectives and organization of the 3rd Policy Forum

Building on the previous Policy Fora, the objectives of the 3rd policy Forum were:

- NCA users and producers sharing case studies, challenges and ideas for 'policy-fit' NCA.
- Focusing on climate change and biodiversity challenges, and how NCA can support their planning, implementation and monitoring
- Combining the learning and energies of business and government in NCA
- Consolidating findings, and further testing the 'living principles' for policy-fit NCA, and scoping possible guidance material
- Discussing future collaboration, including a possible 4th Forum

The 3rd Policy Forum was divided into 8 sessions, which explored a combination of conceptual and practical issues, from a range of government and business perspectives. Each session had time for questions and discussions that were facilitated by Steve Bass. The 8 sessions were:

- Session 1 Welcome and opening
- Session 2 Challenges of improving decisions on climate change
- Session 3 Climate change: what natural capital thinking can achieve
- Session 4 Natural capital: why it matters to countries and how natural capital accounting and complementary approaches can support policy
- Session 5. Challenges of Improving decisions in Biodiversity
- Session 6. Biodiversity: What natural capital thinking can achieve
- Session 7. Mainstreaming natural capital: Building an enabling environment for NCA and complementary natural capital approaches
- Session 8. Taking steps to inform policy agendas: Conclusions & next steps

The complete agenda is found online[12] and is also found in the Appendix 1.2 of this chapter. Summaries of sessions grouped by the main issues follow.

1.2 Welcome and opening

Dr. Laurence Monnoyer-Smith, Commissioner General for Sustainable Development, Ministry for Ecological and Solidarity Transition, France, welcomed participants, noting the huge policy interest in biodiversity conservation and climate change. This welcome was followed by introductory remarks from Raffaello Cervigni from the World Bank, Alessandra Alfieri from UNSD, Martin Lok from the Ministry of Agriculture, Nature and Food Quality, Netherlands and Mark Gough of the Natural Capital Coalition. Each highlighted the work done by their respective organizations and recognized that the time was ripe for great levels of cooperation and collaboration in the development and application of NCA is a range of circumstances.

1.3 Challenges of improving decisions on climate change and what natural capital thinking can achieve

Sessions 2 and 3 examined climate change. The objectives of Sessions 2 and 3 were to:

- Understand which policy decisions and tools are needed to ensure effective climate change mitigation and adaptation
- Share experience with the application of natural capital accounting to issues of climate change mitigation and adaptation
- Provide guidance on the application of natural capital accounting to climate change mitigation and adaptation

Session 2 had four presentations and began with a keynote address via video link on the climate change policy challenges by Saleemul Huq, International Centre for Climate Change and Development, Bangladesh. Saleemul Huq's keynote address emphasized how The Paris Agreement is central to the decisions that most countries will need to make, following their commitment to meet the target of keeping global warming to less than 2°C. All countries will need to mitigate climate change, adapt to climate change, and handle implications of stranded assets as well as 'loss and damage'. The many implications of climate change on developing countries for achieving the Sustainable Development Goals (SDGs) mean that all of these aspects of climate change need to be addressed together and comprehensively. Climate change has an impact on all SDGs and notably those concerned with poverty, food and water security. Increased flooding and droughts were two key risks.

[12] See https://www.wavespartnership.org/en/3rd-policy-forum-natural-capital-accounting-better-decision-making

The need for better understanding and preparing for increased risks has a range of implications, including the need to finance actions in developing countries which were most vulnerable. Research in Bangladesh and elsewhere has highlighted the need to address loss and damage from climate change in a comprehensive risk management framework which needs cross-sectoral collaboration. Local-level research indicates that countries need to target adaptation support – with policy-makers needing better information about the limits to adaptation and stronger signals to communities in decision-making processes. NCA would seem to provide a way of providing information to governments and local communities to support such decision making.

The presentation by Arjan Ruijs, Environmental and Resource Economist PBL, the Netherlands, was based on the background paper he led that was prepared expressly for the 3rd Policy Form[13]. In the presentation, he summarized how NCA can be applied to climate mitigation and adaptation. Many economic sectors need to change if climate change is to be limited below 1.5 degrees. A range of possible applications were described to help make decisions on these changes, and implications for the SDGs were highlighted. A key message was that almost all accounts of the System of Environment-Economic Accounting (SEEA) are relevant. A key issue for countries is where and how to start. To date, energy and greenhouse gas emissions accounting has been the focus but there has been less attention given to emissions from land use change, agriculture, waste and trade – and inadequate use of NCA for adaptation.

The data coming from NCA shows which activities are responsible for producing greenhouse gases and NCA time series shows how this is changing. From this information, particular industries can be targeted for attention and the effectiveness of past polices can be assessed (e.g. if current or past polices have resulted in lower greenhouse gas emissions, or at least slowing their growth). An extension of this is using the accounts to populate models for forecasting future emissions or the particular impacts of different policy options (e.g. scenario modelling).

It was also noted that low- and high-income countries could learn from each other. Work in high-income countries has shown how production of the accounts leads to increased interaction between account producers and policy-makers which increases the incidence of produced accounts being perceived as useful. However, in most cases policy makers needed to have the accounts and their possible applications carefully explained.

The experience of Zambia was presented by Chola Chabala, Permanent Secretary, Ministry of Development Planning. The accounts produced for water highlighted the risks to water supply from climate change, a policy message which was raised to Cabinet level. A particular risk from climate change to Zambia's development was electricity production as a large proportion (near 90%) of generation was from hydropower. Other issues included the increase use of charcoal and the related greenhouse gas emissions when electricity subsidies

[13] This paper is included as chapter 2 of this document as well as being on the PBL website:

to households were removed, and the need for water for wetlands in the north of the country which were important for biodiversity conservation. The key policies that NCA needs to inform are the National Policy on Climate Change and Zambia's Vision 2030.

For Indonesia, Dr Sudhiani Pratiwi, Deputy Director, Ministry of National Development Planning, described how accounting was linked to the governments' commitments to reducing greenhouse gas emissions via the Midterm Development Plan and, within this, the Low Carbon Development Plan. In the latter, both greenhouse gas emissions and growth in GDP were forecast using modelling incorporating different scenarios.

Session 3 began with a panel discussion with four discussants: Michael Beutler, Sustainable Operations Director at Kering; Jaime Luis Carrera, researcher at Rafael Landivar University, Guatemala; Robert Bradburne, Deputy Director Department for Environment, Food and Rural Affairs (Defra), United Kingdom (UK); and Sjoerd Schenau, Program Manager Environmental Accounts, Statistics Netherlands.[14]

Robert Bradburne began by noting the intimate links between climate change and biodiversity. He went on to outline how it was important to understand the 'head space' of decision makers. Many are managing multiple political risks: will NCA add to their worries if they simply reveal further problems they cannot control? Or are decision makers looking for real solutions to complex problems? If so, then NCA can bring together much of the data required. The UK has new 25-Year Environment Plan and a Climate Change Act and is looking for solutions: in such circumstances, the data from accounts can help, especially if they can be used to make better predictions on the likely effects on the economy of different policy options (e.g. carbon taxes) and for achieving the goal of change in climate of less than 2^{o}C.

Jaime Luis Carrera made a detailed presentation on the situation in Guatemala. In a context where climate change, illegal logging, and charcoal production all interact, the accounts for energy, greenhouse gas emissions, forest and water have real potential. A feature of the work in Guatemala was the use of modelling to assess the likely changes to ecosystem condition and ecosystem services resulting from climate change and the expected impacts of different policy options. A particular advantage of account production and application within a university setting is the ability for research and sophisticated modelling to be combined to both examine and propose policy options.

Sjoerd Schenau provided the perspective of an account producer. He noted that producers need to get to grips with the key task of understanding policy-makers and current policies. To do this, liaising with environment agencies is key as is preparing policy briefs showing information of interest to policy-makers. One issue for statistics agencies is that their role is usually limited to providing information which could be used in policy monitoring and review. While this is useful, the accounts could also play a role in policy design and implementation – and particularly for climate change adaptation (although statistics

[14] Special thanks were offered to Dr Schenau for stepping in at short notice after James Mathew, Department of Environment and Climate Change, India, was unable to attend.

agencies were usually limited to what they could do in this area.) To address this, Statistics Netherlands had worked closely with other government agencies (e.g. PBL) as well as universities.

Michael Beutler provided a business perspective, noting that – while the concept of NCA was fantastic – there were real problems in getting both data and agreement on how to value things. Business are interested in a range of applications of NCA, including 'environment profit and loss statements' for public reporting. They are also interested in understanding supply chain dependencies. For example, clothes-selling businesses depend on agricultural production (e.g. for cotton, leather and wool) and those selling watches depend on mining and metal manufacturing. Understanding this can help to reduce the footprint of a company's activities– which Kering is committed to do. In discussion that followed this presentation, Mark Gough (Natural Capital Coalition) noted that 50,000 companies are engaged in deploying natural capital accounting and other approaches in their work.

From the presentations and discussions on climate change in Sessions 2 and 3, several key points emerged, and these are discussed below.

Rationale: for using NCA in climate change decisions

- Climate change decisions need to make trade-offs across time, space, sectors, resources, indeed social groups. The accounting structure can supply information relevant to assessing these trade-offs.
- There are major implications for natural capital of the required big changes to stay within 2 degrees (or 1.5 degrees): keeping carbon in the ground; increasing sources of renewable energy (e.g. replacing energy sources that use coal and oil); installing green infrastructure instead of infrastructure using concrete and metal; and halting deforestation and investing in reforestation... NCA can track these.
- There is an increasing policy move to reduce or compensate for climate-related 'loss and damage', and NCA can provide much of the information on lost and damaged natural capital

Coherence of climate and NCA definitions and criteria:

- Need to make UNFCC and SEEA guidelines on carbon and emissions accounting coherent (common concepts and definitions, methods of measurement, etc.)
- Need to interpret or adapt NCA 'language' so that it makes sense to the various climate change audiences and tailor communications
- Ensure NCA is recognized in Paris-related texts as a way to contribute information used in the climate change decision making and monitoring machinery of governments and business
- Potential for NCA to improve scrutiny and effectiveness: tracking 'climate-friendly' investments and assessing how 'green' are green bonds in principle and in practice

Showcasing NCA's contribution to climate action:

- Promote cases of credible NCA that have informed or could inform climate change policy and investment decisions. – drawing on and expanding examples given in Sessions 2 and 3.
- Find further cases – the rapid growth in NCA being used in many countries and businesses for decision-making machinery should led to more tangible examples that can be made available
- Cover government and business use – the potential applications of NCA are similar for both, but the scale and purposes differ

Improving NCA for climate change decisions:

- Spatial NCA – climate change needs a spatial basis for planning and NCA needs to be structured this way
- Scenario modelling and forecasting – as climate change is future-looking, NCA can and should feed government and business decisions for the future
- Data availability and valuation – these have been key issues for producing accounts. While recognizing the issues with data, it was also noted that: (1) with data the "perfect is the enemy of the good"; (2) that NCA helps systematized existing data, brought rigor and credibility to the data; and (3) the NCA methods are clear and repeatable
- Distributional issues – accounts have been useful where they reveal climate trade-offs between different groups within countries and between countries. The most critical natural capital decisions involve prioritizing among trade-offs, so methodologies need to be developed
- Valuation – consistent valuation concepts and methods need to be developed
- Policy entry points – there is a need to identify the range of entry points for NCA in climate change decisions. To do this requires increased understanding of what NCA can do to inform the processes around the Paris Agreement

1.4 Developing a narrative on why natural capital matters to countries and how natural capital accounting and complementary approaches can support policy

The aim of the 4th session was twofold: first, to present and discuss the draft narrative developed through the Government Dialogue on Natural Capital, and, second, to identify concrete steps forward, both at individual country level and internationally.

The narrative *"Natural Capital for governments. What, why and how"*[15] was developed to show senior decision-makers what natural capital is, why it matters for wealth and wellbeing, and how governments can act on it.

[15] See https://www.wavespartnership.org/sites/waves/files/images/GDNC2018-005-W3%20Natural%20capital%20for%20governments%20-%20DRAFT%20vs1_0%20%2820181121%29.pdf

To kick off the session, Martin Lok from the Netherlands Ministry on Agriculture, Nature and Food Quality presented the draft narrative, focusing on four key messages:

1. Wealth & wellbeing depend on natural capital
2. Natural capital generates four returns that contribute to achieving policy ambitions
3. Governments have six levers to maximize the returns that natural capital delivers
4. Many governments already support natural capital approaches to support their ambitions and contribute to achieving SDGs

Three questions were then presented for discussion:

5. Which of the four returns of natural capital are most relevant and/or under pressure in your context?
6. Which of the six key levers for change provide the best opportunities in your context?
7. How can you use the narrative to mainstream natural capital into your national economic and social policy agendas? What can we do internationally?

These questions were first discussed in a panel consisting of Claudine Uwera, Minister of State, Ministry of Finance and Economic Planning (Rwanda), Antonin Vergez Manager, Ministry for an Ecological and Solidarity Transition (France), Andre Andrade Manager, Casa Civil (Brazil), and Katia Karousakis, Environmental Economist (OECD). Following this, participants shared their observations and suggestions in 12 round table discussions.

Three key points emerged from both panel and round table discussions:

1. **Four returns of natural capital:** in general, the concept of thinking in terms of multiple returns from natural capital was welcomed by participants. However, it was felt that the Policy Return is different from the other three (Societal, Environmental and Economic Returns) and needs to be approached as a cross-cutting return that could help to identify trade-offs between the other three returns. The other returns were seen as equally relevant, although their relevance can differ from country to country, depending on the specific context.
2. **Six levers of change to better address natural capital issues**: all the proposed levers of change were felt to be valuable for government action, though different contexts require different priorities: (1) mainstream natural capital into decision-making; (2) support first movers, (3) support standardization, (4) seek insights; (5) change the rules of the game; and (6) fund change. A majority of the participants called for a seventh lever of change regarding fostering stakeholder engagement. It was recognized that some of the levers are focused on information and planning, while others were more targeted towards levelling the playing field[16].

[16] For more information see Chapter 5 of this publication or: https://naturalcapitalcoalition.org/wp-content/uploads/2019/02/GDNC2018-005-WS3-Natural-capital-for-governments-Final-28-02-2019.pdf .

3. **Use of the narrative**: participants felt that the narrative would gain effectiveness if it is adapted to different audiences and the key messages are summarized at the beginning of the document. The need to link with multiple narratives was stressed. It is as important to present the *facts* on natural capital that link to green growth narratives, wellbeing narratives, the SDGs, etc., as to generate a self-contained natural capital narrative. Relevant stakeholders to approach should be identified outside the natural capital community; first candidates are Foreign Affairs, Planning and Finance.

At the end of the session participants were invited to share detailed comments with the authors. Building on the discussion in Paris and comments received afterwards the narrative was finalized in February 2019 and available on the NCC website – see Chapter 5.

1.5 Challenges of improving decisions in Biodiversity and what natural capital thinking can achieve

Session 5 and 6 examined the challenges to biodiversity and how NCA can contribute. The objectives of the sessions were to:

- Understand which policy decisions and tools are needed to ensure biodiversity conservation and sustainable use of ecosystems important for biodiversity while also ensuring livelihoods for the rural poor
- Share experience with the application of natural capital accounting to issues of biodiversity conservation and use
- Provide guidance on how natural capital thinking can provide support mainstreaming sustainable use and conservation of biodiversity in public and private policy making

Session 5 on the challenges with biodiversity opened with a keynote address by Juha Siikamaki, Chief Economist, IUCN, outlining the main biodiversity policy challenges ahead of us. Despite a trend of increasing biodiversity-related budgets, the Aichi targets are still out of reach. There are glimpses of optimism, with increasing numbers of protected key biodiversity areas and sufficient proof that protection efforts can work. Yet, domestic funding differs considerably between countries, in many countries biodiversity threats intensify, and in turn some approaches taken to biodiversity protection threaten social exclusion and the provision of other environmental benefits. Despite the attention to biodiversity conservation, only about one sixth of the funds needed are made available annually. Public funding alone is not sufficient to reach the biodiversity objectives, especially in developing economies.

The main global agreement on biodiversity is the Convention on Biological Diversity (CBD). Its goal is to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services. This is translated into the 20 Aichi Biodiversity Targets, set for achievement by 2020. In none of these 20 targets has sufficient progress been demonstrated. The first steps towards a new convention in 2020 to replace the Aichi targets are being taken. An important question is how to shape a new agreement

that is as visible, publicly and politically, as the Paris Agreement of the UNFCCC – one that enjoys wide engagement of state and non-state actors and promotes an easily communicable, science-based target, including an 'apex' target akin to the 1.5°C target of the Paris Agreement. The search is for a planetary target that can be disaggregated to allow commitments by countries, but also by non-state actors such as companies, counties and cities.

This overview of current global initiatives to halt the loss of biodiversity, was followed by a presentation by Arjan Ruijs, Environmental and Resource Economist, PBL, Netherlands, discussing how natural capital accounting can be and currently is applied to help biodiversity-related policy questions. The presentation was drawn from the paper prepared specifically to support the discussions at the 3rd Policy Forum and can be found online[17] as well as in Chapter 3 of this publication. The list of potential uses of NCA for biodiversity decision-making is long, with almost all natural capital and ecosystem accounts potentially being relevant – especially if designed to accommodate biodiversity policy choices. Accounting can be applied to core areas of biodiversity policy such as in the establishment and management of protected areas. But they are equally useful for policies that seek to balance biodiversity with other uses of natural capital – sustaining the supply of ecosystem services across landscapes, building resilient ecosystems, and safeguarding food security, or for policies promoting sustainable use of ecosystem services by economic actors.

The ecosystem extent accounts can provide a basis for many policy decisions, as can the ecosystem services and ecosystem condition accounts, which together can assess effectiveness of existing policy. Currently, ecosystem and species accounts are especially used for determining the effectiveness of policies aimed at protecting rare and endangered species. Indeed, most accounting experiments and policy applications are related to protection decisions. There is a risk that the accounts are not sufficiently linked to the other accounts that would allow for other biodiversity related questions. A key aspect of ecosystem accounting is that it allows for combining economic and biodiversity data, in this way showing risks to the economy, and human well-being more generally, of declines in biodiversity. While there are challenges to the production of biodiversity-related accounts, the work to date shows that they can be produced, and the key task now is to embed accounting for biodiversity into the machinery of government.

Arjan Ruijs' overview of potential and current uses of natural capital accounts for biodiversity-related policy questions was followed by two presentations showing current experiences in China and South Africa. Zhiyun Ouyang, from the Chinese Academy of Sciences (via video), discussed the results of China's ecosystem survey and assessment. This showed changes in ecosystem services patterns, identified crucial areas for conservation, and led to China's work on Gross Ecosystem Product Accounting, GEP, which measures the

[17] See https://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2018-NCA-for-mainstreaming-biodiversity-3639.pdf

total value of ecosystem final goods and services supplied to human well-being, links ecosystem accounting to conservation policy at several administrative levels. For example, it is used for evaluating the effectiveness of ecological compensation and restoration and for showing the contribution of nature to human well-being.

Finally, Mandy Driver, Senior Biodiversity Policy Advisor, South African National Biodiversity Institute, discussed how ecosystem accounting is used in South Africa as a tool for biodiversity mainstreaming. South Africa is currently developing a substantial set of ecosystem accounts, including ecosystem asset accounts, protected area accounts and species accounts. They have found the term 'ecological infrastructure' to be a powerful tool for mainstreaming biodiversity into other sectors that do not traditionally consider biodiversity. Indeed, they have found that NCA unlocks collaboration with non-traditional partners and opens up new conversations. For this, they do not necessarily need the monetary accounts. The physical accounts, yielding e.g. an ecological condition index at catchment level, may be more powerful. However, in general there is some way to go before environmental statistics in South Africa can match the 'well-oiled machinery' that routinely produces – and uses – economic and social statistics.

Further examples of what natural capital thinking can provide to support mainstreaming biodiversity use and conservation in public and private policy-making were provided in a panel discussion. The panel discussion featured: Roland Kaggwa, Manager Production, Trade and Tourism Planning from the National Planning Authority in Uganda; Andrea Cruz Angon, Coordinator Biodiversity Strategies and Cooperation from CONABIO in Mexico; Julia Baker, Biodiversity Technical Specialist from Balfour Beatty; and Joachim Maes, Policy Officer from the Joint Research Centre of the European Commission. The four panellists offered a brief summary of their experiences with the policy opportunities provided by natural capital accounting, showing that there is a broad range of useful policy applications that have already led to substantial and encouraging results.

Uganda has rapidly gained experience in ecosystem accounting, which has already resulted in effective changes such as the ban on the cutting of the *Prunus africanus* and a quota on the exportation of its bark. The accounts produced were rooted in national development frameworks and visions and were designed to address the policy questions that are relevant for Uganda[18].

Mexico has also used its accounts for mainstreaming biodiversity in decision making, showing the needs for climate and biodiversity financing and for setting up local financial mechanisms for conservation, as well as the impacts. Mexico is now working on a substantial set of ecosystem accounts, a process that has enabled new cooperation with other institutes.

[18] See the Experimental Ecosystem Accounts for Uganda: https://www.unep-wcmc.org/resources-and-data/experimental-ecosystem-accounts-for-uganda

Balfour Beatty, an infrastructure building company, is one of the frontrunners in assessing the natural capital impacts of its construction activities and in adapting plans to minimize the impact on biodiversity and where possible to create net gains in biodiversity. Balfour Beatty estimates the biodiversity net gains and natural capital values of its projects' footprints and engages with its clients to make its plans more sustainable. Finally, the European Commission is experimenting with monetary accounts for pollination and for nature recreation, with the objective to be able to show the use benefits of biodiversity in European policies.

The panel discussion was followed by table discussions in which the participants discussed three questions:

The first question sought clarity on the *value added of Natural Capital Accounting* in mainstreaming biodiversity. Participants identified two main issues. First, NCA provides a common, unifying language, helping to translate biodiversity into economic language and in this way giving nature a voice that would not otherwise be heard in economic and financial decisions. But it is not confined to economic information: the physical measures also attract the attention of people other than nature organizations, promote discussion, and enable an integrated message of the importance of biodiversity for people, economies and the earth. Second it shows the macro-economic importance of biodiversity – how natural capital and the ecosystem services that flow from it contribute to income and wealth. Its consistency and comprehensiveness make NCA a unique tool to show – in a spatially explicit way and at multiple scales – the trade-offs and synergies between biodiversity protection and economic development, while showing which economic sectors are at stake.

The second question focused on the *steps to take to ensure that Natural Capital Accounting addresses the priority issues in each country/institution's biodiversity agenda* (e.g. the National Biodiversity Strategies and Action Plans, NBSAPs). The discussions centered around three issues. First, from NCA, indicators can be derived that can be used to set Key Performance Indicators in the NBSAP, as well as being part of a wealth indicator or dashboard alongside economic indicators from the national accounts and social indicators. This makes it possible to define priority areas, assess which assets need protection, and show how benefit flows are used and by whom. Moreover, it makes it possible to monitor the NBSAP or policy plans and show their progress. Secondly, the natural capital accounts allow for making linkages between biodiversity departments and other ministries. By placing NCA in the heart of the government, it becomes easier to show the contribution of biodiversity to wealth and how this depends on the relations between biodiversity and economic sectors. There is a special need for people working in the treasury or ministries of finance to access knowledge about the importance of biodiversity and the potential uses of NCA. Thirdly, participants argued that it is important that the post-2020 agenda of the Convention on Biological diversity recognizes NCA as an important tool to help reach the new biodiversity targets. NCA not only allows monitoring of whether targets are reached or likely to be reached. It can also help with target setting, the development of improved

policies, and is useful for reaching policy makers with well-organized and routine information. Linking NCA with wealth indicators and with the System of National Accounts can help to convince policy-makers of its usefulness for setting high-level targets.

The third question concentrated on the *steps that need to be taken to broaden the use of the ecosystem accounts to help prevent biodiversity degradation or unsustainable use.* First, it is important that the ecosystem accounts are made official. Policy-makers are more inclined to include official accounts in their macro-economic models and plans than to use experimental accounts. It would help if reference material could be developed to show the linkage of NCA with GDP and wealth as well as explain the linkages of the ecosystem accounts with the System of National Accounts (SNA). This should show how major economic actors use ecosystem services or cause damage, show with the monetary ecosystem accounts the net economic impacts of biodiversity change or the economic costs of inaction, and show that there are limits to nature's capacities and what happens if they are exceeded. NCA has to be made part of any 'capitals' framework that policy-makers may already use (human, social and economic capital) and it has to be decided strategically which accounts are most pertinent for policy use. Starting with the ecosystem assets that have economic use, instead of starting with species accounts, may help. Second, it is important to make the biodiversity case for business – using the accounts to show business the dependence of their activities on natural capital, and the reciprocal impact of their activities on nature. There are sufficient examples nowadays to make this a positive story: not saying 'you must not do …' but showing where businesses have opportunities to invest in natural capital and saying 'how this may help'. All participants agreed that this needs a collaborative approach; between policy makers, accountants, and academics and researchers. The last group can make the link with assessments and policy analysis, for both public and private stakeholders. They can learn from the climate change community on how to sell their message, what types of analyses are relevant and what data are needed.

1.6 Mainstreaming natural capital: Building an enabling environment for NCA and complementary natural capital approaches

The session was built around the 'Combining Forces' initiative that had been established to bring together the public and private sectors' thinking on natural capital. The objectives of the initiative are to: foster a greater mutual understanding of different approaches to the assessment of natural capital; and combine natural capital accounting efforts. This contributes to the greater aim of ensuring that people's relationship with nature is accounted for and included in decision-making in both business and government.

The session began with presentations by Sarah-Jane Hindmarsh, Director Environmental-Economic Accounting, Department of Environment and Energy, Australia and James Spurgeon, Director Sustain Value. It was followed by comments from a panel then a group discussion. On the panel were Elizabeth White, Principal Strategy Officer of the International

Finance Corporation; Irene Alvarado-Quesada, Coordinator Environmental Statistics Central Bank, Costa Rica; Simon Cook, Certification and Compliance Manager of Forico (an Australian forest company); and Chris Dodds from the Scottish Government.

Sarah-Jane Hindmarsh's presentation compared the approaches of the Natural Capital Protocol, which is used by business, and the SEEA which is used by governments. How these two approaches can be connected and the opportunities for collaboration and sharing learning where highlighted. Barriers to data-sharing and assuring data quality and were identified as key issues.

The presentation by James Spurgeon focused on priority areas for collaboration and drew on a paper made available before the meeting[19], included as Chapter 4 of this volume. The presentation examined why combining public and private activity would improve NCA, including the current lack of influence, and weak alignment and limited integration of respective government and business approaches. An expert elicitation was used to identify opportunities and priority areas for future work, which include building the community of practice and communicating examples of the benefits of NCA.

The panel speakers covered a range of experiences in using natural capital approaches, with each discussing the benefits of combining forces across public/private sectors as part of their work and providing their views on what is needed to increase collaboration. Their experiences showed that while collaboration is certainly possible, it is context-specific and requires an explicit focus on relevant stakeholders to make progress. Notwithstanding the challenges involved, the experiences presented reinforced the positive benefits from using a natural capital approach and showed its potential for providing a platform for exchanging experience and finding solutions.

The group discussion saw participants consider the benefits and challenges of combining forces across four key themes for future work that were identified in the paper presented by James Spurgeon. These four themes were: (1) Narrative; (2) Harmonization; (3) Data and (4) Building the community. Working groups were asked to design natural capital case studies involving multiple sectors. Many potential studies emerged, but a key finding was that there remains a considerable gap in understanding the perspectives of each sector with various misconceptions and differences in language to be overcome. A very pertinent observation was recognizing the general stages involved in building connections – forming, (brain)storming, norming and performing.[20] As a whole, the private/public sector natural capital relationship should be considered to be at the 'forming' stage and moving into the 'storming' stage – there is definitely work to do.

[19] See https://naturalcapitalcoalition.org/wp-content/uploads/2018/12/Combining-Forces-Priority-Areas-for-Collaboration_Print-PDF_28pg_Final.pdf

[20] See https://courses.lumenlearning.com/atdcoursereview-speechcomm-1/chapter/stages-of-team-development/

1.7 Taking steps to inform policy agendas: conclusions and next steps

The 3rd Policy Forum successfully brought together people from a diversity of countries and backgrounds to share experiences with NCA and discuss how it can better employed to improve decisions. Participants expressed their thanks to both the French hosts and the organizers. It was generally agreed that greater use of NCA could improve decision-making in both government and the private sector – and in particular for both biodiversity conservation and climate change mitigation and adaptation which formed the focus on this Forum.

To support the potential of NCA, particular issues to be addressed include:

- Better aligning approaches to NCA among the public and private sectors, while understanding the different roles NCA plays in, for example, internally-focused business decision-making versus public reporting
- Developing the narrative about natural capital and NCA in particular, and cataloguing the case studies available for demonstrating how NCA is best used in management, planning or target setting (including publishing the material presented at the 2018 NCA Policy Forum)
- Ensuring access to the data needed to build accounts as well as processes for assuring data quality

Progress in these areas is particularly important for continuing to improve trust and understanding between account producers and account users, which should result in greater use of NCA. It was acknowledged that there may be tensions with NCA making explicit problems to which there are no simple solutions. But this is outweighed by comprehensive NCA offering real help to understand and address the complexity of linked social, economic and environmental problems.

Participants expressed satisfaction with each year's Forum having improved mutual trust and understanding, and affirmed interest in continuing to share their experiences and build a community of practice. They looked forward to a 4th Policy Forum, with the topics again to be based on user demand. A range of areas were identified for consideration at the 4th Policy Forum, including forest and land management and the marine economy. Continuing to link NCA to international agreements of climate change, biodiversity conservation and sustainable development was also seen as important, especially given the 2020 reform of global biodiversity targets.

The background papers prepared for the forum were an important contributor to the success of the 3rd Policy Forum. The papers effectively summarized a large amount of information, highlighting issues as well as showing were there was convergence and areas for improvements. Again, participants expressed thanks to the authors of the papers and the keynote speakers.

The large number of participants at the 3rd Forum changed the dynamics of the meeting compared to the previous two fora. While this enabled the experiences to be shared widely

it also meant that opportunities for participation from the floor were more limited. Table discussions, message walls and exchanges in the lunch and tea breaks addressed this to some extent. Going forward, ways to accommodate the expanding size and interests of the NCA community and allow room for more contributions from participants should be considered, including between annual events.

In conclusion, the 3rd NCA Policy Forum was an excellent way to kick off the whole 'Natural Capital Week' in Paris. It revealed strong interest in improving natural capital recognition, protection, restoration and sustainable use. It emphasized the urgency for better-organized information to improve the decisions needed in these areas, and in biodiversity and climate change in particular. It celebrated over 100 countries now producing natural capital accounts, and demonstrated that well-designed NCA, embedded in routine government or business mechanisms, is a highly effective way to provide this information. And it was testament to the benefits of business and governments working together at many levels. The Forum closed with a positive spirit, participants looking forward to continued collaboration and meeting again in 2019.

1.8 Acknowledgments

The summary is based on the notes and recollections of several people, including Arjan Ruijs, Martin Lok, Mark Gough, Carl Obst, Emily Benson and Sonu Jain as well as the authors.

Appendix 1.1 Agenda for the 3rd NCA Policy Forum (from website)

Day 1: Monday, November 26, 2018		
8.30 am	**Registration**	Tea and coffee
9.00 am - 10.30 am	**Session 1. Welcome and opening** Facilitator: Steve Bass	
	Opening remarks	• Laurence Monnoyer-Smith, Commissioner general for sustainable development, Ministry for Ecological and Solidary Transition, France
	Setting the scene: Introductory remarks and objectives of the meeting	• Raffaello Cervigni, World Bank • Alessandra Alfieri, UN Statistical Division • Martin Lok, Ministry of Agriculture, Nature and Food Quality, Netherlands • Mark Gough, Natural Capital Coalition
	Welcome "Icebreaker" Getting to know our evolving community and its aspirations	• Steve Bass, Senior Associate, IIED, UK
10.30 am – 11.00 am	**Coffee**	
11.00 am - 12.45 pm	**Session 2. Challenges of improving decisions on climate change** Facilitator: Michael Vardon	
	Keynote on the climate change policy challenges	• Saleemul Huq, International Centre for Climate Change and Development
	How NCA can be useful to the climate change agenda	• Arjan Ruijs, PBL, Netherlands
	Country presentations on NCA and climate change	• Chola Chabala, Ministry of Development Planning, Zambia • Dr. Sudhiani Pratiwi, BAPPENAS, Indonesia, • Andrea Bassi, Knowledge SRL
	Group discussion	
12.45 am – 13.45 pm	**Lunch**	

1.45 pm - 3.00 pm	**Session 3. Climate Change: What natural capital thinking can achieve** Facilitators: Michael Vardon and Steve Bass This session will delve into what can natural capital thinking provide to support mainstreaming for climate change mitigation and adaptation in public and private policy making.	
	Panel discussion	• Michael Beutler, Kering • Bruno Arias, National Forest Institute, • Jaime Luis, Carrera, Rafael Landivar University, Guatemala • Robert Bradburn, DEFRA, UK • India (TBD)
	Group discussion	
3.15 pm – 3.45 pm	**Afternoon tea**	
3.45 pm - 4.15 pm	**Session 4. Natural capital: Why it matters to countries and how natural capital accounting and complementary approaches can support policy** Facilitators: Martin Lok, NL and Oliver Greenfield, Green Economy Coalition This session will discuss a narrative that illustrates the added value of natural capital thinking in both public and private sector.	
	Presentation of natural capital narrative	• Martin Lok, Ministry of Agriculture, Nature and Food Quality, Netherlands
	Panel discussion	• Claudine Uwera, Ministry of Finance and Economic Planning, Rwanda • Antonin Vergez, Ministry for an ecological and inclusive transition, France • Andre Andrade, Casa Civil, Brazil • Katia Karousakis, OECD
	Group discussion	
7:00 pm	**Cocktail and Reception**	Venue: The Netherlands residence Hôtel d'Avaray, 85 rue de Grenelle, 75007 Paris

Day 2: Tuesday, November 27, 2018		
8.30 am	**Arrival**	Tea and coffee
9.00 am - 10.30 am	**Session 5. Challenges of Improving decisions in Biodiversity** Facilitator: Steve Bass	
	Keynote on the biodiversity policy challenges	• Juha Siikamaki, IUCN

	How NCA can be useful to the biodiversity agenda	• Arjan Ruijs, PBL, Netherlands
	Country presentations on NCA and biodiversity	• Zhiyun Ouyang, Chinese Academy of Sciences, China • Mandy Driver, South African National Biodiversity Institute, South Africa
10.30 am - 11.00 am	**Morning tea**	
11:00 am- 12.45 pm	**Session 6. Biodiversity: What natural capital thinking can achieve** Session leads: Arjan Ruis; Facilitator: Steve Bass This session will go further into what can natural capital thinking provide to support mainstreaming for biodiversity use and conservation in public and private policy making. Parallel working groups will share experiences and discuss a few prepared questions.	
	Panel discussion	• Andrea Cruz, Conabio, Mexico • Roland Kaggwa, National Planning Authority, Uganda • Julia Baker, Balfour Beatty • Lars Mueller/Joachim Maes, European Commission
	Group discussion	
12.45 – 13.45 pm	**Lunch**	
1.45 pm - 3.15 pm	**Session 7. Mainstreaming natural capital: Building an enabling environment for NCA and complementary natural capital approaches** Facilitators: Mark Gough and Carl Obst This session will discuss private and public sector gaps and synergies in natural capital approaches, strengthening government-business collaboration with the objective to increase uptake by linking national ambitions and global commitments	
	Presentations from the Combining Forces Initiative	• Sarah-Jane Hindmarsh, Department of Environment and Energy, Australia • James Spurgeon, Sustain Value
	Panel discussion	• Elizabeth White, IFC • Irene Alvarado-Quesada, Central Bank, Costa Rica • Simon Cook, Forico • Chris Dodds, Scottish government
	Group discussion	
3.15 – 3.45 pm	**Coffee**	
3.45 pm - 5.00 pm	**Session 8. Taking steps to inform policy agendas: Conclusions & next steps** Facilitator: Steve Bass	
	Road to China: Key communications opportunities between now and China CBD COP 2020	• Sonu Jain, World Bank • Pete Nelson, UNSD • Joseph Confino, Natural Capital Coalition

	Interventions from countries on planned action on biodiversity leading to China COP	• All country representatives
	Summary of conclusions on papers on climate change, biodiversity, the narrative, combining forces, and guidelines/SEEA application manual	• Alessandra Alfieri, UNSD • Arjan Ruis, PBL, The Netherlands • Emily Benson, Green Economy Coalition • Marta Santamaria, Natural Capital Coalition
	Closing remarks	• Benoit Blarel, The World Bank • Alessandra Alfieri, UNSD • Mark Gough, Natural Capital Coalition • Martin Lok, Government Dialogue, The Netherlands
5.00 pm	**Close of forum**	

Appendix 1.2 3rd Policy Forum participant list

Name	Job Title	Company	Country/Org.
Sofia AHLROTH	Senior Environmental Economist	WAVES Secretariat	World Bank
Nerea AIZPURUA	Policy Officer	European Commission (EC)	
Alessandra ALFIERI	Chief, Environmental Economic Accounts Section	United Nations Statistics Division	UNSD
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Oliver CANSDELL	Researcher	Nesta	United Kingdom
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Raffaello CERVIGNI	Lead Economist	WAVES Secretariat	World Bank
Chola CHABALA	Permanent Secretary	Ministry of Development Planning	Zambia
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Name	Job Title	Company	Country/Org.
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2. Natural capital accounting for mainstreaming climate change in decision making

Arjan Ruijs, PBL Netherlands Environmental Assessment Agency

Cor Graveland, Statistics Netherlands

Abstract

This paper provides an overview of potential and current uses of the SEEA natural capital accounts for climate-change-related policy uses. This refers to mitigation policies to reduce greenhouse gas emissions and to adaptation policies to make countries less vulnerable against the impacts of climate change. This paper shows that, as climate change touches upon almost all areas of society and government, nearly all of the natural capital accounts, both from the SEEA Central Framework and the SEEA Ecosystem Accounts, are useful for formulating climate-change-related policies and assessments. Which accounts are most relevant depends on the questions policymakers face.

Many countries have already adopted a set of SEEA accounts that are relevant for informing mitigation polices. Air emissions accounts, for monitoring trends in greenhouse gas emissions, are among the most popular accounts. Many countries also monitor expenditures to climate change mitigation actions using Environmental Protection Expenditures Accounts and Environmental Goods and Services Accounts. Next to that, for formulating policies stimulating renewable energy use or discouraging fossil fuel use or for monitoring structural economic change, also energy accounts and several of the accounts from the System of National Accounts provide relevant information. So far, accounts seem to be used less often for reducing emissions related to LULUCF, the agricultural sector, waste handling or international trade, even though some interesting examples illustrate their applicability with respect to these themes, as well.

To date, only a limited number of countries are using the natural capital accounts for informing adaptation policies. However, those who do use it, such as Australia, Botswana and the Netherlands, show that the information in the natural capital accounts is useful for monitoring a country's resilience to climate change impacts and in preparing adaptation policies. This may relate to adaptation policies aiming at reducing economic damages from flooding or water scarcity with the water, material flow and agricultural accounts. Depending on the adaptation question to be tackled, relevant data may come from the land, water, forest, aquatic, energy (asset) or soil accounts from the SEEA Central Framework or ecosystem services and assets accounts from the SEEA Ecosystem Accounts. The natural capital accounts are being used less for these types of analyses because of insufficiently detailed spatial disaggregation of the accounts or because many of the adaptation questions are raised by subnational authorities who have less access to the natural capital accounts.

The results in this paper show that there is a gap between potential and current use of the natural capital accounts for climate-change-related policies. To advance the application of natural capital accounting to policy, it is important that users, producers and analysists of the accounts unite to decide about the most relevant policy questions and accounts. As almost all of the natural capital accounts are useful, it is important to choose wisely: those accounts that can be inform the most urgent policy questions. Experiences in the European Union show that, once accounts are being compiled and used for relevant policy issues, a snowball effect may occur, leading to an increased demand for more accounts and policy analyses.

This review also shows that the use of the accounts for climate issues differs between developing and developed economies. Developing economies focus more on natural resources accounts, such as accounts for land, water, forest and agriculture, which are especially used for climate change adaptation issues. The developed economies, on the other hand, focus more on the emission and energy accounts, used for informing mitigation policies. Since the majority of emission reductions needs to come from developed economies, whereas the developing economies more strongly feel the impact of climate change, this makes sense. But nonetheless opportunities for developing and developed countries to learn from each other exist. For developing economies to choose a clean development path it is important to also consider mitigation policies. Likewise, as developed economies equally suffer from the impacts of climate change, it is important for them to also compile accounts that help to define adaptation policies. So, ample opportunities exist for both types of countries to learn from each other on how to use the natural capital accounts.

2.1 Introduction

This report provides an overview of how Natural Capital Accounting (NCA), following the System of Environmental-Economic Accounting (SEEA), can be used for informing policies relating to both climate change mitigation and adaptation. The report starts from a policy perspective and discusses how using NCA may inform policymakers. It considers which climate-related questions policymakers face and how NCA may help to answer these questions. This may concern policy questions directly related to climate or those about the coherence between climate and other policy fields.[21]

The objective of this report is to provide a starting point for discussions about what government authorities, the private sector and others could do to integrate NCA and natural capital assessments into climate-change-related decisions and policies.

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods' (Art. 1.2 of UNFCCC). According to the latest reports of the Intergovernmental Panel on Climate Change (IPCC, 2018), it is extremely likely that the increase of greenhouse gases in the atmosphere induced by human activity has caused most of the global warming in recent decades. A continued increase of greenhouse gas concentrations in the coming decades will further aggravate climate change, leading to higher average temperatures, more erratic weather patterns, rising sea levels and changing climatic zones. Climate change has 'significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems, on the operation of socio-economic systems or on human health and welfare' (Art. 1.1 of UNFCCC). It will affect all regions of the world, all sectors and all people on earth.

The 2015 Paris Agreement of the UNFCCC forms the heart of climate policies globally. Its main objective is to keep the global temperature rise to below 2°C of above pre-industrial levels and to pursue efforts to limit it to 1.5°C. For this, it has reached agreement on mitigation actions to reduce greenhouse gas emissions, on adaptation actions to strengthen society's abilities to deal with the impacts of climate change and on actions to financially and technically support developing countries to reduce emissions and build resilience to climate change impacts.

The agreement also recognizes the importance of 'a robust transparency and accounting system…, reporting information on mitigation, adaptation and support' (Art. 13 of the Paris Agreement). While the UNFCCC has its own standards for reporting greenhouse gas

[21] A draft of this report was presented during the Natural Capital Policy Forum held 26 and 27 of November 2018 in Paris. The final version of the report is available on the PBL website https://www.pbl.nl/en/publications/natural-capital-accounting-for-mainstreaming-climate-change-in-decision-making.

emissions, these can be mapped to the SEEA[22] (UN et al., 2014a; see also Keith, 2018). Many of the indicators needed for the Paris Agreement can be obtained from the SEEA accounts (see Text Box 2.1 and UNECE, 2017). The advantage the SEEA has over other statistical and data systems is that not only do they provide information for monitoring greenhouse gas emissions that are consistent with energy and material inputs in the economy, they can also be used for assessing the impacts of climate change on households, the economy and ecosystems, and for informing sector-specific mitigation and adaptation strategies. The SEEA is being adopted by more and more countries for informing their climate policies.

This report looks at NCA from a policy perspective and discusses how such accounts may help policymakers answer climate-related policy questions. Section 2.2 first discusses the key climate-related policy developments. Section 2.3 identifies the policy questions pertaining to effective climate-change-policy development. Moreover, it discusses which natural capital accounts can potentially be used in answering these questions. Section 2.4 discusses a number of mitigation- and adaptation-related examples for which the SEEA has been used, and also shows that the accounts are not yet used to their full potential. In Section 2.5, conclusions are drawn and gaps between potential and current use are outlined.

Box 2.1. Natural capital accounting and the System of Environmental-Economic Accounting

The System of Environmental-Economic Accounting (SEEA) is the internationally agreed standard for natural capital accounting. The SEEA Central Framework (CF) and SEEA Experimental Ecosystem Accounts (EEA) contain the standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics on the environment and on ecosystems and their relationship with the economy (United Nations et al., 2014a,b). They guide the compilation of consistent and comparable statistics and indicators for policymaking, analysis and research.

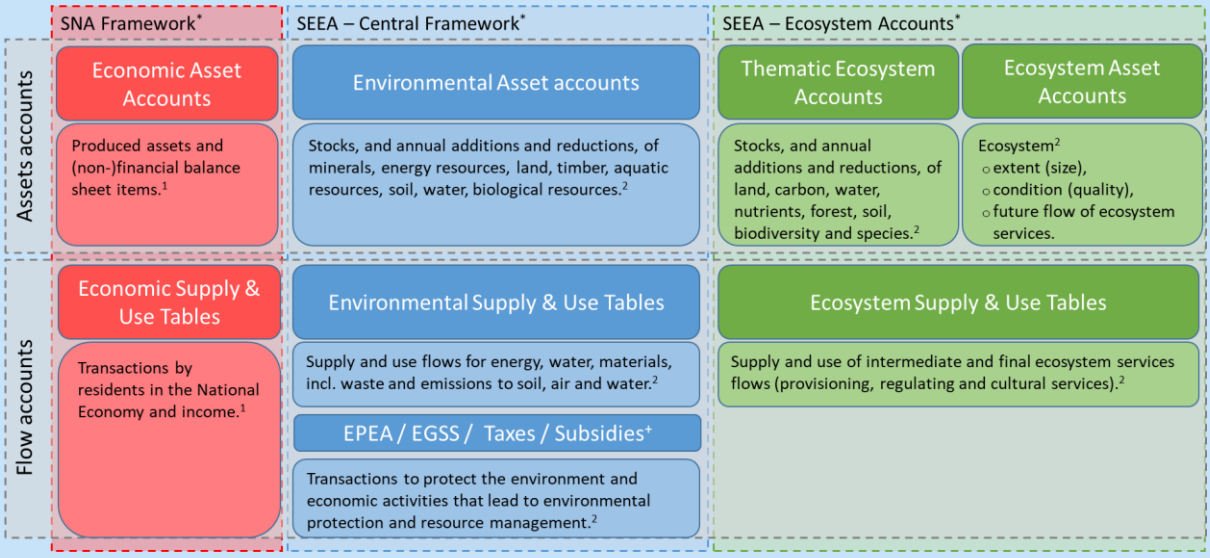
The SEEA-CF allows for compiling physical and monetary accounts for a range of natural resources, such as minerals, timber, and fisheries, and residuals such as air emissions and waste, and linking these to the System of National Accounts, used for calculation of production and GDP. The SEEA EEA adds to this ecosystem accounts that summarise information about the extent and condition of ecosystems, the status of biodiversity, and their changing capacity to operate as a functional unit and deliver a flow of ecosystem services. Some resources are treated both in the SEEA-CF and the SEEA EEA, such as land, water and agricultural production.

The SEEA distinguishes between supply and use tables, asset accounts and functional accounts (see Figure B1). The supply and use tables record in physical and monetary terms the flows of natural inputs, products, ecosystem services and residuals within the economy and those between the environment and the economy. These include for instance water and energy used in production processes, pollination and soil formation necessary for primary production and waste flows to the environment. Asset accounts in physical and monetary terms measure the natural resources available and changes in the amount available due to extraction, natural growth, discovery and other reasons. They, for example, include mineral, timber, soil, water, land, biodiversity and future flows of ecosystem services. Functional accounts record the transactions between industries, households and governments that concern the management of natural resources and the environment, including green investments, jobs related to conservation or climate action, soil restoration and recycling.

[22] The SEEA Central Framework (UN et al., 2014a) notes that the main difference is the application of the residence principle rather than the territory principle. For example, a truck driving in Germany but owned by Dutch production company would have emissions recorded against Germany in the UNFCCC, while in the SEEA it would count as Dutch emissions.

Box 2.1, continued. Natural capital accounting and the System of Environmental-Economic Accounting

Figure B.1: Schematic representation of the SNA, SEEA-CF and SEEA EEA.



* The three frameworks partially overlap, especially for the environmental and ecosystem goods and services directly used in economic processes such as water, land, materials, energy, timber and agricultural crops. 1) In monetary terms ; 2) In physical or in monetary terms (ecosystem extent and condition accounts only in physical terms); + EPEA = Environmental Protection & Expenditure Accounts ; EGSS = Environmental Goods and Services Sector

All three categories of accounts in Figure B1 include those related to climate-change mitigation or adaptation. Climate-related **assets accounts**, include asset accounts for carbon, land, energy, soil, timber, aquatic, biological and water resources. All of these assets are impacted by climate change and the accounts can be used for monitoring those impacts. They may also be applied to assess whether adaptation measures, such as those related to water and soil management, improve resilience to climate change. The accounts measuring annual additions to and reductions from the stocks, can also distinguish between normal changes, e.g. of timber or fish stocks due to biological or ecological processes, and more exceptional or catastrophic changes to forest growth, water quality or diseases e.g. due to extreme weather events. Carbon accounting started by accounting of the carbon sequestered in forests and in fossil fuels and related emissions. With the development of the SEEA-EEA, the scope of carbon accounting broadened, encompassing all parts of the carbon cycle and all carbon pools, and thus covering geo carbon, bio carbon, atmospheric carbon, carbon in the oceans and carbon accumulated in the economy.

Climate-change-related **flow accounts** include those for air emissions (greenhouse gases), energy, materials, water, ecosystem services and a variety of resources and products flowing to particular sectors, such as agriculture, forestry and fisheries. Air emissions accounts measure greenhouse gas emissions from the various sources of energy used in the economy, as well as those from deforestation and land-use change. They include both emissions and sequestration related to carbon sinks, such as peatlands or oceans. Information on carbon stocks and flows is used in the SEEA-EEA as an indicator of ecosystem condition and for measuring current and projected flows of ecosystem services, and includes carbon sequestration and net primary production.

Several countries are compiling **environmental activities and economic instrument accounts** in the form of Environmental Protection Expenditure Accounts (EPEA) and Resource Management Expenditure Accounts (ReMEA), following the Classification of Environmental Protection Activities (CEPA) and Resource Management (CReMa) (see Appendix 1 or Statistics Netherlands, 2016). These classifications include expenditures on activities dedicated to climate change, such as protection of air quality, protection and remediation of soil, groundwater and surface water, management of energy resources and of natural forest resources. In addition to these, the Environmental Goods and Service Sector (EGSS) accounts show where economic production takes place, which sectors invest in environmental protection and resource management goods and services, where new green jobs arise, and relating all this to those who consume these goods, those who pay and those who benefit. Finally, this category contains accounts used for monitoring economic instruments, such as carbon taxes, environmental subsidies and transfers, and carbon permits. See also Schenau (2009) and ABS (2012).

2.2 Climate change and related policies

2.2.1 Climate change causes and impacts

Increases in concentrations of greenhouse gases in the atmosphere cause climate change. The greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and F-gases (chlorofluorocarbons CFC and hydrofluorocarbons HFC). Their concentrations in the atmosphere increase due to:

- Economic activities using fossil energy, such as coal, oil and natural gas, in transport, heating, electricity generation and industrial processes, that emit CO_2, CH_4 and N_2O;
- Livestock farming that causes CH_4 emissions;
- Deforestation, forest fires and land-use changes that lead to less sequestration and more CO_2 emissions;
- Waste dumping in landfill sites that emit CH_4 and CO_2 emissions for sustained periods of time;
- Agricultural and nature-conservation-related land-use practices affecting above and below ground vegetation, and fertilizer use practices that both cause CO_2, CH_4 and N_2O emissions;
- CFC gases used in industrial processes. However, CFC use has gradually been phased out under the Montreal Protocol.

The impacts of climate change may be severe and will intensify further with increasing greenhouse gas concentrations. The major impacts are higher global average temperatures, leading to greater variability in weather patterns, such as precipitation, evapotranspiration and temperature patterns (e.g. IPCC, 2018; Stern, 2006). This leads to higher probabilities of extreme weather events including heat waves, extreme rainfall, extreme droughts, and more storms and cyclones. This in turn leads to greater risks of flooding, land-use degradation, desertification and biodiversity loss. Moreover, sea levels are expected to rise, endangering coastal areas and low-lying islands. Climate zones are also likely to change, affecting regional crop productivity. IPCC (2018) concluded that global warming of 1.5 ^{o}C or more above pre-industrial levels increases the risk for 'long-lasting or irreversible changes'. Each additional increase of average global temperature more than proportionally increases these risks. With lower temperature increases, people and ecosystems can more easily adapt and reduce the risk for long-lasting and irreversible changes.

These impacts have large consequences for society. For example, it will have severe consequences on human health, as well as biodiversity, ecosystem assets and ecosystem services on which human well-being depends. If climate change continues unabatedly, then almost all economic sectors will be affected, for example:

- The agricultural sector will suffer from the changing and more erratic weather patterns;
- Fish stocks are expected to decline due to rising temperature of the oceans;
- Industry and energy sectors have to deal with reduced water availability, higher temperatures and changing agricultural productivity;

- The transport, insurance, infrastructure, real estate, and the tourism sectors all have to deal with rising temperatures, more erratic rainfall patterns and higher probabilities of extreme weather events and corresponding damages;
- In heavily impacted coastal areas migration may increase and lead to security concerns.

Countries have to fight climate change on two fronts. On the first front, countries will need to adopt climate mitigation policies to reduce global greenhouse gas emissions and concentrations in the atmosphere in order to limit global warming. On the second front, countries will need to adopt measures and policies adapting to the consequences of climate change. The latter are meant to make countries more resilient and less vulnerable to climate change. IPCC (2018) talks about the need for 'rapid and far-reaching transitions in land, energy, industry, buildings, transport, and cities'.[23]

2.2.2 Climate change regulation, measures and policies

At the heart of the global climate policies are the UN Framework Convention on Climate Change (UNFCCC) and its treaties, the Kyoto protocol and its successor, the Paris Agreement. The Paris Agreement did not set emission targets but made countries agree to keeping the increase of the global average temperature to well below 2 °C above pre-industrial levels and to limit the increase to 1.5 °C. Under the Paris Agreement, each country must formulate plans to reduce their greenhouse gas emissions, their Nationally Determined Contributions (NDC). Every five years, countries present new plans that have to be increasingly ambitious in terms of emission reductions. Next to emission reductions, these NDCs also include plans to conserve and enhance sinks of greenhouse gases, such as forests and peatlands.

The Paris Agreement also includes climate adaptation and financing goals. Countries have to enhance their adaptive capacity and reduce vulnerability to climate change. Moreover, they have to avert and minimize loss and damage associated with the adverse effects of climate change. Furthermore, developed countries agreed to support developing countries, financially or through international cooperation, to build a clean, climate-resilient future.

The Paris Agreement affects all corners of policy and society. To include all those who have to contribute, for example, the Netherlands, France and the UK (see e.g. PBL, 2018; Rudinger, 2018) initiated processes whereby all stakeholders (authorities, private sector and civil society) contribute to a transition that not only affects energy production and industry, but also transport, the built environment, land-use and consumer behavior. When considering adaptation policies, the agreement also affects agriculture, water management, infrastructure development, health care, nature conservation and the financial sector.

At the same time, climate policies relate to many of the Sustainable Development Goals (SDGs). The SDGs, adopted by the UN in 2015, are a set of seventeen development goals for

[23] From the IPCC press release for the 'Summary for policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments, 8 October 2018.

all countries. These include targets for all dimensions of sustainability, and have economic, social, environmental and natural resources targets. 'The SDGs represent a step towards closer integration of policy frameworks and programmes, requiring more integrated information on the interlinkages between the economy, the environment and society' (UN, 2015). Figure 1.1 shows that SDG 13, on 'Climate Action' is a clear example of such an interlinked target (Campagnolo et al., 2017).

Climate policies are also integrally related to policy developments focusing on wealth, green growth or sustainability in general. Measuring growth, taking climate impacts into account, goes beyond measuring growth of GDP within the System of National Accounts (SNA). Recent initiatives that measure a broader conception of wealth or green growth: include the OECD Green Growth indicators (OECD, 2017a); the Eurostat monitor of sustainable development in the EU (Eurostat, 2017); the World Bank Wealth of Nations report (World Bank, 2018); and the Sustainability Monitor of the Netherlands (Statistics Netherlands, 2017a). These examples track multi-dimensional progress or regress in countries, which is also relevant for tracking the multi-dimensional impacts of climate change.

Figure 1.1: Relationship of SDG 13 on 'climate action' with the other SDGs.

Source: After Campagnola et al. (2017).

2.3 Potential contributions of NCA to climate policies

From Section 2.2, it becomes clear that climate change policies relate to a very broad range of policy fields. In fact, almost all government actions in one way or another relate to climate adaptation or mitigation. Climate mitigation policies broadly focus on greenhouse gas emissions from industry, electricity production, livestock rearing, land-use change and waste management as well as on policies on influencing consumer energy use or consumption patterns. Such policies affect many sectors, including agriculture, fisheries, water management, environmental management, tourism and health care. Integrated policy-making, considering all these dimensions simultaneously, is necessary to bring comprehensive solutions to the climate change problem.

As climate policies cover such a wide range of policies, the multisector coverage and integration with the national accounts makes NCA a perfect starting point to analyze climate change issues and policies. Yet, due to this wide coverage, the question becomes: where to start? Which accounts are useful for which policy questions? To systematically consider how the natural capital accounts can benefit climate change policies, this section discusses which climate-related policy questions are pertinent, how NCA could help in addressing these questions, and which analytical methods would be useful.

2.3.1 Climate change policies, policy questions and accounts

Climate change policies cover both mitigation and adaptation. Considering the causes of climate change, discussed above, climate mitigation policies can be divided into policies with five types of objectives:

M1: Reducing emissions from coal, oil and gas usage for energy production, combustion, industrial processes, transport and heating from the different sectors, including negative emissions through carbon capture & storage (CCS) techniques;
M2: Reducing deforestation, stimulating afforestation, preserving bio-organic matter and reducing emissions from Land Use, Land Use Change and Forestry (LULUCF);
M3: Reducing emissions from livestock and agricultural practices or enhancing sequestration;
M4: Improving waste handling to reduce methane and other emissions;
M5: Reducing emissions from international trade.

Similarly, climate change adaptation policies may be divided into three areas:

A1: Improving water management, including practices for improving water use efficiency, increasing water storage capacities to safeguard water availability during periods of water scarcity; improving water safety measures with dams, dykes and civil works against sea level rise, river flooding and extreme rainfall events; as well as for preventing water quality problems due to increased risks of salinization, eutrophication and sewage overflows;
A2: Enhancing agricultural productivity and nature management, including policies for reducing soil degradation, erosion and sedimentation; enhancing irrigation efficiency; introducing climate proof crop varieties; improving land-use efficiency and resilience; and improving nature and forest management to prepare protected areas for shifting climate zones;
A3: Preparing cities, infrastructure and society for the effects of climate change, including policies for: storing more water during extreme rainfall events; draining water more efficiently; reducing heat island effects; constructing climate proof buildings; preventing disturbance to critical infrastructure (e.g. water, energy, telecommunication and transport and harbors); and managing disasters and crises.

Designing policies to meet these objectives requires policymakers and policy analysts to raise questions that address the most pertinent problems. Generally, three types of policy questions are raised during various stages of decision-making:

Q1. What are the status and trends of climate-change-related indicators and of indicators on how society is affected by climate change and climate change policies?
Q2. What are the possible trade-offs and synergies of climate-change-related policies, in terms of dependencies between policy areas and between impacts on climatic, social, economic and ecological developments?
Q3. What are the envisaged effects of climate mitigation and adaptation policies on autonomous developments and on the impact of existing policies?

Table 2.1 gives a non-exhaustive list of potential policy questions raised by either policymakers or policy analysts, for each of the categories of climate change policy. Following the status and trends of mitigation policies (Q1 above for policies M1 to M5) requires measuring: greenhouse gas emissions; changes in fossil fuel and renewable energy use; mitigation expenditures and; how mitigation policies impact on general social, ecological and economic developments in society. For following status and trends of adaptation and adaptation policies (Q1 for policies A1 to A3), measuring the effects of climate change on natural capital (e.g. water, agricultural, fisheries, forestry), produced capital (e.g. infrastructure or fixed capital in housing, construction and machinery) or human capital (esp. health issues) is important.[24]

As climate change affects all corners of society, it is important to learn how climate-related changes lead to trade-offs or synergies, in the various policy fields (Q2 above). This may, for example, relate to learning about: decoupling of emissions and economic developments; relationships between international trade patterns and greenhouse gases incorporated in imports; synergies between greenhouse gas emissions and air quality problems; and trade-offs between reductions of methane emissions from agriculture and developments in the livestock sector. Likewise, for adaptation issues, learning about relationships between climate patterns and water and agricultural indicators, or between the emergence of heat waves and the number of premature deaths, is important.

Policy evaluation questions (Q3) for mitigation may focus on the efficiency of emission trading systems, effects of energy or carbon taxes, impacts of waste management regulations or the effects of clean innovation subsidies. Adaptation-related policy questions may be related to, for example, the impact of new water management measures on flood risk, the effects of irrigation regulations on agricultural productivity, or behavioral effects of

[24] Schenau (2009) orders the adaptation and mitigation related questions according to the drivers-pressures-state-impact-response framework. The drivers are the economic activities causing greenhouse gas emissions. The pressures are the greenhouse gas emissions. Impacts refer to impacts on natural capital (water, ecosystems, fisheries crop productivity), produced capital (infrastructure, fixed capital in buildings and machinery) and human capital (health). Responses refer to the adaptation and mitigation policies.

subsidies on the number of *green roofs* that are used in the Netherlands for water retention and additional roof insulation.

Table 2.1 Policy questions for climate-change-related policies

	Q1: STATUS AND TRENDS	Q2: ASSESS TRADE-OFFS AND SYNERGIES	Q3: EVALUATE POLICIES
MITIGATION			
M1: REDUCE EMISSIONS FROM FOSSIL FUEL USE, INCLUDING CARBON CAPTURE & STORAGE	Trends in greenhouse gas emissions by source and by sector. Trends in mitigation expenditures. Trends in carbon capture technologies and of underground storage	Relationship between economic development and emission reduction. Sectoral shifts and winners/losers of mitigation policies. Relationships between climate and air quality policies. Risks of CCS technologies to society.	Evaluate mitigation policies such as an emission trading system, fiscal greening (taxing emissions), subsidising emission reducing and CCS innovations, setting emission norms for industries and transport.
M2: REDUCE EMISSIONS FROM OR ENHANCE SEQUESTRATION IN LULUCF	Trends in greenhouse gas emissions and sequestration from land use, land-use change and forestry.	Relationship between developments in LULUCF and emissions or sequestration.	Evaluate mitigation policies focusing on land-use management and forestry policies.
M3: REDUCE EMISSIONS FROM LIVESTOCK AND AGRICULTURE	Trends in greenhouse gas emissions from livestock rearing, land use and fertilizer use.	Relationships between livestock and agricultural innovations and emissions.	Evaluate mitigation policies focusing on the agricultural and livestock sectors.
M4: REDUCE EMISSIONS FROM WASTE HANDLING	Trends in greenhouse gas emissions from waste handling.	Relationships between waste management innovations and emissions.	Evaluate mitigation policies focusing on waste handling, land fill and incineration policies.
M5: REDUCE EMISSIONS FROM TRADE	Trends in greenhouse gases included in emissions.	Relationships between trade patterns and greenhouse gases incorporated in imports.	Evaluate impacts of international trade policies on greenhouse gases incorporated in imports.
ADAPTATION			
A1: WATER MANAGEMENT	Trends in water use efficiency per sector, water storage capacities, water safety, water quality, and damages from extreme weather events and corresponding economic effects.	Relationships between changing climate patterns, water management measures and major water and economic indicators.	Evaluate adaptation policies such as water management, water safety. Evaluate efficiency and effectiveness of water safety, water use and water storage measures.
A2: AGRICULTURAL PRODUCTIVITY AND NATURE MANAGEMENT	Trends in agricultural productivity, soil degradation and agricultural innovations. Trends in shifts in ecosystems and protected areas	Relationships between changing climate patterns and agricultural indicators such as production, water use, landslides or degradation, or shifting ecosystems in protected areas.	Evaluate agricultural adaptation and development programmes, such as agroforestry. Evaluate adaptation programmes for protected areas.
A3: PREPARE CITIES AND INFRASTRUCTURE	Trends in adaptation expenditures in cities and for infrastructure.	Synergies and trade-offs between measures to prepare cities and infrastructure for climate change.	Evaluate efficiency and effectiveness of urban and infrastructural adaptation programmes

To answer the above policy questions, policymakers and analysts require information. NCA can provide a large amount of such information (see Text box 1). Especially, the consistency of the accounts across sectors and their linkages with the system of national accounts opens a broad range of applications. In fact, almost every SEEA account provides information for at

least one climate-related policy question. However, therein also lies a risk. All accounts may be useful, but when answering a specific policy question, choices have to be made regarding which accounts and indicators to use or which sector, ecosystem or land-use classifications would be most relevant. These choices must be made jointly between policymakers, policy analysts and statistical organizations to avoid accounts being produced that do not cover policymakers' questions.

Table 2.1 provides a non-exhaustive overview of the SEEA accounts that help answer climate change policy questions (see also Schenau, 2009; UNECE, 2017). The table shows that the key accounts for mitigation policies are the *air emissions accounts* per sector and per type of greenhouse gas in combination with the economic accounts from the System of National Accounts. They can be used for measuring trends in emissions and provide much of the information needed for international reporting obligations under the UNFCCC. *Economic accounts, energy asset and energy flow accounts, material flow accounts* and some of the *ecosystem services stock and flow accounts* are useful for assessing energy- and fossil-fuel-related policies. A time series of these accounts may show: a) whether emissions show lower growth rates or even decline while the economy continues to grow (decoupling); b) changes in emissions, energy efficiency or fuel mix; c) whether energy intensive sectors develop differently from the less energy intensive sectors (structural change); or d) to what extent innovation subsidies or carbon taxes reduce emissions. Mitigation policies focusing on emissions from agriculture, can obtain information from the *agricultural accounts*, the *land accounts* and some of the *ecosystem accounts.* These help to monitor which agricultural subsectors are more energy efficient or which land-use practices are best for carbon sequestration. Similarly, mitigation policies focusing on waste and waste water management need *waste and water emission accounts*. Combined with *material flow accounts*, they can show whether waste production reduces or waste disposal choices change.

For learning about climate change impacts and adaptation policies, other types of accounts are needed. These are, for instance, the *water accounts (e.g. water flow and asset accounts, water quality accounts, disaster-related accounts)*, *agricultural accounts* (e.g. *agricultural supply and use tables* per subsector), *forest accounts (*e.g. *timber stocks and flows* and accounts for *non-timber food products* or *recreation*), *land accounts (e.g. land-cover* and *land-use accounts)*, *ecosystem accounts (*e.g. *biodiversity accounts, soil accounts, ecosystem extent accounts* and *ecosystem services accounts)* and *environmental activity and environmental protection accounts*. Combined with time series information on climate patterns, the accounts can be used for analyzing how climate change affects water availability, use and efficiency; damages from droughts or extreme weather events; agricultural productivity; soil degradation; ecosystem changes, etc. Similarly, it can be analyzed whether policies or investments result in less vulnerable ecosystem assets and a more sustainable economy. Finally, health accounts, which sit outside of the SEEA, may be of use to assess impacts of climate change on health issues and health expenditures in the economy.

2.3.2 Relevant analytical methods

To analyze the research and policy questions identified, policy analysts can choose from a broad set of analytical approaches. The three types of policy questions—about status and trend, synergies and trade-offs, and policy effects—require different approaches. In this, the analysis of policy effects is analytically more demanding than the analysis of status and trends. Table 2.3 shows which types of analysis are useful.

For analyzing status and trends of climate change impacts and policies, numerous indicators can directly be derived from the SEEA accounts. Examples include: greenhouse gas emissions per sector, energy mix, energy efficiency, mitigation expenditures and deforestation. Examples related to adaptation include costs to prevent climate-change-related damages, water availability, agricultural productivity, soil degradation, and health impacts. UNECE (2017) presents a set of key climate change-related statistics and indicators that can be derived from the SEEA (Box 2.2).

Regression analysis can provide evidence about synergies and trade-offs resulting from climate change or climate-change-related policies. For instance, the accounts provide the data to estimate causal relationships between on the one hand greenhouse gas emissions and on the other hand energy use, material use, land-use changes, ecosystem services supply, water availability or innovation expenditures. These relationships help to show whether a country's economic growth can be decoupled from emissions or whether effective investments are made to reduce greenhouse gas emissions. They also show where adaptation measures are needed to reduce climate change impacts on, for example, water supply, agriculture and biodiversity. The consistency of the accounts—in terms of economic sectors, ecosystem classifications, or spatial boundaries—enables analysts to integrate data for different sectors and areas, which is necessary for these analyses.

Two relevant applications are Structural Decomposition Analysis (SDA) and the Emission Trade Balance. SDA measures to what extent greenhouse gas emissions decouple from economic growth. Using emission, energy or material flows accounts, the extent to which emissions decouple, in relative or even in absolute terms from economic growth can be determined as well as the underlying causes of it. For example, if decoupling occurs, is it due to a change in the size of the economy, the structure of the economy (e.g. a growth of the services sector at the expense of the industrial sector), a change in the fuel mix, dematerialization of production, or from particular technical emission reduction measures? The Emission Trade Balance allows for determining if and how emissions are related to domestic production, imports or exports.

Box 2.2: Framework for NCA-based key climate change statistics for use in policy

In 2017, UNECE, jointly with a group of statistical organizations and international organizations, published a list of key climate change indicators (UNECE, 2017). They started by prioritizing policy questions, to assure that the most relevant climate-change-related issues are covered, that the most relevant policy questions are addressed and that upcoming information needs are met. This resulted in indicators that covered:

- the *drivers* of climate change that emit greenhouse gases, such as share of fossil fuels in primary energy supply, support for fossil fuels/GDP, energy intensity of production activities, CO_2 intensity of energy, emission intensity of agricultural commodities, and energy consumption per capita;
- the greenhouse gas emissions that put *pressures* to the climate system, such as greenhouse gas emissions from fuel combustion, land use, production activities or households, and the carbon footprint;
- the *impacts* of climate change on human and natural systems, such as average surface temperature, land area suffering from unusual wet or dry conditions, proportion of degraded land, deaths due to hydro-meteorological disasters, vector-borne diseases, or agricultural loss due to hydro-meteorological disasters;
- the *mitigation policies* to avoid the consequences of climate change, such as share of renewable energy, mitigation expenditures/GDP, share of energy- and transport-related taxes, climate-change-related subsidies, or average carbon price; and
- the *adaptation policies* to adapt to the consequences of climate change, such as government adaptation expenditures as percentage of GPD, changes in water use efficiency, progress towards sustainable forest management, population living in air-conditioned dwellings, or area under sustainable agriculture.

For this, the SEEA accounts provide much of the necessary information. This includes physical flow accounts for energy; agriculture, forestry & fishery accounts; physical flow and asset account for water; environmental activity accounts; air emissions accounts; land asset accounts; soil accounts; and ecosystem accounts.

Table 2.2: Overview of accounts from the System of National Accounts, the SEEA Central Framework and the SEEA Ecosystem Accounts that are useful for climate-change-related policy questions *

CLIMATE CHANGE POLICIES AND NATURAL CAPITAL ACCOUNTING		SNA – National Acc.		SEEA – Central Framework							SEEA – Ecosystem Accounts			
	Account category	Economic Accounts	Satellite Accounts	Environ-mental Activity Accounts	Supply and Use Tables		Asset Accounts Thematic Ecosystem Acc.				Ecosystem Asset Accounts			Eco-system Services Acc.
	Content of Account	Economic Supply & use, Import & export	Labour, education, technology, agriculture, energy, water, tourism	Production & transactions to protect the environment	Supply and use of energy, water, materials	Flows of waste and emissions to soil, air and water	Stocks & resources of minerals, energy, timber, water	Land use and land cover	Stocks of carbon, soils and nutrients	Stocks of biodiversity and species	Extent of ecosystems (size)	Condition of ecosystems (quality)	Future flow of ecosystem services (stock/ resource)	Supply and use of ecosystem services [1)]
	Unit [(a)]	€	€ / Q	€	P / €	P / €	P / €	P	P / €	P	P / €	P	P / €	P / €
Status and trends	(b)													
s	M													
Agricultural production and productivity	M / A													
Energy use / energy efficiency / share renewable	M													
Material use / resource efficiency	M													
Emissions in traded goods and services	M													
Waste residuals and emissions	M													
Land, forest, soil and marine environmental changes	M / A													
Drought, flooding, water availability	M / A													
Ecosystem services and biodiversity	A													
Climate-related investments, expenditures, taxes and subsidies, government spending	M / A													

Assess trade-offs and synergies														
Relation agricultural productivity & emissions	M													
Relation Energy use – GHG emissions	M													
Relation Material use – GHG emissions	M													
Relation Land use/cover – GHG emissions	M													
Relation Soil use & management – GHG emissions	M / A													
Relation Forest Use – GHG emissions	M / A													
Relation Waste Management – GHG emissions	M													
Relation Water use/availability – climate patterns	A													
Relation Agricultural productivity – climate	A													
Relation Ecosystem services/biodiversity – climate	A													
Relation Water-related risks – climate patterns	A													
Policy response / implementation / review														
Energy or carbon (CO_2) policies & instruments	M													
Material / resource efficiency policy (Circular Ec.)	M													
Nitrogen policy	M / A													
Sustainable agriculture (mainstream and organic)	M / A													
Forestry policy	M / A													
Waste and wastewater management policies	M													
Water management (safety, conservation, supply)	A													
PES for bio-carbon, sequestration or agroforestry	M / A													
Urban / infrastructure development regulations	A													

Notes: * The black cells show which accounts can be applied for answering the respective policy questions. The white cells indicate that the accounts do not provide relevant information for that policy question. The accounts coloured green and blue are covered both in the SEEA-CF and SEEA EEA. (a) P = in physical terms, € = in monetary terms, Q = in quantitative terms; (b) M = Mitigation, A = Adaptation.

Table 2.3: Overview of analytical approaches useful for climate-change-related policy questions

CLIMATE-CHANGE-RELATED POLICIES *		TYPES OF ANALYSIS
STATUS AND TRENDS		
GHG emission and intensity, per sector and source	M	Trends in greenhouse gas emissions and intensity per source and per sector
Agricultural production and productivity	M / A	Trends in crop production, yields, post-harvest losses and crop or yield loss
Energy & Material use / efficiency	M	Trend analysis of energy use/production/efficiency per type of (renewable) energy; trends in circularity of the economy / resource efficiency per sector or type of resource
Emissions incorporated in traded goods and services import or export	M	Trends in imported or exported greenhouse gases that are incorporated in traded goods
Waste recycling rate, residuals and emissions	M	Trends in waste and residuals per sector and in waste management practices including reuse, recycling, etc.
Land, forest and soil changes	M / A	Changes in land/forest area, land/forest/soil use, in soil and ecosystem quality, change in soil organic matter content
Drought, flooding, water availability	M / A	Trends in droughts, excess water, temperature, extreme weather events, flooding; identify locations under threat of flooding or heat islands
Ecosystem services and biodiversity	A	Trends in ecosystem services and biodiversity affecting agricultural productivity, such as pollination, soil fertility, pest control
Climate-related expenditures and health impacts	M / A	Trends in climate adaptation and mitigation-related investments, expenditures and burden, trends in climate-related health expenditures
TRADE-OFFS AND SYNERGIES		
Relation GHG emissions – energy use/material use	M	Regression analysis between GHG emissions per sector and per source and energy use / production / material use to analyse decoupling between emissions and economic growth
Relation GHG emissions – land use/land cover/ soil management / forest use / farming practice	M / A	Regression analysis of GHG emissions / sequestration vs land-use patterns / pressure relationships / agroforestry / forest cover / soil management / agricultural practices / forest management practices
Relation GHG emissions – waste management	M	Regression analysis of GHG emissions / sequestration and waste incinerating / processing / landfilling / waste water processing
Relation climate – water use/availability/risks & agriculture & ecosystem services / biodiversity	A	Regression between temperature/rainfall patterns and water use / availability excess & deficit / risks, crop yields or ecosystem services / biodiversity

Table 2.3, cont.

POLICY RESPONSES / IMPLEMENTATION / REVIEW

Energy / carbon / material / resource policies (taxes, subsidies, innovation grants)	M	Econometric analysis to assess potential and historic effects of fiscal policies, trade policies or other measures to change energy use, GHG emissions, material/resource use.
Agricultural/nitrogen policy	M / A	Bio-economic modelling to assess impacts of agricultural, food and nitrogen policies on farming practices, nitrogen emissions and deposition, and resulting impacts on agrobiodiversity, ecosystem and resource conditions, and estimation of the economic costs involved.
Forestry policy	M / A	Bio-economic modelling to assess behavioural impacts of forestry policies on logging patters and resulting impacts on biodiversity, ecosystem conditions, NTFP harvesting and local livelihoods, and estimation of (economic) costs involved.
Waste management policies	M	Modelling behavioural impacts of waste policy on waste generation and waste management.
Water management policies	A	Bio-economic modelling to assess behavioural impacts of water policies on water use and water-related risks. Focus on agricultural and industrial water use and potentials for water-use efficiency.
PES – bio-carbon enhancement / Carbon sequestration / agroforestry	M / A	Econometric analysis to assess potentials and historic effects of PES on organic matter enhancement and carbon sequestration in land and vegetation, in ecosystems, other effects and payment involved.
Urban/ infrastructure development regulations	A	Cost-benefit analysis of public investments in urban spatial planning and infrastructure development

Note: * M = mitigation policies, A = adaptation policies, PES = Payment for Ecosystem Services. The same policies are listed as in Table 2.

Finally, integrated assessment or input-output and general equilibrium models can be applied using information from the accounts. Input-output analyses with environmental extensions support footprint analyses, including carbon footprint indicators showing, for example, greenhouse gases incorporated in a country's consumption basket. For forward-looking policy assessments, several modelling approaches use the natural capital accounts. General equilibrium models are usually directly based on the National Accounts, making NCA perfectly suited to add environmental aspects to the models. This is also true for many other types of environmental-economic models.

2.4 Experiences with NCA for climate policies

This section briefly outlines current experiences of countries with compiling and using SEEA accounts for climate-change-related policies and developments. Table 2.4 lists examples of countries using SEEA accounts to identify the causes and impacts of or responses to climate change. Examples are given both for mitigation and adaptation policies.[25] We do not intend

[25] These examples originate from different sources, including a literature and web search by the authors and a survey conducted amongst a group of countries with whom the UN Statistics Department and the WAVES partnership hold contacts, and from the 2017 Global Assessment of Environmental Economic Accounting (Statistics South Africa, 2017; UNCEEA, 2018). See appendix 2 for a brief summary of the survey results. Increasingly accounting concepts are also used for the private sector. Examples hereof are discussed in Lok et al. (2018).

to provide a complete overview (which would require a more elaborate search) but illustrate current focus and developments. Table 4 shows that the number of countries working on greenhouse gas emission reduction or carbon accounts for their mitigation policies is substantial and has grown over the last few years. Fewer countries seem to use the accounts for monitoring climate change impacts or for adaptation policies. As many countries have several such accounts in the pipeline, the levels of understanding and use may grow rapidly, in the coming years.

Box 2.3: From supply- to demand-driven accounts in the European Union

The European Union, through Eurostat, plays a key role in the development, coordination and implementation of accounts in the EU Member States. This development is closely aligned with the related directorates of the EU, with the European Environment Agency (EEA) and organizations such as the OECD and UN-ECE. Recently, the European Commission established a legal basis that requires Member States to compile the following six SEEA accounts: air emissions accounts (AEA), Economy-wide material flow accounts (EW-MFA), Environmental taxes accounts, Physical energy flow accounts (PEFA), Environmental Protection Expenditure Accounts (EPEA) and Environmental Goods and Service Sector (EGSS) accounts, all of which are relevant for climate change adaptation and mitigation policies.

Accounts compilation was first initiated to be supply-driven, with central banks, statistical and environmental organizations constructing the accounts largely in isolation without consultation of the end users. Gradually, this has changed. Authorities at different levels — European, national, provincial or municipal — start to demand information and indicators from the accounts for their policies. The approach followed in the EU shows that, once countries have a first set of SEEA accounts that is regularly published, potential users will, step by step, start using the accounts. In fact, after a while, requests for more detailed and more types of accounts are typically made, ingraining these accounts into the policy process. The initial use most often relates to monitoring purposes, but, later on, the accounts are also being used for policy preparation. In comparison to the macroeconomic data from the national accounts, the SEEA accounts are used by a broader group of users, working more on multidisciplinary topics. This includes economic and environmental assessment organizations and planners, but also environment ministries and water management bodies.

Furthermore, the coherent way in which the SEEA accounts are set up for all EU Member States creates opportunities to use the accounting information for international benchmarking, such as for the SDGs or green growth. The integrated accounts provide much richer information for such analyses than other multi-country sources of information. These comparisons also stimulate countries to keep their key indicators up to date, which in turn leads them to invest more in their national and SEEA accounts.

It is noted that it is not too difficult to find out which natural capital accounts have been compiled by countries. Finding out how the accounts are used is less obvious as it is not always properly acknowledged from where data are taken.

Over 80 countries are currently compiling SEEA accounts (UNCEEA, 2018). About half of them are producing air emissions accounts, which are part of the core accounts to monitor progress regarding the Paris Agreement. Air emissions accounts are compiled in the 28 Member States of the European Union (EU) and the countries associated with Eurostat, such as Iceland, Norway, Switzerland and Turkey. In the EU, air emissions accounts are among a group of six accounts that are mandatory to compile (See Box 2.3). Other countries that produce greenhouse gas emissions accounts include Australia, New Zealand, Chile, Colombia, Ecuador, Mexico, Indonesia, Mauritius, Cyprus and the Philippines. The way in which the accounts are set up differs slightly per country, depending on the needs of the individual countries. Experiences in the European Union show that the demand for information from the SEEA accounts is gradually increasing. Where, in the beginning, such accounts were largely supply-driven, parties nowadays increasingly demand information from them (see Box 2.3).

Box 2.4: Sweden, policy target on carbon footprint

Sweden has adopted a policy target to reduce emissions attributed to the Swedish consumption pattern. In this way, greenhouse gas emissions from Swedish consumption are made part of the country's *environmental quality objectives*. SEEA-based greenhouse gas emissions are used to estimate a consumption footprint indicator of consumption-related 'incorporated' greenhouse gas emissions. This combines domestically generated emissions with emissions incorporated in the goods that are produced in Sweden but consumed abroad. In this way, the country shows its commitment to also reduce emissions outside of its national territory. The footprint analysis is based on an input-output analysis using the input-output tables from the National Accounts and the air emissions accounts (Statistics Sweden, 2015).

The SEEA has specific guidelines for setting up the air emissions accounts. They assign emissions to production activities by all residents of the country. Several other frameworks exist to monitor countries CO_2 and greenhouse gas emissions (Statistics Netherlands, 2013a). Well-known is the IPCC / UNFCCC format for monitoring countries' emissions, generally recording all emissions that occur on a country's territory. Two exceptions are that emissions by road traffic are based on domestic sales of motor fuels, regardless of the user, and it only considers emissions from domestic air transport and shipping. Emissions related to international air transport and shipping are mentioned as a memorandum item. As an alternative framework, only greenhouse gases emitted within a country's territory are recorded; these are closely related to the IPCC format. In a fourth format, one looks at who owns the production activities that cause emissions, either done from within or from outside a country. This is relevant for countries with an open economy and with many multi-national enterprises (Statistics Netherlands, 2013b). In a so-called bridge table, one can show how these frameworks relate to one another (UN et al., 2014a; Statistics Netherlands, 2013b).

Finally, an altogether different approach is to assign emissions to final consumption categories. Currently, Sweden is the only country that has set targets for consumption-based emissions (Box 2.4).

Table 2.4 also shows that several countries are compiling environmental activity accounts for their climate change policies. UNCEEA (2018) shows that Environmental Protection Expenditure Accounts (EPEA) are among the most popular modules of the SEEA. This includes the EPEA compiled by the EU countries for monitoring climate change mitigation expenses based on the CEPA classification (see Appendix 2.1). An interesting application comes from Sweden, again, where they are used to increase understanding of the environmental impact of the state's budget allocation and of the impact of environmental economic instruments (Statistics Sweden, 2008). Unfortunately, the CEPA classification does not contain separate categories for adaptation expenditures (Statistics Netherlands, 2012). For this reason, it is more difficult to separate adaptation expenditures for the construction of infrastructure such as dykes and dams (or making existing infrastructure climate proof) from recurring maintenance costs of existing infrastructure. At the request of the European Commission, Statistics Sweden (2012) has developed a methodology to disaggregate the costs of adaptation, but to our knowledge this has not been widely adopted yet. Also, the Resource Management Expenditure Accounts (ReMEA) are compiled by several countries, such as Colombia, Mexico, Georgia, Latvia and Lithuania. These are used, for example, for monitoring management of scarce resources, such as forests, water or fisheries, impacted by climate change.

Other environmental activity accounts that are regularly used are the Environmental Goods and Services (EGSS) accounts. The EU Member States use them for monitoring the value added of renewable energy production, of energy efficiency measures or of sustainable technological innovations. Furthermore, several countries, such as Sweden, Australia, New Zealand, Estonia, Latvia, Lithuania, Portugal and Norway, are compiling environmental tax accounts and subsidy accounts. These are used for monitoring the consequences of carbon taxes, natural resource use taxes or innovation subsidies to the state budget, society and the environment, and for monitoring behavioural changes. Closely related, are the CO_2 permit balance sheets that have been set up, for example by Denmark, to keep track of changes in their carbon emission trading system. These balance sheets show the opening and closing stocks of permits as well as their purchases and sales. This information is necessary to monitor how much public money is involved, for example in permit auctions.

Furthermore, Table 2.4 shows that a substantial number of countries have physical and monetary energy flow accounts, material flow accounts, water flow accounts, ecosystem services and carbon accounts. Especially the carbon, energy and material flow accounts are used for climate mitigation policies. They record for instance changes in energy supply and use, changes of the fuel mix and changes in the shares of renewable energy produced. For instance, in South Africa, energy accounts and air emission accounts are used to calculate carbon intensities and indirectly related emissions; these calculations are subsequently used

for formulating the emission reduction strategy. Before introducing a carbon tax, the government wanted to have reliable information about its economic impact, per sector. The South African energy accounts showed that the economic impacts would remain relatively small. These accounts also served as input into an economic model used for establishing the tax level needed to achieve the emissions targets (WAVES Partnership, 2016). Besides using them for climate policies, such accounts are also used, for instance in the European Union, to inform circular economy programmes, or policies focused on dematerialization and resource efficiency.

For adaptation policies, where resilience of hydrological and ecosystems becomes relevant, water accounts and ecosystem services accounts are being compiled. Countries with vulnerable inland or marine ecosystems, often start compiling accounts for water, forest or aquatic ecosystems. But, currently, only few countries use these accounts to inform their climate change adaptation policies. An exception is the Netherlands, who use them for example for preparing for flood risks (see Text box 5). Furthermore, Botswana uses the water accounts to monitor climate change impacts on particular sectors within the economy and on their water system. Italy uses a water asset account in a model for analyzing the expected future climate change impact on water allocation in the Po region. Australia uses its water accounts to assess the impact of water allocation along the main rivers during periods of prolonged drought and the accounts for the Great Barrier Reef to assess the recovery from the 2011 cyclone. Finally, Brazil uses its water (asset) and ecosystem accounts to gain insights into the quality and value of its ecological capital and Green Domestic Product and to learn about its vulnerability to climate change.

Finally, three more general lessons are drawn from the examples. First, countries increasingly use the accounts for broader sustainability, green growth or wealth assessments. The EU Member States use the SEEA accounts for their broader sustainability and transition agendas. These agendas include climate change policy aspects, such as the transition to a low-carbon economy, green growth policies, the Sustainable Development Goals, the circular economy agenda, or resource efficiency and natural capital policies. Also, other countries or organizations stress the importance of the natural capital accounts as a basis for measures for sustainability, wealth or well-being. Examples include the NCA developments by the countries participating in the Gaborone Declaration on Sustainability in Africa, the World Bank Wealth of Nations report that uses NCA insights for showing developments in wealth (World Bank, 2018), or the Sustainable Development Goals that use NCA for monitoring many of their targets (see Ruijs et al., 2018).

Table 2.4: Examples of climate-change-related SEEA accounts

COUNTRY	ACCOUNT TYPE [(A)]	M / A[(B)]	POLICY USE
AUSTRALIA[1]	CF: Land asset accounts for Great Barrier Reef and disaster recovery after a cyclone in 2011.	A	To measure impact from the cyclone.
AUSTRALIA[2]	CF: Physical water flow and asset account, with industry breakdown.	A	The accounts are used to analyse water allocation across the Murray Darling basin during drought, to find measures to minimise impacts from droughts. Water flow accounts indirectly used as input into forecasting models for water consumption and use to inform policymakers on future development and needs.
AUSTRALIA[+]	CF: Land, energy, water, carbon, agriculture, greenhouse gas and tax accounts are given by industry. Focus on flow accounts	M	The ABS accounts have been used indirectly, particularly the water and energy accounts. The National Greenhouse Accounts (not SEEA-based), produced by the Australian Government Department of the Environment and Energy, track emissions estimated at a national, state and industry level from 1990 onwards.
BOTSWANA[3]	CF: Water flow accounts with a breakdown by industry and water stock accounts.	A	Data are used as input for the economic diversity strategy, assessment of investments and water sector reforms. The water accounts inform the National Development Plan 2017–22, the National Strategy for Sustainable Development, the National Vision 2036, and ratification of the Gaborone Declaration for Sustainability in Africa (GDSA). Data are also used as input into forecasting models for water consumption and use as well as to monitor water assets.
BRAZIL[*]	CF: Water and land accounts. Plan to also develop timber and energy accounts. EA: Pilots for ecosystem accounts and future flows of ecosystem services.	A	Accounts used to calculate Green Domestic Product, which includes valuation of national ecological capital. Computation of the Green Domestic Product, must be aligned with SEEA.
BRAZIL[4,]	CF: Energy, water, land, timber, and air emission accounts	M / A	Used by the Presidents' cabinet and related ministries, to address the challenge 'of managing the huge tropical forest' and 'exploitation of assets of water, energy and materials' and considering carbon sequestration and resilience to climate change. Used for the annual assessment of its Green GDP, or an assessment of cross-border damages to the country's assets and causes to degradation impacting the poor. Also looking for priorities including PES schemes focusing on climate change aspects.
CANADA[+]	CF: energy use (flow) and greenhouse gas emission accounts, water flow accounts	M / A	The physical flow accounts and the water asset accounts have been used as part of the analysis leading to the development of Canada's policy on Clean Growth and Climate Change (CGCC). The accounts have been used to compile indicators on greenhouse gas intensity by industry and by commodity, which provide insight on performance of existing policies and the design of new ones. The water asset account supports the CGCC Framework by providing spatial data on water assets, quality and variability.
CANADA[5]	CF: Flow accounts for air emissions and energy use	M	Used to identify potential impacts on the environment resulting from a proposed trade agreement under negotiation, to assess likely environmental impacts of changes with help of SEEA Physical Flow Accounts, and for a decomposition analysis. greenhouse gas physical flow account is also used by the Environment Department for their reports to the UNFCCC.
CANADA[6]	carbon budget.	M	The Forest Service prepared a carbon budget for forests to inform better forest management, to monitor carbon budgets in forests and the relation between land use and emissions. It is used to assess for different management and climate conditions

COUNTRY	ACCOUNT TYPE [A]	M / A[B]	POLICY USE
			their impacts on carbon emissions. This carbon budget is not formally linked to the SEEA or integrated alongside other accounts.
CHINA P.R.[7]	CF: Asset and flow accounts for water, land, timber. EA: A pilot for air emissions accounts and other ecosystem accounts.	A	Given demand for integrated policies, the National Bureau of Statistics of China has adopted the SEEA as the statistical framework for measuring inter-relationships between the economy and the environment and plan to compile accounts in physical terms at national and provincial level from 2018 and onwards
COSTA RICA[*,8]	CF: Water asset and flow accounts by sector; Energy flow account by economic activity; SEEA-AFF for forest asset and flows and land use and quality.	M / A	Costa Rica monitors progress of the 2030 agenda for sustainable development, by monitoring trends in the relevant SDGs based on the SEEA accounts for water access, efficiency and stress (SDG 6); renewable energy and energy intensity by economic activity (SDG 7); and forest area share, sustainable managed forest and forestland degradation (SDG 15).
COSTA RICA[9]	SNA and SEEA-CF accounts used in Social Accounting Matrix for general equilibrium model. Mainly air emission accounts, but also environmental tax and energy accounts.	M / A	Accounts are input into the Integrated Environmental Economic Modelling for Costa Rica (IEEM-CR). Model used for forward-looking analysis of public policies, for given risk scenarios. Policy analysis on the effects of taxing high polluting products and on energy substitution in the transport sector.
COSTA RICA[10]	CF: Water Accounting	A	The Central Bank of Costa Rica applied Water Accounts in the water supply sector with the aim to show the usefulness of NCA for business. Water use and supply by industry for 2005–2013 was assessed with the aim to look at sustainability, water fee and PES.
DENMARK[11]	SNA & SEEA-CF accounts on air emissions; flow and asset accounts for energy, minerals, water, timber and waste; EPEA, EGSS and environmental taxes and subsidy accounts; EA: land asset accounts	M	Accounts used for monitoring indicators, such as 'intensity', 'resource productivity' or 'consumption of resources' based on water, energy and carbon accounts. Further, the SDG indicator on the ratio of land consumption to population growth and on hazardous waste generated per capita and proportion of hazardous waste treated by type. Indicators used for policy analysis of the interactions between the economy and the environment, particularly via a selection of five environment-economy integrated SDG indicators. SEEA data can be linked with Input-Output models to compile resource, environmental and carbon footprints.
EUROPE[12]	CF: land, materials, water, energy, carbon and thematic indicators. EA: Regulating, cultural & habitat services	M	SNA- and SEEA-based indicators for 'resource productivity', including water and carbon. Further thematic indicators estimated to monitor progress in key areas such as economic transformation, nature & ecosystems preservation, energy, food, buildings and transport. Used in the EU Growth strategy for 2010–2020 that searches for smart, sustainable and inclusive growth and aims at a resource efficient Europe. Monitoring is based on a scoreboard, with resource productivity the lead indicator.
EUROPE[13]	CF: several modules	M	SNA and SEEA used for compilation of SDG indicators, such as intensity or productivity, for several natural resources, residuals and emissions based on the related accounts. Also, environmentally extended input-output analysis using the environmental vectors from the accounts. Used for monitoring several SDGs, such as for water (SDG 6), energy (SDG 7), materials (SDG 8), greenhouse gas emissions per type of infrastructure (SDG9) or the total economy (SDG13). Also used for carbon footprint (SDG 17) and material footprint (SDG 8 & 12).

COUNTRY	ACCOUNT TYPE [A]	M / A[B]	POLICY USE
EUROPE[14]	CF: Air Emissions	M	Footprints for air emissions incorporated in products, based on air emissions accounts and economic input–output tables.
FRANCE [4]	CF: SEEA Forest Accounts, asset and flows EA: Supply & Use, range of Ecosystem services	A	The accounts are used to inform government decision-making in preventing the reduction of the forest cover e.g. for monitoring forest extent and to show the economic contribution by individual economic sectors such as forestry.
GUATEMALA[15]	CF: Energy, air emission EA: Biodiversity and Carbon Accounts	M / A	Guatemala uses NCA to monitor the impacts of climate change and search for sustainable management of firewood.
OECD COUNTRIES[16]	CF: air emission and energy flow accounts	M	Indicators developed on air emissions (production- and consumption-based) and energy use to monitor 'Green Growth' in each member country and identify trade-offs and win-win cases in managing natural capital. The Dutch 'Green Growth Monitor' follows the OECD Green Growth strategy and prescribed format.
NEPAL[*]	CF: Timber flow accounts and land asset accounts, incl. physical land cover account		SEEA is incorporated into the National Strategies for the Development of Statistics (NSDS) with high priority to monitor the country's natural resources.
NETHERLANDS[+]	CF: Air emission account, Energy PSUT, EGSS, EPEA, ReMEA, environmental tax and subsidies EA: carbon and ecosystem services accounts	M / A	The accounts are used in the Dutch climate policies, energy transition policies, circular economy programme and policies related to sustainability and the SDGs. They have primarily been used for monitoring, but also as input for scenario modelling. From the accounts, indicators have been compiled on greenhouse gas intensity, carbon footprint, employment and value added in the energy sector. They have also been used in trend analysis and footprint analysis. Data on the EGSS (sustainable energy sector) are used for the National Energy Outlook (published together with PBL Netherlands Environmental Assessment Agency), which is the basis for monitoring policies related to climate change and energy transition. Indicator data from SEEA related to climate change are incorporated in the Well-being Monitor of Statistics Netherlands.
NETHERLANDS[17]	CF: SEEA – Forest asset and AFF accounts EA: Carbon accounts	A	Accounts used for monitoring carbon sequestration. Also used for measuring Green Growth by using the results from several SEEA modules including forest accounts and AFF accounts.
NETHERLANDS[18]	CF: physical water flow and water emission accounts, on regional level	A	Water availability, water excess, water discharge, drainage, and flooding data used on the level of a medium-sized city, Zwolle. To study how existing data, including SEEA-Water data, can be used to adapt to climate change, and what new data in this field is need most.
NETHERLANDS[19]	CF & EA: SEEA accounts on air emissions, energy, EPEA, EGSS, subsidies, carbon permits. Both asset, flow and environ. activity accounts	M	Accounts used for preparing a factsheet about climate change facts for the Netherlands, to inform the Ministry of Economic Affairs. Factsheet includes figures from several SEEA accounts, including air emissions, energy, EPEA, EGSS, subsidies, carbon permits.
NETHERLANDS[20]	CF: energy, air emissions combined with NA: Supply & Use tables	M	Requested by the Ministry of Economic Affairs, a European comparative analysis was performed of the energy and greenhouse gas emission intensity of heavy manufacturing industries across Europe, while looking after industry structure and product mix.

COUNTRY	ACCOUNT TYPE [A]	M / A[B]	POLICY USE
NL-CARIBBEAN[21]	CF: & EA: SEEA framework applied	A	SEEA use for an assessment of climate change impacts and to identify adaptation needs. This includes monitoring the magnitude and quality of nature and the valuation of ecosystem services.
NORWAY	CF: air emission flow accounts per industry	M	Used to identify profile industries by combining economic output and greenhouse gas emissions in order to know who contributes the most, both in terms of economic value added and emissions.
RWANDA[22]	CF: land, water, mineral accounts EA: carbon, land, water provisioning accounts	A	Use of land cover maps and SEEA Land and Water Accounts in Ecosystem modelling. Assessment of the magnitudes of water flows, soil erosion and soil organic carbon stocks, in order to prioritise policies under the Green Growth Strategy and build capacity for ecosystem services assessment and policies.
SWEDEN[+]	CF: air emissions accounts, material flow accounts (MFA), EPEA, EGSS, environmental taxes and subsidies, consumption-based emissions accounts, land accounts	M	The environmental subsidies, the MFA and consumption-based indicators are part of the monitoring of the Swedish environmental goals. The data were used by the Ministry of Finance for preparing budgets and for policy analyses. Several organisations use the consumption-based data for analysing global consumption impact. The Swedish Energy Agency, the Swedish EPA and the Swedish consumer agency all ask for data for various purposes. The Swedish national institute of economic research uses data from SEEA accounts on air emissions, taxes and energy use for their economic model. The SEEA data are also used in research.
SWEDEN[23]	CF: air emissions accounts	M	Footprint analysis, based on an input-output analysis using the national accounts and air emissions accounts, showing emissions from Swedish consumption, combining domestic emissions and emissions caused elsewhere in the value. Information used for informing the Swedish environmental quality goals.
SWEDEN[+]	CF: energy and air emissions accounts	M	Accounts used to monitor fuel use and resulting CO^2 emissions from construction activity and the real estate industry. Used for monitoring the environmental quality goals by sector.
MEXICO[*+]	CF: EPEA, especially detailing CEPA class 'Other', which implicitly includes topics related to climate change mitigation	M	Results used for the environmental overview of the country, as part of the Environmental and Natural Resources Programme. SEAA accounts are also used for estimating the country's ecological net domestic product.
NEW ZEALAND[24]	CF: energy accounts and air emission accounts	M	The Treasury undertook analyses of a proposed carbon tax including the impact this would have on households (by income bracket, number of adults and children) and businesses.
FRANCE[+]	CF: air emissions accounts; physical energy flow accounts; environmental protection expenditure accounts (EPEA), including air and climate expenditure	M	Results used for the new Wealth indicators. Moreover, they have been used for indicators on CO^2 and greenhouse gas emissions per capita or per unit of GDP, and for the Carbon footprint (demand-based greenhouse gas emissions).
GERMANY[+]	CF: air emissions accounts, PEFA, MFA (sources and use of each subject material), EPEA and EGSS	M / A	EGSS data is provided annually to Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The Federal Environmental Agency (Umweltbundesamt, UBA) annually publishes reports containing indicators on greenhouse gas emissions from agricultural products, industrial energy use and greenhouse gas emissions, energy use and CO2 emissions of private households, raw material productivity, environmental taxes, and environmental protection expenditures. These data are used for environmental policies, for monitoring energy transition etc. In addition to that, data have been used in the 'Monitoring Report on the German Adaption Strategy to Climate Change'.

COUNTRY	ACCOUNT TYPE [A]	M / A[B]	POLICY USE
COLOMBIA[+*]	CF: air emissions accounts and environmental activity accounts with EPEA and REMEA	M / A	Accounts used to monitor mitigation policies related to reducing emissions from combustion of energy and industrials processes. Accounts are regularly produced since 2016, due to a regulatory decree of the National Statistical System. Accounts are used for policies related to monitoring water stocks and natural capital, and green employment. Further, SEEA-based indicators are used for the SGD, Colombian Green Growth Policy and the Solid Waste Integral Policy. SEEA accounts are also used as input in the Colombian CGE model for analysing climate change; e.g. used for estimating climate change finance and budget effects and for assessing environmental economic impacts from Climate Change.
RUSSIAN FEDERATION[*, 25]	CF: energy, water, minerals (pilot accounts)	A	A broad range of accounts with a focus on natural resources use and stocks, especially for estimating effects on future income. Less focus on climate change, although indirectly by assessing energy efficiency. Results are used at different governmental levels and sectors for decision-making.
SOUTH AFRICA[+]	CF: land accounts and energy asset and flow accounts, aquatic resources EA: ecosystem accounts in KwaZulu-Natal	M & A	Through development of Land and Ecosystem Accounts in KwaZulu-Natal and National River Ecosystem Accounts, the institutional cooperation between SANBI and Statistics South Africa has strengthened.
UGANDA[4]	CF: air emission accounts EA: carbon accounts	M	NCA used to learn about the shares of greenhouse gasses from agriculture, how to assess and reduce their emissions and how to prioritise policies among sectors and sub-sectors.
UNITED KINGDOM[+, 26]	CF: several SEEA-CF asset and flow accounts EA: supply & use of a range of ecosystem services	M	The accounts are firmly established in government decision-making at different levels, e.g. by showing the contribution of natural capital to individual economic sectors such as agriculture and forestry. Used to help governments to focus their budget and spending on priority areas of the country's and regional natural capital, including magnitude of carbon sequestration. NCA is part of the 25 Year Environment Plan. Carbon footprints are calculated but not yet used in policies.
UNITED STATES [27]	EA: mangrove accounts, condition accounts, soil accounts	A	NCA used to learn about the impacts from climate change for the US, such as flooding, storms and severe droughts leading to forest fires and losses.
UNITED STATES [27]	CF: air emission accounts EA: carbon accounts	M	Assess the air emissions generated by cattle; the accounts inform the policy process and help to prioritise policies.
ITALY[28]	CF: water asset and flow accounts	A / M	Water accounts used in a model for analysing climate change impacts in the Po River Basin. Used for assessing whether measures are needed to adapt to climate change risks related to drought and flooding, while water allocation should not change too much.
ITALY[29]	CF: air emissions accounts, SNA: tax accounts	M	Used to monitor costs or payments for emission permits issued by governments.
INDONESIA[30]	CF: air emissions, renewable energy accounts EA: carbon accounts	M / A	Indonesia has a low carbon development plan, connected to SDG 2030 roadmap, focusing on reducing greenhouse gas emission intensity. Further, it has a National Action Plan on adaptation that uses NCA information. A Systems Dynamics Modelling is applied using NCA and an Adjusted net-savings indicator is used for monitoring natural resource development due to climate impacts.
ZAMBIA [31]	CF: land, water, forest, etc. (future; energy and tourism)	A	NCA used to monitor impact on honey production and trade-offs with other forest produce. The ministries and Parliamentarian Committee involved in WAVES want to know if and how climate change affects Zambia's natural resources. NCA also used to

COUNTRY	ACCOUNT TYPE [A]	M / A[B]	POLICY USE
	CF: water accounts (PSUTs for 2010–2016; plans for water asset and pollution tables		prioritize natural resource management and policies. Water Accounts are used to monitor impact and preservation of wetlands, enhance water flows to serve agriculture and hydro power.

Notes: (A) CF = SEEA Central Framework, EA = SEEA Ecosystem Account; (B) A = Adaptation, M = Mitigation

Note on sources: *The information in this table was compiled by the authors based on the survey sent to countries and literature reviewed.* + From own survey; * from UNCEEA (2018); 1) ABS, (2015, 2017); 2) Lound (2016); 3) WAVES Botswana (2016); 4) WAVES Third Policy Forum Paris 26–27 November 2018, personal communication; 5) http://www.international.gc.ca/trade-agreements-accords-commerciaux/env/env-ea.aspx?lang=eng and https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810009701; 6) Roberts (2016); 7) https://unstats.un.org/unsd/envaccounting/Brochure.pdf and https://seea.un.org/news/ecosystem-accounting-and-ecological-civilization-china; 8) WAVES Costa Rica, 2015; 9) Banerjee et al. (2017); 10) https://naturalcapitalcoalition.org/government-dialogue-best-practice-costa-rica-best-practice-on-water-accounting-for-decision-making-case-of-the-public-services-company-of-heredia/. 11) Eriksson (2018); 12) Fuente (2016); 13) national SDG reports of several European countries; 14) ec.europa.eu/eurostat/cache/metadata/en/env_ac_io10_esms.htm; 15) WAVES Guatemala, 2014. 16) OECD (2011, 2017b); 17) Statistics Netherlands (2015, 2017b); 18) Kist (2018); 19) Statistics Netherlands (2017c); 20) Statistics Netherlands, 2018 (to be published); 21) https://www.wolfscompany.com/projects/ and personal communication with Esther Wolfs; 22) https://snappartnership.net/teams/rwanda-natural-capital-accounting/; https://www.wavespartnership.org/en/rwanda-launches-first-natural-capital-accounts-inform-economic-planning. 23) Steinbach (2016); 24) Webb et al., 2016; 25) Fomenko and Fomenko (2018) and Tatarinov (2018); 26) Connors (2016); 27) John Matuszak, US, November 2018, personal communication; 28) Pedro-Monzoísa et al. (2016); 29) Recchini (2016); 30) https://www.wavespartnership.org/en/indonesia and personal communication during the Third Natural Capital Policy Forum; 31) https://www.wavespartnership.org/en/early-results-show-value-nca-development-policies-zambia.

Box 2.5: Climate adaptation and the SEEA in the Netherlands

In the Netherlands, a substantial amount of information is gathered and knowledge developed about the possible impacts and risks of climate change and the need for adaptation policies. This includes information about impacts of the increased risk of flooding on economic assets, which is obtained from the national and environmental accounts. Recent insights show that, in addition to the water-related adaptation challenges, it is urgent to make critical infrastructure and networks resilient to climate change impacts and to take the impacts of climate change into account in regional and local spatial development (PBL, 2015).

The critical infrastructure and networks that are vulnerable to climate change include the primary dykes and the energy, ICT and transport infrastructure. The Dutch environmental accounts provide indicators that can serve as early warning indicators for climate change impacts. For this, the water, agricultural and material flow accounts are used to estimate, for instance, the yearly level and the current and forecasted future distribution of irrigation water over the country; this indicator informs farmers to anticipate irrigation decisions to future droughts. Other elements of the national 'critical infrastructure' have to undergo a 'stress test' to assess their climate resilience, such as for energy, ICT and transport infrastructure. This test also relies on information from the national accounts and the natural capital accounts. The Netherlands, being a low-lying country, has a dedicated policy to protect the country against flooding, ensure fresh water availability and contribute to a climate-proof and water-robust spatial planning. For this, a so-called 'signaling group', consisting of knowledge institutions, looks after early warning signals some of which are taken from the accounts.

As climate change impacts are felt at the local or regional level, provinces, municipalities and water boards currently develop climate resilient spatial development strategies. For this, information is used from the Dutch natural capital accounts and from the newly established urban and rural data centers that have been set up as satellites of Statistics Netherlands. These satellites help to streamline and coordinate data needs on climate adaptation between the central and local governments. For example, Rijkswaterstaat, the government organization that manages waterways and dykes, has asked Statistics Netherlands to assess the status and trends of the ecosystem assets and ecosystem services for their (water)infrastructure, in order to better consider climate resilience in their decision-making processes. For this, they use the land accounts, ecosystem extent account, ecosystem condition account, and the supply and use tables of ecosystem services. This assessment considers the protection of the country's assets and people against flooding, as well as the ecosystem services provided by the river network and its surrounding areas that provide economic benefits. Moreover, it also pays specific attention to the long-term robustness of the river network.

Second, prioritizing the selection of SEEA accounts to be compiled differs between countries and regions. Several aspects seem to explain this. One aspect is the existence of a legal framework, which obliges, for example, EU Member States to invest in certain accounts. Beyond that, the examples in Table 2.4 and the analysis in UNCEEA (2018) show that the focus on accounts that support mitigation policies, or accounts that support adaptation policies, differ across the world. Accounts that support mitigation policies are predominantly compiled in developed countries. They require air emissions accounts, energy flow accounts and material flow accounts for monitoring changes in their greenhouse gas emissions as well as to assess how to comply with UNFCCC targets at the lowest cost. They often also have EPEA and EGSS accounts for monitoring environmental activities, and environmental tax and subsidy accounts to monitor financial and economic consequences of for example the EU emission trading system and carbon taxes. Nevertheless, Table 2.4 shows that a growing group of countries in other parts of the world do compile accounts for their mitigation policies as well, such as Costa Rica, Ecuador, Colombia and China. They all use these accounts to monitor emission reduction from energy use. The accounts used for adaptation policies are compiled more often by the relative newcomers to NCA from the developing regions. Most of these countries start with accounts related to natural resources, such as land, water and forestry, as their economies more heavily rely on farming, fisheries and forest activities, all of which are impacted by climate change. Their first priority, therefore, in addition to poverty alleviation, is to properly manage their natural resources and to make their country more resilient to climate change.

Third, the survey amongst countries working on SEEA accounts revealed that several countries are positive about the institutional implications of implementing the SEEA accounts (see Appendix 2.2). Setting up the accounts provided a base for cooperation between the compilers and, for example, the environmental assessment organizations and research institutes. As a result, closer connections with the ministries that use these types of data have been established.

2.5 Conclusions

This report provides an overview of potential and current use of the SEEA natural capital accounts for climate-change-related policy uses. Globally, climate change is high on the societal and political agendas. Many parties are searching for solutions — for mitigation measures to reduce greenhouse gas emissions as well as for adaptation measures making countries less vulnerable to the impacts of climate change. This paper shows that, as climate change affects almost all areas of society and government, nearly all of natural capital accounts (from the SEEA Central Framework and the SEEA Ecosystem Accounts) are relevant for climate-change-related policies and assessments. As such, the key question for users and

producers of these accounts is where to start? Which accounts are most relevant for the most pertinent policy questions?

In this report, we distinguish between mitigation- and adaptation-related policy questions. The examples show that many countries have already adopted a set of SEEA accounts that are relevant for informing mitigation policies. Nowadays, monitoring trends in greenhouse gas emissions per sector and type of greenhouse gas is common practice in nearly all the countries that compile accounts. For this reason, air emissions accounts are among the most popular accounts. Many countries also monitor expenditures on climate change mitigation and on policies aimed at 'greening' the economy using Environmental Protection Expenditures Accounts and Environmental Goods and Services Accounts. As much policy attention goes to reducing emissions from fossil fuel use, many countries compile energy accounts. They provide the relevant information to monitor trends in renewable energy use or energy efficiency, to identify structural economic changes or to prepare carbon taxes, emission trading schemes or renewable energy subsidies. So far, accounts have been used less for reducing emissions related to LULUCF, the agricultural sector, waste handling or international trade. Some interesting examples, however, show that policy-relevant uses are possible for these themes, as well; for example, see a Swedish footprint analysis of greenhouse gases incorporated in consumption, Indonesian peatland accounts, and several countries that estimate carbon sequestration in forests and agricultural land.

The second category of policy questions is related to climate change adaptation. The examples reviewed show that, so far, only a limited number of countries use the natural capital accounts for their adaptation actions. Countries such as Australia, Botswana and the Netherlands show that monitoring a country's resilience to climate change impacts or preparing adaptation policies benefits from the information in the natural capital accounts. For instance, in the Netherlands, adaptation policies aiming for reducing economic damages from flooding or water scarcity, use information from the water, material flow and agricultural accounts. Depending on the adaptation question to be tackled, relevant data may come from the land, water, forest, aquatic, energy (asset), soil accounts from the SEEA Central Framework or ecosystem services and assets accounts from the SEEA Ecosystem Accounts. For adaptation questions related to flood damage in coastal zones or to urban adaptation needs, data from economic asset or regional accounts from the System of National Accounts are equally relevant. However, despite the international attention to these topics, to our knowledge, only few countries have used the accounts for these types of analyses. One reason may be that spatial disaggregation of the accounts is not yet sufficiently detailed or accurate enough for policy use. Another reason may be that the urban adaptation questions are raised by subnational authorities who are less familiar with the natural capital accounts. The example from the Netherlands shows that reaching out to subnational users, for example through

regional data centers, creates new demand and uses for accounting information. In this, the role of universities has been very important in both the Netherlands and Australia.

The accounts provide useful inputs into data intensive policy analyses using statistical, econometric or modelling techniques. Some examples of countries or organizations using the accounts for scenario and outlook studies exist. Such studies provide policy-relevant insights in expected developments of climate change and energy and natural resources use. But, use of accounts for these purposes still appears limited. The European Union and its Member States are frontrunners here, probably because a broad range of accounts are available for all Member States over a series of years, which enables more and more elaborate benchmarking and analytical uses. The European Union also has a history of evidence-based policy-making (Wilson, 2015), which creates demand for uniform and coherent data sources.

A key finding of this review is that there is still a gap between potential and current use of the natural capital accounts for climate-change-related policies. To advance the application of natural capital accounting in policy design and evaluation, it is important that users, producers and analysists of the accounts jointly decide on the most relevant policy questions and accounts. This implies a process that not only includes the departments directly involved in climate change policies, such as those working on energy, agriculture and water, but also those whose sectoral policies indirectly impact, or are impacted by, climate change, such as housing, infrastructure, mining and nature.

As almost all of the natural capital accounts are useful, it is important not to be overwhelmed, but to choose wisely and start by developing accounts that can be used for the most urgent policy questions and policy instruments that are most likely to be used. Experiences in the European Union show that, once accounts are being compiled and used for relevant policy issues, a snowball effect may occur, leading to an increased demand for more accounts and policy analyses. A legal mandate to compile these accounts helps to create this demand.

This review also shows that developing and developed economies have a different focus in the types of climate-change-related accounts being compiled. Developing economies focus more on natural resources accounts, such as those for land, water, forest, agriculture and minerals, which are especially used for questions related to climate change adaptation. The developed economies focus more on the emission and energy accounts, used to inform mitigation policies. For the moment, there is a logic for this, as the majority of emission reductions have to come from developed economies, whereas the developing economies more strongly feel the impact of climate change on their availability of natural resources. For developing economies to choose a clean development path, it is, however, important to equally monitor changes in their energy mix and greenhouse gas emissions. Likewise, as developed economies also suffer from the impacts of climate change, it is important for them to also compile accounts that help to define adaptation policies. So, countries from both types of economies

can learn from each other on how to use the natural capital accounts for better decision-making.

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Appendix 2.1: CEPA/CReMA categories

The CEPA, Classification of Environmental Protection Activities, as recommended by SERIEE is composed of 9 classes, whereas CReMA, the Classification of Resource Management Activities, consists of 7 main classes. The SEEA-CF (Table 4.1; 2014a), recommends both. This preliminary classification has the following structure:

	The **CEPA** general structure is as follows:
CC.	1: Protection of ambient air and climate
CC.	(1.1 Protection of air & climate, prime focus on climate; only in this pilot project, with a test on the data)
	(1.2 Protection of air & climate, prime focus on ambient air; only in this pilot project, with a test on the data)
CC.	2: Wastewater management
CC.	3: Waste management
CC.	4: Protection and remediation of soil, groundwater and surface water
	5: Noise and vibration abatement
CC	6: Protection of biodiversity and landscape
	7: Protection against radiation
	8: Research and development
	9: Other Environmental Protection activities

	CReMA, The Classification of Resource Management Activities. This preliminary classification has the following structure:
	10: Management of water resources
CC.	11: Management of natural forest resources
	11 A: Management of non-cultivated forest areas
	11 B: Minimisation of the intake of forest resources
CC.	12: Management of wild flora and fauna
CC.	13: Management of energy resources:
	13 A: Production of energy from renewable sources
	13 B: Heat/Energy saving and management
	13 C: Minimisation of the intake of fossil resources as raw material for other use than energy production
	14: Management of minerals
	15: Research and development activities for natural Resource Management
	16: Other natural Resource Management activities

Source: Eurostat, 2008; SEEA-CF (2014a; partly), Classification of Environmental Activities (CEA), P.267; Ramon, 2014; Classification of Environmental Activities (CEA), 2011; Eurostat, 2012, Taskforce, special sub-group on Environmental activity classification; slight adjustments and additions by Statistics Netherlands (2014).

Appendix 2.2: Summary of the SEEA survey results

1. WHICH ACCOUNTS HAVE BEEN PRODUCED IN YOUR COUNTRY THAT RELATE TO CLIMATE CHANGE ADAPTATION OR MITIGATION? PLEASE PROVIDE DETAILS ABOUT THE TYPES OF ACCOUNTS.

NETHERLANDS	Statistics Netherlands compiles air emissions accounts (annual and quarterly data), Physical energy supply and use tables, Environmental Goods and Services Sector (EGSS), Environmental Protection Expenditure Accounts (EPEA). and Resource Management Expenditure Accounts (ReMEA), Environmental taxes and subsidies accounts, Carbon accounts and Ecosystem services accounts.
SWEDEN	Statistics Sweden complies air emissions accounts (annual on a national (including fossil/biofuels use in TJ) and regional level, quarterly accounts at national level), Environmental protection expenditure accounts (EPEA). A methodology was developed on behalf of the European Commission, a few years back, on climate change adaptation expenditures, but this has not been implemented, nationally. Moreover, Statistics Sweden compiles accounts on taxes and subsidies, EGSS, consumption-based climate change emissions and land accounts.
MEXICO	The Economic and Ecological Accounts of Mexico (SEEA-México) include the Expenditures on Environmental Protection (EPEA). The class 'Other for environmental protection', implicitly includes topics related to climate change mitigation, e.g. the public transport investment in order to reduce the CO_2 emissions.
FRANCE	Air emissions physical accounts, Physical energy flow accounts, Air and climate protection expenditure accounts are compiled.
GERMANY	The German Environmental protection expenditure accounts (EPEA) provide information about expenditures concerning 'Protection of ambient air and climate' (CEPA 1). Data is available for the general government and for non-specialised producers of ancillary services. It is not possible to separate expenditure for the protection of climate from the protection of ambient air. The module environmental goods and services sector (EGSS) provides data on turnover, exports, gross value added and employment of corporations — except corporations of the agricultural sector — concerning protection of climate and ozone layer (CEPA 1.1.2 and 1.2.2). There are also the physical flow accounts on materials, energy and emissions which provide information on sources and use of each commodity.
AUSTRALIA	The following SEEA Accounts have been produced by the Australian Bureau of Statistics: 1) Energy accounts (annual time series from 2008-09): physical supply and use tables; monetary supply and use tables; 'hybrid' supply and use tables which provide a combined presentation of the supply and use of energy by industry and households in physical and monetary terms; energy indicators; and physical and monetary energy assets tables. 2) Water accounts (annual time series from 2008-09): physical supply and use tables; monetary supply and use tables; water indicators. 3) Land accounts (selected jurisdictions on an irregular basis): land cover; land value; land use. 4) Carbon accounts (one-off publication): Biocarbon stock accounts for the Great Barrier Reef region (1989-2016). 5) Agricultural accounts (one-off publication for 2011-2016): SEEA Agriculture, Forestry and Fisheries accounts for Australia. 6) Greenhouse gas emissions accounts (2004-05 to 2015-16): Published in Australian Environmental-Economic Accounts, 2018. 7) Environmental taxes (2003-04 to 2015-16): Published in Australian Environmental-Economic Accounts, 2018. It is also worth

	noting the following accounts (not produced by the ABS and not SEEA-compliant) have been produced in Australia: 8) Carbon accounts, using the 'full carbon accounting model (FullCAM)', produced by the Australian Government Department of the Environment and Energy. 9) the National Greenhouse Accounts, produced by the Australian Government Department of the Environment and Energy (more information below). 10) the National Water Account, produced by the Australian Bureau of Meteorology
COLOMBIA	Colombia is compiling environmental activities accounts, containing Environmental Protection Expenditure and Resources Management Expenditure (EPEA/ReMEA) for the government, industries and public services, from 2009 to 2017. In 2018, jointly with the National Planning Department and Ministry of Environmental and Sustainable Development, DANE, the national statistical agency, harmonised methods, information sources and treatment of statistical information and environmental-economics accounts, that were used to estimate climate change finance with the MRV model. Moreover, DANE compiled air emissions accounts, containing emissions by combustion of energy and industrials processes. These were used for monitoring climate change mitigation. In 2018, DANE worked with the Institute of Hydrology, Meteorology and Environmental Studies to harmonise the *treatment of statistical information used in the national inventory of greenhouse gases and environmental economics accounts.*
SOUTH AFRICA	Land and Ecosystem Accounting in KwaZulu-Natal, and Energy Accounts.
UNITED KINGDOM	Defra publishes annual data on carbon footprint of the UK:
ZAMBIA	So far, physical supply and use tables for water (PSUTs) for the period 2010-2016 have been compiled. There are plans to compile the water pollution tables and asset tables for the same period. Furthermore, steps are being undertaken to have the water accounts produced annually.
CANADA	StatCan produces annual energy use, and greenhouse gas emission accounts, as well as a biennial water use accounts, all at the national level. Data are compiled by industry, commodity and final demand categories (direct and indirect) and presented as industry totals. They are working on producing energy and greenhouse gas physical flow accounts (PFA) at the provincial level. As of September 2017, PFA for energy use is being compiled at the provincial/territorial level. Sub-national greenhouse gas estimates are expected to be released shortly. Water yield data (our water asset account) over time are also produced and provide some information with regards to climate change.
COSTA RICA	The Central Bank in Costa Rica is currently working on the experimental ecosystem account for carbon sequestration, using information for the period 2013-2014 from the National Forest Inventory.

2. HAVE THE ACCOUNTS BEEN USED IN POLICY PROCESSES RELATED TO CLIMATE CHANGE MITIGATION OR ADAPTATION?

A. WHAT POLICY NEEDS HAVE THE ACCOUNTS HELPED ADDRESS? HAVE THEY BEEN USED FOR PROBLEM IDENTIFICATION, POLICY PREPARATION, POLICY REVIEW OR MONITORING?

B. WHICH INDICATORS WERE BASED ON THE ACCOUNTS?

C. HAVE THE ACCOUNTS BEEN USED IN ADDITIONAL ANALYSES, SUCH AS TREND ANALYSIS, MODELLING, EX ANTE POLICY ANALYSIS OR ANY OTHER ANALYSIS?

NETHERLANDS	The accounts are used in the Dutch climate policies, energy transition policies, circular economy programme and policies related to sustainability and the SDGs. They have primarily been used for monitoring, but also as input for scenario modelling. From the accounts, indicators have been compiled on greenhouse gas intensity, carbon footprint, employment and value added in the energy sector. They have also been used in trend analysis, footprint analysis, and scenario analysis.
SWEDEN	The Swedish data, such as the environmentally motivated subsidies, the MFA and consumption-based indicators, are part of the monitoring of the Swedish environmental goals, especially the 'generation goal' — *A society in which the major environmental problems in Sweden have been solved … without increasing environmental and health problems outside Sweden's borders.* The data was used by the Ministry of Finance in their work on the spring budget (Appendix 3 – Bilaga 3 Miljö). The Ministry of Finance has also expressed that the web-tool that Statistics Sweden publish with all SEEA data for further analysis is useful in their policy analyses. Moreover, several organisations in Sweden have used the consumption-based data for further analysis of the global consumption impact. The Swedish Energy Agency, the Swedish EPA and the Swedish consumer agency all ask for data for various purposes, either annually or on ad-hoc basis. The Swedish national institute of economic research receives some of the SEEA account annually for their economic model, EMEC, e.g. air emissions, taxes and energy use by industry. The data from the accounts is also used in research. Some use what is available online free of charge and others ask for some additional tweaks and even microdata level data. Data are usually energy, air emissions, taxes and environmental protection expenditures. Some continue the research on consumption-based data.
MEXICO	The accounts are used for the environmental overview of the country, in the frame of the Environmental and Natural Resources Programme (PROMARNAT). Based on the accounts an indicator on loss of natural capital has been estimated. The accounts have been used for the 'Estimaciones del impacto del cambio climático, desde el Sistema de Cuentas Económicas y Ecológicas de México 2010-2100' from the Environmental and Natural Resources Ministry (SEMARNAT).
FRANCE	The environmental accounts have been used for estimating the new Wealth indicators. Moreover, they have been used for indicators on CO_2 and greenhouse gas emissions per capita or per unit of GDP, and for the Carbon footprint (demand-based greenhouse gas emissions).
GERMANY	Data on EGSS is provided annually to the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). In principle, data can be used by all ministries but there is no clear evidence about which data are used. The Federal Environmental Agency (Umweltbundesamt, UBA) annually publishes 'data on the environment' (Daten

	zur Umwelt). This indicator set contains, among others, data on greenhouse gas emissions from agricultural products. Furthermore, UBA has assembled a 'core indicator set', which contains e.g. industrial energy use and greenhouse gas emissions, energy use and CO2 emissions of private households, raw material productivity, environmental taxes, and environmental protection expenditures. These indicators are compiled by the Federal Statistical Office and are based on SEEA accounts. These data are used for environmental politics, for monitoring energy transition etc. They serve as a source of information for, among others, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). In addition to that, analyses have been used in the 'Monitoring Report on the German Adaption Strategy to Climate Change' (Monitoringbericht zur Deutschen Anpassungsstrategie an den Klimawandel (2015)) by the Federal Government.
AUSTRALIA	The ABS SEEA accounts have not been used directly in policy processes, but it is assumed that the ABS accounts have been used indirectly, particularly the water and energy accounts. The National Greenhouse Accounts (not SEEA-based), produced by the Australian Government Department of the Environment and Energy, track emissions estimated at a national, state and industry level from 1990 onwards. The data is used to meet Australia's reporting commitments under the United Nations Framework Convention on Climate Change, track progress against Australia's emission reduction commitments, and inform policymakers and the public.
COLOMBIA	Actually, the environmental economic accounts produce approximately 30 indicators related to different topics that comply with the SEEA recommendations. These indicators are available at: http://www.dane.gov.co/index.php/estadisticas-por-tema/cuentas-nacionales/cuentas-satelite/cuenta-satelite-ambiental-csa/cuenta-satelite-ambiental-csa-indicadores. Moreover, the environmental economic indicators are used to monitor progress of the SGD, the Colombian Green Growth Policy and the Solid Waste Integral Policy. Moreover, they are an input for the Colombian Computable General Equilibrium Model for Climate Change.
SOUTH AFRICA	The accounts are not used for policy or indicator development at this stage as the accounts are still discussion documents.
UNITED KINGDOM	Not yet
ZAMBIA	The water account has helped to identify the issue that most water used by households is derived from boreholes, which means that household are exposed to untreated water and potentially water-borne diseases. The other issue is that though households accounted for the large portion of water use, it was industry that paid for the bulk of the water consumed. The initial draft results are being used to develop models for water and forestry accounts by the Modelling TWG.
CANADA	The PFA have been used as part of the analysis leading to the development of Canada's policy on Clean Growth and Climate Change. The Water Asset data have been used as part of the Pan-Canadian Framework on Clean Growth and Climate Change. The accounts have been used to compile indicators on greenhouse gas intensity by industry, as it can provide insight on performance of existing policies and the design of new ones. Also, greenhouse gas intensity per commodity has been provided, as it is helpful in the case of emission-intensive, trade-exposed sectors. The water asset accounts support the Pan-Canadian Framework on Clean Growth and Climate Change by providing spatial data sets on water assets, water quality and water variability

COSTA RICA	Not yet

3. HAVE THE ACCOUNTS INFLUENCED DECISIONS MADE OR THE ADOPTION OF POLICIES RELATING TO CLIMATE CHANGE ADAPTATION OR MITIGATION?

NETHERLANDS	Data on EGSS (sustainable energy sector) are used for the National energy outlook (published together with PBL Netherlands Environmental Assessment Agency), which is the basis for monitoring and policy review in the Netherlands of policies related to climate change and energy transition. Data on indicators from SEEA related to climate change are incorporated in the Monitor of Well-being published by Statistics Netherlands. This annually publicised report is an assessment of well-being in the Netherlands, which is not merely based on gross domestic product (GDP), but also takes other indicators into account, including environment, health, education, labour, security, trust and inequality. This report is made at the direct request of Dutch Cabinet.
SWEDEN	It is very hard to know whether the accounts have influenced decisions as they are part of general discussion and insight where we are right now. The data is also available free of charge on our web-site making it difficult to know the in-depth aspects of the policy cycles or how researchers impact on policy advisors.
MEXICO	No information available
FRANCE	No information available
GERMANY	No information available
AUSTRALIA	The accounts have not directly influenced policy, but it is assumed that the ABS accounts have been used indirectly, particularly water and energy accounts. However, in the Australian Government publication 'Environmental Economic Accounting — A Common National Approach, Strategy and Action Plan' (April 2018), it is stated that 'the SEEA frameworks will enable for several of the sustainable goals and targets to be measured using robust common indicators', listing as one of these Target 2.4 'Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.'
COLOMBIA	No information available

SOUTH AFRICA	None at this stage as the accounts are still discussion documents.
UNITED KINGDOM	No information available
ZAMBIA	Not as yet because they still have to be finalised first
CANADA	No information available
COSTA RICA	No information available

4. IS THE SEEA MENTIONED IN ANY LEGISLATION RELATED TO CLIMATE POLICIES? PLE

NETHERLANDS	No information available
SWEDEN	No information available
MEXICO	The Climate Change General Law states that: a) Art. 22. Section. XV. Contributes to the Ministry adm order to quantify the cost of environmental pollution and natural resources depletion made by econom to value the ecological net domestic product; and b) Art. 77. Section. VI. The valuation of cost attribut in a certain year, which will be included into the ecological net domestic product. In both cases, the M domestic product is compiled from the applied recommendations by the SEEA, since its 1993–2012 v
FRANCE	No information available
GERMANY	No information available
AUSTRALIA	No information available
COLOMBIA	SEEA is not mentioned in any law. In 2017, policy documents on green growth and solid waste menti environmental economics accounts, to monitor environmental policy.
SOUTH AFRICA	None at this stage as the accounts are still discussion documents.
UNITED KINGDOM	No information available
ZAMBIA	No information available
CANADA	No information available
COSTA RICA	No information available

5. HAS IMPLEMENTATION OF THE SEEA RESULTED IN THE ESTABLISHMENT OF NEW INSTITUTIONAL MECHANISMS AND ARRANGEMENTS? HAS THIS IMPACTED HOW THE ACCOUNTS ARE USED FOR POLICIES RELATED TO CLIMATE CHANGE MITIGATION OR ADAPTATION? THIS MAY INCLUDE, BUT IS NOT RESTRICTED TO, FOR EXAMPLE NEW INSTITUTIONAL COOPERATION, NEW BUDGETARY RULES OR NEW POLICY-MAKING PROTOCOLS.

NETHERLANDS	Statistics Netherlands works closely together with PBL Netherlands Environmental Assessment Agency to publish the annual Energy outlook publication.
SWEDEN	Publishing the consumption-based statistics enabled the discussion on our impact on global greenhouse gas emissions, on a policy level. There have been several organisations that have used these statistics and elevated the discussion to the policy level.
MEXICO	No information available
FRANCE	No information available
GERMANY	The implementation of SEEA resulted in a more intensive cooperation with the German Environment Agency (UBA) and the Institute of International Forestry and Forest Economics of Thünen Institute (TI).
AUSTRALIA	The Australian Government recently finalised and published a strategy and action plan for a common national approach to SEEA-based Environmental Economic Accounting. The strategy sets out how a common national approach to the implementation of the United Nations System of Environmental-Economic Accounting will provide coherent and integrated data for decision-making by governments, business and the community. It is too early for this strategy to have had an impact on how the accounts are used for policies related to climate change mitigation and adaptation, however the potential is certainly there.
COLOMBIA	In 2016, Colombia established a regulatory decree of the National Statistical System. It is an instrument to regularly produce statistical information. Policymakers recognise the need of the new technical advances in environmental economic accounting, and this has been incorporated in the action plan of the institution. These needs relate to water stocks, economic valuation of natural capital, material flow accounts, green employment, etc.
SOUTH AFRICA	Through the development of the Land and Ecosystem Accounting in KwaZulu-Natal, and National River Ecosystem Account, there was the development and strengthening of the institutional cooperation between SANBI and Stats SA.
UNITED KINGDOM	No information available
ZAMBIA	No information available
CANADA	No information available
COSTA RICA	No information available

6. IS THE SEEA USED FOR OR MENTIONED IN YOUR INTENDED NATIONALLY DETERMINED CONTRIBUTION (INDC) TO THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)? IF SO, PLEASE ELABORATE.

NETHERLANDS	No
SWEDEN	No. The work on the UNFCCC reporting is done at Statistics Sweden on commission from the Swedish EPA who are responsible for this work. This is not part of the SEEA-group.
MEXICO	No
FRANCE	No
GERMANY	The EU and its Member States communicated a common INDC report. SEEA is not mentioned.
AUSTRALIA	Not the SEEA, however, the National Greenhouse Accounts (not SEEA-based), produced by the Australian Government Department of the Environment and Energy, are used to meet Australia's reporting commitments under the United Nations Framework Convention on Climate Change, track progress against Australia's emission reduction commitments, and inform policymakers and the public.
COLOMBIA	No, in Colombia the official information reported to the UN Framework Convention on Climate Change is related to the national inventory of greenhouse gases realised by Institute of Hydrology, Meteorology and Environmental Studies IDEAM.
SOUTH AFRICA	Yes
UNITED KINGDOM	No
ZAMBIA	No. Knowledge of the SEEA is limited among relevant professionals.
CANADA	No information available
COSTA RICA	No

3. Natural capital accounting for mainstreaming biodiversity in public policy making

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Michael Vardon, Australian National University

Abstract

This report provides an overview of current and potential uses of natural capital accounting for biodiversity-related policy. The list of potential uses of the accounts is long, with many types of accounts from the System of Environmental-Economic Accounting (SEEA), both the Experimental Ecosystem Accounting and Central Framework, and the System of National Accounts relevant for assessing the importance of biodiversity for economic production, wealth and human well-being, as well as the effects of various government policies on biodiversity. Which accounts are most relevant depends on the policy and the policy questions raised. Accounting can be applied to obvious areas of biodiversity policy, such as the establishment and management of conservation areas. In addition, they are also useful for policies on sustaining the supply of ecosystem services, building resilient ecosystems and safeguarding food supply from agricultural biodiversity, or for policies promoting the sustainable use of ecosystem services by economic actors.

The ecosystem extent accounts have many policy uses, as do the ecosystem services and ecosystem condition accounts, and, together, these can be used to assess the effectiveness of existing biodiversity-related policies. The species accounts are especially useful for determining the effectiveness of policies aimed to protect rare and endangered species. The water, mineral and forestry accounts from the SEEA Central Framework or the supply and use tables from the System of National Accounts can be relevant for policy questions related to the impacts of resource exploitation or economic activity on biodiversity. These accounts allow comparison between the benefits of economic activity and the costs of biodiversity protection, and provide data for modelling the impacts of various policies. Furthermore, the environmental protection expenditure accounts are useful for keeping track of the effectiveness of public and private environmental protection expenditures.

The more advanced analytical approaches are not yet widely used, nor are analyses that combine multiple accounts to show synergies or trade-offs between biodiversity and economic changes, or changes in ecosystem resilience. To more fully exploit the potential of ecosystem accounting, a number of issues should be addressed. These include:

- Integrating the accounts into national information systems and ensuring that the base data are regularly updated, just like the many other updates, such as on the economy and society, by statistical organizations.
- Ensuring demand-side guidance is provided to help policymakers and analysts understand how these accounts could be used. The list of possible accounts is long, and that of their possible applications for indicator development, analysis or policy use is even longer.
- Encouraging more practical experience in how the accounts could be used for trend analysis, econometric analysis, input-output analysis and bioeconomic modelling. Building the accounts is important, but actually using them is equally important, to provide insight into possible applications for policymakers. This requires external support for developing countries and closer cooperation between policymakers, account compilers and researchers in all countries.

A key aspect of ecosystem accounting is that it combines economic and biodiversity data. In this way, accounting can be used for implementing the National Biodiversity Strategy and Action Plans (NBSAPs) and refining existing or developing new strategies to conserve biodiversity. Maybe even more importantly, ecosystem accounting also shows the importance of biodiversity for the economy and can highlight the risks of biodiversity decline to the economy and human well-being, more generally. Finally, while there are challenges in producing biodiversity-related accounts, the work to date shows that producing them is possible and that the key task now is to embed biodiversity accounting into the machinery of government.

3.1 Introduction

This report provides a brief overview of how natural capital accounts—set up according to the System of Environmental-Economic Accounting (SEEA; UN et al., 2014a,b)—can be or are currently already used to inform biodiversity-related polices. It discusses, from a policy perspective, how Natural Capital Accounting (NCA) can be used both to inform policymakers and to identify common biodiversity-related questions they may have, and how NCA can be used in answering these questions. These questions may refer to biodiversity conservation or may be about the coherency between biodiversity policies and other policy fields and the economic importance of the sustainable use of biodiversity. The report is based on a literature review and a short questionnaire sent out to statistical institutes of various countries.[26]

The objective of this report is to provide a starting point for discussions about what government authorities, businesses and others can do to further integrate natural capital accounts and natural capital assessments into their biodiversity-related policies and related decision-making processes. The United Nations (UN) and Convention on Biological Diversity (CBD) define biodiversity as:

> 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (UN et al., 2014b, www.cbd.int).

Biodiversity is a key determinant of ecosystem health, functioning and resilience (Santamaria and Mendez, 2012) and therefore essential for sustaining ecosystem services and human well-being. Yet, biodiversity levels are still declining, among other things due to deforestation, land-use changes, unsustainable land and water use, climate change and pollutant emissions to the air, water and land (GBO, 2014). For that reason, accounting for biodiversity, and explicitly showing 'the dependencies of human economic activity, and human well-being more broadly, on ecosystems and biodiversity and the wide variety of priced and unpriced services they provide' (Vardon et al., 2018) is important for delivering sustainable development.

Protecting biodiversity and the sustainable use of biodiversity are at the core of the Aichi targets of the CBD. These objectives are also covered in the Sustainable Development Goals, and, since the Millennium Ecosystem Assessment (2005), are high on the agenda of many governments and businesses around the world. More and more, it is recognized that the protection of biodiversity is increasingly recognized to have many benefits and as a necessary condition for lifting people out of poverty and improving wealth (World Bank,

[26] This report was presented during the Natural Capital Policy Forum held 26 and 27 of November 2018 in Paris. The final version of the report is available on the PBL website: https://www.pbl.nl/en/publications/natural-capital-accounting-for-mainstreaming-biodiversity-in-public-policy

2018). However, there is still a long way to go to mainstream biodiversity into day-to-day policies and governance decisions of governments and business.

Government authorities and businesses need information if they are to mainstream biodiversity into policy-making. This, for example, includes information about the trends in ecosystems and species occurrence, abundance and distribution. And, maybe even more importantly, it also includes information about the impacts or externalities of land and resource use related to biodiversity and about the importance of biodiversity for maintaining resilient ecosystems and the delivery of ecosystem services (incl. agricultural production, renewable resources, fisheries and water availability). Moreover, it also includes information on the broad range of benefits of conservation decisions and the effectiveness of current expenditures on biodiversity.

The SEEA provides an integrated framework for organizing biodiversity-related statistics into a series of accounts. Biodiversity-related natural capital accounts provide a framework for collecting, systematically storing and regularly presenting this type of information (Hamilton, 2013). Standardized biodiversity-related accounts are being developed as part of SEEA Experimental Ecosystem Accounting (SEEA-EEA) (UN et al., 2014b; and see Text box 1). As SEEA-EEA is linked to the System of National Accounts (SNA), it integrates biodiversity information into national-level accounting frameworks and reporting systems. It, thus, allows for analyzing trends in biodiversity, biodiversity use and the importance of its protection and use in the economy and society, more generally.

Box 3.1: Natural capital accounting and the System of Environmental-Economic Accounting

The System of Environmental-Economic Accounting (SEEA) is the internationally agreed standard for natural capital accounting. The SEEA Central Framework (CF) and SEEA Experimental Ecosystem Accounts (EEA) contain the standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics on the environment and on ecosystems and their relationship with the economy (United Nations et al., 2014a,b). They guide the compilation of consistent and comparable statistics and indicators for policymaking, analysis and research.

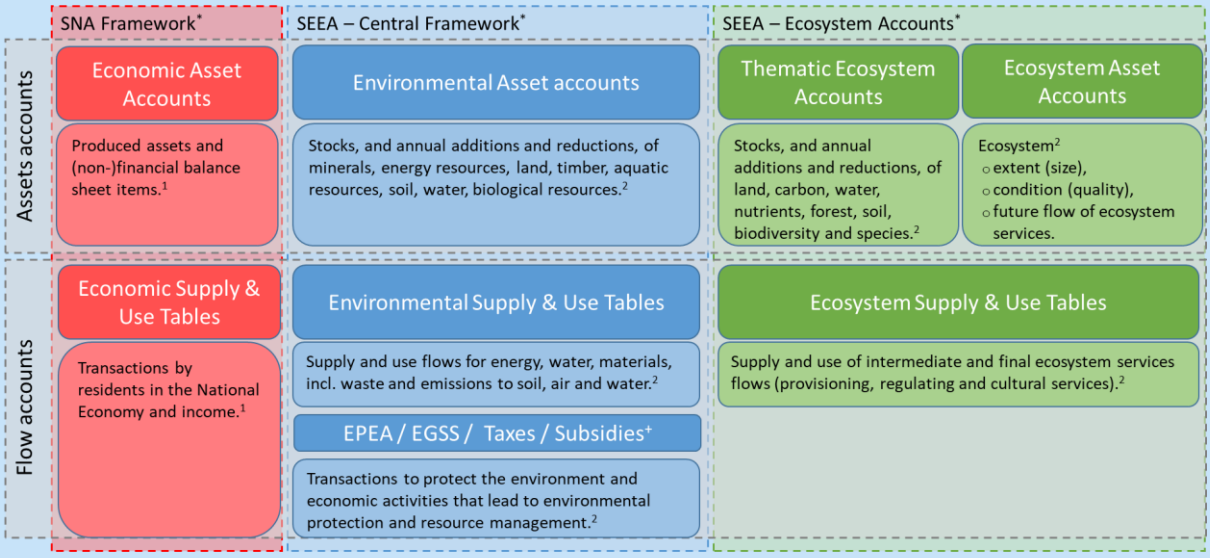
The SEEA-CF allows for compiling physical and monetary accounts for a range of natural resources, such as minerals, timber, and fisheries, and residuals such as air emissions and waste, and linking these to the System of National Accounts, used for calculation of production and GDP. The SEEA EEA adds to this ecosystem accounts that summarise information about the extent and condition of ecosystems, the status of biodiversity, and their changing capacity to operate as a functional unit and deliver a flow of ecosystem services. Some resources are treated both in the SEEA-CF and the SEEA EEA, such as land, water and agricultural production.

The SEEA distinguishes between supply and use tables, asset accounts and functional accounts (see Figure B1). The supply and use tables record in physical and monetary terms the flows of natural inputs, products, ecosystem services and residuals within the economy and those between the environment and the economy. These include for instance water and energy used in production processes, pollination and soil formation necessary for primary production and waste flows to the environment. Asset accounts in physical and monetary terms measure the natural resources available and changes in the amount available due to extraction, natural growth, discovery and other reasons. They, for example, include mineral, timber, soil, water, land, biodiversity and future flows of ecosystem services. Functional accounts record the transactions between industries, households and governments that concern the management of natural resources and the environment, including green investments, jobs related to conservation or climate action, soil restoration and recycling.

Box 3.1, continued. Natural capital accounting and the System of Environmental-Economic Accounting

All three categories of accounts in Figure B1 include those related to climate-change mitigation or adaptation. Climate-related **assets accounts**, include asset accounts for carbon, land, energy, soil, timber, aquatic, biological and water resources. All of these assets are impacted by climate change and the accounts can be used for monitoring those impacts. They may also be applied to assess whether adaptation measures, such as those related to water and soil management, improve resilience to climate change. The accounts measuring annual additions to and reductions from the stocks, can also distinguish between normal changes, e.g. of timber or fish stocks due to biological or ecological processes, and more exceptional or catastrophic changes to forest growth, water quality or diseases e.g. due to extreme weather events. Carbon accounting started by accounting of the carbon sequestered in forests and in fossil fuels and related emissions. With the development of the SEEA-EEA, the scope of carbon accounting broadened, encompassing all parts of the carbon cycle and all carbon pools, and thus covering geo carbon, bio carbon, atmospheric carbon, carbon in the oceans and carbon accumulated in the economy.

Figure B.1: Schematic representation of the SNA, SEEA-CF and SEEA EEA.



* The three frameworks partially overlap, especially for the environmental and ecosystem goods and services directly used in economic processes such as water, land, materials, energy, timber and agricultural crops. 1) In monetary terms ; 2) In physical or in monetary terms (ecosystem extent and condition accounts only in physical terms); + EPEA = Environmental Protection & Expenditure Accounts ; EGSS = Environmental Goods and Services Sector

Climate-change-related **flow accounts** include those for air emissions (greenhouse gases), energy, materials, water, ecosystem services and a variety of resources and products flowing to particular sectors, such as agriculture, forestry and fisheries. Air emissions accounts measure greenhouse gas emissions from the various sources of energy used in the economy, as well as those from deforestation and land-use change. They include both emissions and sequestration related to carbon sinks, such as peatlands or oceans. Information on carbon stocks and flows is used in the SEEA-EEA as an indicator of ecosystem condition and for measuring current and projected flows of ecosystem services, and includes carbon sequestration and net primary production.

Several countries are compiling **environmental activities and economic instrument accounts** in the form of Environmental Protection Expenditure Accounts (EPEA) and Resource Management Expenditure Accounts (ReMEA), following the Classification of Environmental Protection Activities (CEPA) and Resource Management (CReMa) (see Statistics Netherlands, 2016). These classifications include expenditures on activities dedicated to climate change, such as protection of air quality, protection and remediation of soil, groundwater and surface water, management of energy resources and of natural forest resources. In addition to these, the Environmental Goods and Service Sector (EGSS) accounts show where economic production takes place, which sectors invest in environmental protection and resource management goods and services, where new green jobs arise, and relating all this to those who consume these goods, those who pay and those who benefit. Finally, this category contains accounts used for monitoring economic instruments, such as carbon taxes, environmental subsidies and transfers, and carbon permits. See also Schenau (2009) and ABS (2012).

This report discusses, from a policy perspective, how accounts can help policymakers to address biodiversity-related policy questions. Section 3.2 first provides an overview of relevant international biodiversity policy frameworks that guide most of the national biodiversity-related policies. Section 3.3 provides an overview of the accounts and discusses their various applications. A growing number of countries is experimenting with natural capital accounts to inform their biodiversity-related policies, and Section 3.4 discusses a number of recent examples. These experiences may inform other countries about the opportunities these accounts provide for compiling policy-relevant indicators to monitor biodiversity changes, or for using them as input into policy analysis. Chapter 3.5 draws conclusions and describes lessons learned.

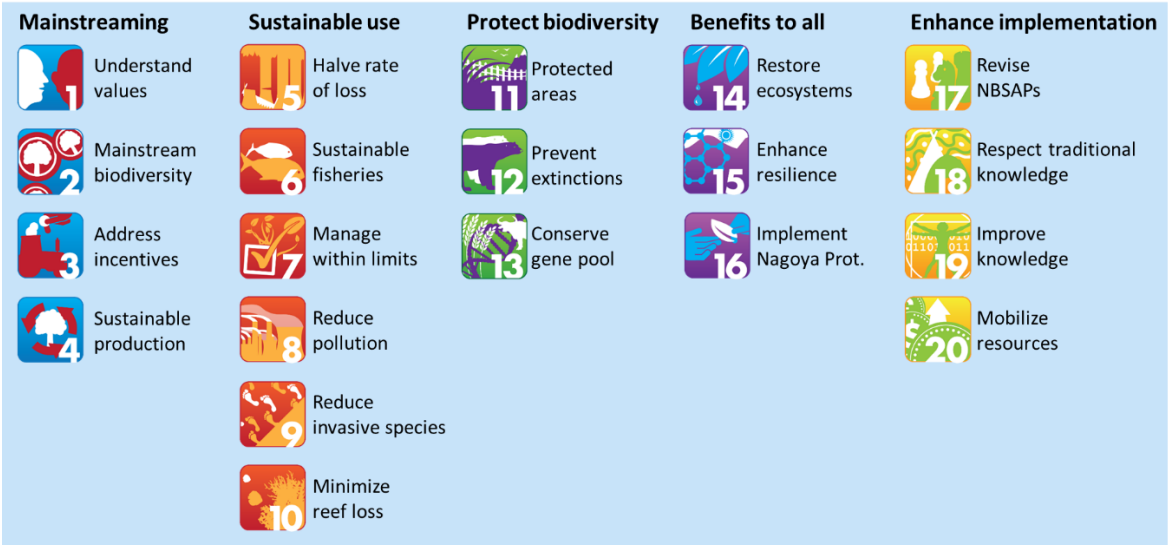
3.2 International biodiversity policy frameworks

Biodiversity is relevant to a range of policy areas. Conservation and the sustainable use of natural resources, such as forests and fish, are key policy areas. Increasingly there is recognition of the importance of biodiversity to other parts of the economy and human well-being. For example, the importance of: insect pollination to agriculture (e.g. Allsopp et al., 2008); natural areas and green spaces for human health (e.g. Aerts et al., 2018); and the importance of well-functioning ecosystems for the sustained availability of clean water (e.g. Bennett et al., 2009).

While biodiversity is applicable to a range of policy areas, the Strategic Plan for Biodiversity 2011–2020, agreed at the 10th meeting of the Convention on Biological Diversity (CBD) in Nagoya, forms the backbone of biodiversity policies, worldwide. This plan includes an ambitious set of 20 targets, the Aichi Biodiversity Targets—see Figure 3.1 and Appendix 3.1. These targets contribute to five strategic goals:

A. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society (targets 1–4),
B. Reduce the direct pressures on biodiversity and promote sustainable use (targets 5–10),
C. Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity (targets 11–13),
D. Enhance the benefits to all from biodiversity and ecosystem services (targets 14–16), and
E. Enhance implementation through participatory planning, knowledge management and capacity building (targets 17–20).

Figure 3.1: The 20 Aichi Biodiversity Targets set by the CBD



Source: www.cbd.int, Icons: © BIP/SCBD

The two targets that especially focus on mainstreaming biodiversity into national policy-making processes are targets 2 and 17. Target 2 aims on the one hand at integrating biodiversity values into national and local development and poverty reduction strategies and planning processes. On the other hand, it aims at incorporating biodiversity values into national accounting and reporting systems. Target 17 specifies the formulation and implementation of National Biodiversity Strategy and Action Plans (NBSAPs). This is one of the key instruments to motivate countries to formulate biodiversity policies. To date, 190 out of 196 parties to the CBD have developed NBSAPs and have made a start to mainstream them into the activities of those sectors whose activities can impact biodiversity.

A second important policy driver are the Sustainable Development Goals (SDGs). The SDGs, adopted by the UN in 2015, are an ambitious set of seventeen development goals for all countries, covering all dimensions of sustainability. The SDGs recognize that sustainable development requires integration of all pillars of sustainability into policy frameworks and programmes, including biodiversity protection. SDG 15, 'life on land', especially calls to halt biodiversity loss, to integrate biodiversity into development and poverty reduction strategies and to integrate it into accounting systems. Directly or indirectly all SDGs relate to biodiversity. This may be obvious for SDG 6 on 'clean water and sanitation', 12 on 'responsible consumption and production', 13 on 'climate action' and 14 on 'life below water'. Also related to biodiversity, either because they depend on its sustainable use or because they impact upon it are: SDG 2 on 'zero hunger'; SDG 3 on 'good health and well-being'; SDG 7 on 'clean energy'; SDG 8 on 'decent work and economic growth'; SDG 9 on 'industry, innovation and infrastructure'; and SDG 11 on 'sustainable cities and communities'.

These key policy drivers influence biodiversity protection policies and policies to improve sustainable use of biodiversity globally. A general element in the Aïchi targets and the SDGs is to mainstream biodiversity into policy through action plans and to integrate biodiversity

into accounting and reporting systems. This is necessary for increasing awareness, monitoring progress, learning about causes of biodiversity loss or unsustainable use, and assessing the impacts of proposed policies. The next section shows how countries are making progress on this.

3.3 Potential contributions of NCA to biodiversity-related policies

The potential benefits of biodiversity-related accounts are manifold (UN et al., 2014b; UNEP-WCMC 2015). They are important for monitoring the status of biodiversity and for international reporting obligations related to the Sustainable Development Goals, the Aichi targets and climate change. But the possible use of biodiversity-related accounts go beyond reporting. As policies are increasingly considered in a more integrated and multidisciplinary fashion, ecological and biodiversity information will be used to identify issues, assess policy options and analyze the success or otherwise of existing policy or management.

In this, the biodiversity-related accounts can provide information that is needed for the assessment of sustainable economic growth, the contribution of ecosystems and their services to such growth as well as overall human well-being. This is achieved by linking the biodiversity and ecosystem accounts to standard economic accounts, allowing the tracking of interdependencies between the economy and the environment. Potentially, the accounts can be used for a broad range of biodiversity-related policy questions including, for example, adequacy of budget allocations to restore or protect biodiversity or economic incentives related to the stimulation of land management changes leading to the enhancement of different baskets of ecosystem services. Accounting for biodiversity may also be used in more general policies, including those related to sustainable production and consumption or to the use of alternative sources of energy and other resources. Finally, as the biodiversity accounts are spatially explicit, they allow for the assessment of policy responses at fine geo-spatial scales, and can be used, for example, for identifying and protecting hotspot areas, managing river basins or enhancing sustainability of agricultural land use (UN et al., 2014b).

To systematically consider how the ecosystem accounts can benefit biodiversity-related policies we will now discuss which biodiversity-related policy questions are pertinent, how the accounts can be of help, and what analytical methods are needed.

3.3.1 Biodiversity policies, policy questions and accounts

In this section, we distinguish between policy categories being implemented in relation to biodiversity, as well as the key policy questions that arise through the policy cycle. First, we distinguish the following three categories of biodiversity-related policies.

A. Protecting biodiversity, focusing on protection programmes for species and ecosystems and the selection of suitable areas to designate as protected area.

B. Sustaining the supply of ecosystem services and building resilient ecosystems by safeguarding agricultural biodiversity. These policies relate to the instrumental role of biodiversity and especially aim for maintaining the ecosystem conditions and for protecting the genes, species and ecosystems that are necessary for a sustained supply of ecosystem services. It includes for example the protection of bee populations for pollination, the protection of soil biodiversity to maintain soil productivity, the protection of hedges and vegetation that provide habitat to insects controlling pests and fungus, and the enhancement and organisation of protected areas to sustain eco-tourism. These services provide the necessary conditions for food production and eco-tourism.

C. Stimulating a sustainable use of ecosystem services and preventing further declines of biodiversity. These policies aim for preventing pollution crossing key thresholds or planetary boundaries and for preventing unsustainable land use, resource exploitation or harvest levels that exceed natural regeneration rates. This refers especially to policies regulating water use, industrial emissions, mining, agricultural land use, fisheries and forestry. It may include policies limiting emissions to soil, air and water, limiting water use in periods of water scarcity, regulating the use of hazardous inputs and equipment and sustainably managing harvest concessions.

In short, policy category A concentrates on species and ecosystem protection for sake of their intrinsic value. Policy category B considers protection of functional biodiversity, whereas policy category C considers the regulation of economic activities that directly or indirectly result in biodiversity decline. Table 3.1 gives the links between these policy categories and the Aichi targets.

Table 3.1: Relation between the policy categories and the Aichi targets

Policy category	Aichi strategic goal
Policy A. Protect biodiversity	Aichi target C. Safeguard ecosystems, species and genetic diversity
Policy B. Sustain supply of ecosystem services and build resilient ecosystems	Aichi Target D. Enhance the benefits from biodiversity and ecosystem services
Policy C. Stimulate sustainable use of ecosystem services and prevent biodiversity declines.	Aichi Target B. Reduce the direct pressures on biodiversity and promote sustainable use

Note: See Section 2 for a description of the Aichi targets.

Policy analysts and policymakers need information for identifying which issues of the above policy categories are relevant in their situation and for preparing, implementing and monitoring policy instruments. We distinguish between three types of policy questions that arise throughout the policy cycle:

1. What is the status and are the trends in biodiversity and sustainable biodiversity use?
2. What are possible trade-offs and synergies of biodiversity policies?

3. What are the envisaged effects of biodiversity-related policies and policy instruments?

Table 3.2 gives examples of policy questions that may be raised for the three categories of biodiversity policies presented in Table 3.1. The questions listed in this table are not exhaustive but they give an idea about the possible questions that can be raised for each policy category. For monitoring the evolution of biodiversity and biodiversity use, policy analysts and policymakers firstly need insights into status and trends of biodiversity, species diversity, species abundance, species relevant for the delivery of ecosystem services, environmental pressures, resource use, emission levels, etc. This is necessary for identifying where problems are most pressing, what to protect, and which pressures are causing biodiversity decline. It is also necessary for raising awareness at the beginning of the policy cycle and for assessing policy success or failure at the end of the policy cycle.

Secondly, for preparing effective policies, policy analysts and policymakers need understanding of the trade-offs and synergies between the multiple effects of their policies. How is biodiversity impacted by changes in land use, resource exploitation or emissions and how do ecosystem services depend on biodiversity? Knowing this, they can assess whether the net benefits of conserving land for biodiversity outweigh those of converting land to other uses (e.g. agriculture), especially if externalities across space and time and social aspects are properly included.

Finally, for ex ante analysis of policy plans, questions relate to where to locate protected areas or how effective or efficient are expenses incurred to demarcate/designate protected areas. For this, policy analysists would also like to learn how the behavior of people changes with policies aimed at promoting sustainable biodiversity use or punishing or prohibiting behavior that damages biodiversity. This covers a broad range of possible industrial policies, especially on forestry, agricultural and fisheries, as well as those that promote ecosystem services, mitigating climate change and managing water. All these can be done through a range of standard policy instruments including subsidies, taxes, and regulations.

A broad range of accounts can be useful for answering the above questions; accounts from the System of National Accounts, natural capital accounts from the SEEA-CF and ecosystem accounts from the SEEA-EEA (see Box 3.1). Those unfamiliar with natural capital accounting will almost certainly not understand which accounts are relevant for their situation or where to start applying natural capital accounts to biodiversity-related policies. To address this, Table 3.3 shows which accounts are useful for which policy questions and which policy categories. This overview is not necessarily complete but provides an overview of the main biodiversity-related policy questions.

Table 3.2: Policy categories related to biodiversity-related policy questions

	1. STATUS AND TRENDS	2. TRADE-OFFS AND SYNERGIES	3. EFFECTS OF POLICIES AND INSTRUMENTS
A. PROTECT BIODIVERSITY	What are trends of species, habitats and ecosystems?	What are trade-offs and synergies between biodiversity and protection measures; which species/ecosystems benefit or lose from conservation measures?	How do hotspot areas affect biodiversity, are of protection expenses effective, and what effects does biodiversity offsetting have?
B. SUSTAIN SUPPLY OF ECOSYSTEM SERVICES AND BUILD ECOSYSTEM RESILIENCE	What are trends in species affecting ecosystem services, such as bee populations, insects for pest control, soil biodiversity, charismatic species and eco-tourism habitats?	What are trade-offs and synergies between biodiversity, land-use intensity and ecosystem services delivery and use? What are externalities of loss of resilience over space and time?	What are effects of land use, forestry, agricultural, and fisheries regulating and stimulating policies? What is the effect of payments for the use or protection of services (PES))?[1]
C. STIMULATE SUSTAINABLE USE OF BIODIVERSITY	What are trends in indicator species that are affected by pollution, overexploitation or land-use change? What are trends in resource use rates and emissions to soil, air and water>	What are trade-offs and synergies between biodiversity and resource use / emissions / environmental quality? What are externalities of sustainable and unsustainable resource use over space and time?	What are the effects of industrial, climate, water, or nitrogen policies? What is the effect of payments for damages caused to ecosystem services (PES)*

[1] PES policies can be part of policy category B and C. Under policy category B, they stimulate biodiversity enhancing behavior, whereas under category C they punish biodiversity damaging behavior.

For status and trends, the key accounts are those on biodiversity, ecosystem extent, land use and land cover. Box 3.2 explains in more detail which accounts can be distinguished for tracking changes in biodiversity. Other accounts are also useful for signaling whether rates of resource use exceed regeneration rates. In this, the supply and use tables of resources such as energy, water, materials and ecosystem services are important, as are the waste and emissions accounts that show the hazardous substances released to air, water and soil and the amounts of waste dumped into the environment. Finally, the monetary environmental activity accounts and the information from the System of National Accounts are relevant for estimating resource efficiency, i.e. to calculate whether more or fewer resources are used or waste is produced to generate a certain economic return. Section 3.4 discusses which countries are currently experimenting with these accounts.

Trade-offs and synergies pertain policy questions relating to the dependency of biodiversity on different land uses and the dependency of human activity and wellbeing on biodiversity—i.e. the natural resources (e.g. timber, fish, medicines) and ecosystem services biodiversity provides. For this, data from the biodiversity accounts are related to data from several of the SEEA-CF and -EEA accounts, depending on the specific question. For example, biodiversity data may be compared with data from the land-use/land-cover accounts to learn how different land uses and land management activities affect biodiversity and from the monetary environmental activity accounts to assess the effectiveness of environmental management expenditure. For the reverse case, of economic activity dependent on biodiversity, the natural resource and ecosystem service accounts are key, showing how

agricultural, timber and fish production as well as water quality and availability depend on biodiversity.

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Box 3.2: Accounting for changes in biodiversity

Biodiversity has many dimensions and there is no single indicator that captures all of them. The CBD agreed that the state of biodiversity can be measured using trends for four indicators (UN et al., 2014b): a) extent of selected ecosystems, b) abundance and distribution of selected species, c) status of threatened species and d) genetic diversity. Information on the basic steps and choices necessary for producing accounts for these indicators is given in the SEEA-EEA (UN et al., 2014b), guidelines by UNEP-WCMC (2015, 2016) and SEEA-EEA Technical Recommendations (UN, 2017). Indicators for biodiversity accounting have also been explored in general by Garnåsjordet et al. (2012) and by Remme et al. (2016).

The basis of the **ecosystem extent accounts** are the land cover accounts, supplemented with a range of data on various ecosystem characteristics. So far, there is no internationally accepted classification for ecosystem types and the SEEA-EEA Technical Recommendations (UN, 2017) shows a basic set of nine (9) ecosystem types. It is almost certain that for policy or management applications of biodiversity accounts more detailed classifications of ecosystems will be required. For example, Conservation International et al. (2016) had 17, Eigenraam et al. (2013) 23 and Keith et al. (2017) 47.

For preparing **species accounts**, species can be grouped by taxonomy (e.g. mammals, birds, insects), species extinction risk as per the IUCN species status classifications or national counterparts or other characteristics (e.g. distribution area, reproductive strategy). A key finding of Bond and Vardon (2018) was that species accounts needed to show more than just conservation status and that groupings of species by endemic/non-endemic or specialist/generalist were useful.

What dimensions are useful to show within species accounts depends very much on the policy question. This also includes choices regarding spatial unit size and aggregation, measurement approaches (e.g. remote sensing data, measures on the ground, or both) and classifications. For example, if species accounts are used for conservation purposes, UNEP-WCMC (2016) recommends setting up accounts for threatened species, endemic species, migratory species or phylogenetically unique species. For accounts to monitor ecosystem services, it is advised to set up accounts for species that deliver direct use benefits (e.g. for consumption, recreation, or that are culturally or socially important) or for species that provide indirect use benefits (e.g. pollination, water purification, carbon sequestration, hazard protection, pest control, soil formation). Finally, for analysing ecosystem condition, it is advised to use accounts considering keystone species and species groups that are important for ecosystem functioning (e.g. nitrogen fixing plants, herbivores, predators), which help to signal unsustainable use of biodiversity.

Data availability is one of the major barriers to setting up biodiversity accounts, especially for species accounts. Land-use and land-cover accounts can be reasonably well compiled based on remote sensing data. Combined

with modelling or detailed sampling data, ecosystem-extent accounts can be made. However, for species accounts, spatially explicit species data are needed at a resolution that is suitable for management, is temporally relevant, and comparable to a defined reference condition (UNEP-WCMC, 2015). Few species have such data available, and it often requires years and many volunteers to collect such data (see e.g. Bond and Vardon, 2018). For accounts on species abundance, primary data availability may be particularly problematic. For that reason, Schipper et al. (2017) experimented with the use of GLOBIO model data of the Mean Species Abundance indicator to set up mean species abundance accounts for Mexico.

The effects of biodiversity-related policy instruments also can be investigated via accounts. As will be shown in Section 4, not many countries use the accounts for these purposes. For example, for selecting hotspot areas, spatially explicit biodiversity accounts, ecosystem extent and condition accounts and land-use accounts are useful, showing areas suitable for protection. Furthermore, two widely used economic instruments to protect biodiversity are Payments for Ecosystem Services (PES) and Biodiversity Offsetting and accounts can be used to analyze the impacts of such policy instruments. Here, the land-use/land-cover and biodiversity accounts are key, along with the ecosystem services accounts that relate resource use or emissions to biodiversity impacts. The environmental activity accounts track the financial or budgetary consequences of such programmes. Finally, a broad range of policy instruments exists that regulate particular resource uses or polluting activities with the objective of reducing negative impacts to the environment or stimulating positive impacts. For this, biodiversity accounts and land-use/land-cover accounts are key. These are supplemented with supply and use tables, asset accounts, ecosystem services accounts, and the environmental protection expenditure accounts, depending on the activity or sector on which they focus. For example, for policies on reducing nitrogen deposition, information is needed from the energy (fuel mix), emissions, agricultural and land-use accounts.

3.3.2 Relevant analytical methods

To analyze the policy questions (Tables 3.2 and 3.3), policy analysists can choose from a broad set of approaches. The three types of policy questions identified—status and trend, synergies and trade-offs, and policy effects—each require different approaches. In general, the analysis of policy effects is analytically much more demanding than the analysis of status and trends. Table 3.4 shows which types of analysis may be useful for which questions.
For analyzing status and trends of biodiversity change and resource efficiency, numerous indicators can be directly taken from the accounts (Appendix 3.1). This may include international reporting obligations about biodiversity, specific species or habitats, or about biodiversity protection expenditure. Similarly, resource efficiency indicators can directly be computed from the economic data in the System of National Accounts and the information on biodiversity in the natural capital accounts. Regression analysis can be used to trace trends in resource efficiency or supply of ecosystem services and relate this to trends in biodiversity change.

More detailed regression or econometric analysis can provide evidence about synergies and trade-offs between biodiversity on the one hand and land use, ecosystem services supply,

resource use and ecosystem conditions on the other. For instance, the accounts provide the necessary data to estimate causal relationships between:

- biodiversity status and budgetary expenditures,
- biodiversity status and land-use intensity,
- fruit production and pollination services,
- soil biodiversity and net primary production,
- land cover and carbon sequestration,
- water use efficiency and ecosystem conditions, or
- economic growth, sectoral energy use and carbon emissions.

As will be discussed in the next section, there are only few examples of countries using the accounts for these purposes so far. Yet, they are very suitable for these purposes. The consistency of the accounts—in terms of economic sector, ecosystem categories, or spatial boundaries— enables analysts to take data from multiple accounts. This is not usually possible with data taken from multiple data sources that use different concepts, sources and methods.

The same applies for the third type of policy questions—evaluating policies and policy instruments. The accounts can be used both for ex post and ex ante policy evaluations. For ex post evaluations of biodiversity-related policy instruments, data about the impacts of the instruments for particular ecosystems, regions or sectors are needed that can be taken from the accounts. For example, for comparing effectiveness of three potential policies to conserve biodiversity—Payments for Ecosystem Services, biodiversity offsetting or expanding protecting areas—costs, biodiversity impacts and economic development impacts can be estimated from the accounts. Similarly, for ex ante policy assessments, bio-economic models can be applied that use information from the accounts as input.

Several modelling approaches use the natural capital accounts, often in the form of a Social Accounting Matrix, to calibrate the model. An example includes the Integrated Environmental-Economic Model (IEEM) (Banerjee et al., 2016). Other approaches, can use information from the natural capital accounts for estimating functions that relate, for example, land use to species abundance or economic development to ecosystem conditions. Many of these approaches can also be used to explore future scenarios of change, cost-benefit analysis of future investments, or assessing impacts of biodiversity-related policies.

Table 3.3: Overview of SEEA-CF or -EEA accounts that are useful for biodiversity-related policy questions. *

BIODIVERSITY POLICIES AND NATURAL CAPITAL ACCOUNTING	Account category	SNA	SEEA Central Framework			Asset Accounts / Thematic Ecosystem Accounts				SEEA Ecosystem Accounts			
		National accounts	Environ. protect. expend. accounts	Supply and Use Tables						Ecosystem Asset Accounts			Ecosystem Services Accounts
	Content of account[a]		Transactions to protect the environment	Flows of energy, water, materials	Flows of waste and emissions to soil, air and water	Stocks of minerals, resources, timber, water	Land use and land cover	Stocks of carbon, soils and nutrients	Stocks of biodiversity and species	Extent of ecosystems (size)	Condition of ecosystems (quality)	Future flow of ecosystem services (stock)	Supply and use of ecosystem services
	Unit [(a)]	P / M	M	P / M	P / M	P / M	P	P / M	P	P / M	P	P / M	P / M
Status and trends	(b)												
Biodiversity / species change	A / B / C												
Resource efficiency	C												
Synergies and trade-offs													
Relation biodiversity – land use / protection	A												
Relation biodiversity – ecosystem services use	B												
Relation biodiversity – resource use / emissions / environmental quality	C												
Policy response/implementation/review													
Determine and protect hotspot areas	A												
PES / biodiversity offsetting	A / B												
Policies to restrict resource use/emissions													
- Nitrogen policy	B / C												
- Water policy	B / C												
- Forestry policy	B												
- Sustainable agriculture	B												
- Climate policy	B / C												

Notes: * The black cells show which accounts can be applied for answering the respective policy questions. The white cells indicate that the accounts do not provide relevant information for that policy question. The accounts coloured green and blue are covered both in the SEEA-CF and SEEA-EEA. a) P = in physical terms, M = in monetary terms; b) A = Policies to protect biodiversity, B = Policies to sustain supply of ecosystem services and build resilient ecosystems, C = Policies to stimulate sustainable use of ecosystem services

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Table 3.4: Overview of analytical approaches

BIODIVERSITY-RELATED POLICIES *		TYPES OF ANALYSIS
STATUS AND TRENDS	*	
BIODIVERSITY /SPECIES CHANGE	A/B/ C	Estimate indicators for biodiversity and species and estimate trends in species, habitats and biodiversity budgets using regression analysis.
RESOURCE EFFICIENCY	C	Estimate indicators and trends in the relationship between resource use or ecosystem services use and biodiversity, ecosystem/resource quality or ecosystem services supply using regression analysis.
SYNERGIES AND TRADE-OFFS		
RELATION BIODIVERSITY – LAND USE / PROTECTION	A	Regression/econometric analysis of biodiversity vs land-use relationships
RELATION BIODIVERSITY – ECOSYSTEM SERVICES USE	B	Regression/econometric analysis of biodiversity vs. ecosystem services use relationships
RELATION BIODIVERSITY – RESOURCE USE / EMISSIONS / ENVIRONMENTAL QUALITY	C	Regression/econometric analysis of biodiversity vs. resource use / environmental and ecosystem quality relationships
POLICY RESPONSE/IMPLEMENTATION/REVIEW		
DETERMINE AND PROTECT HOTSPOT AREAS	A	Estimate spatial indicators of presence of species and habitats, indicators of pressures affecting ecosystem extent and quality, indicators of carbon sequestration
PES / BIODIVERSITY OFFSETTING	A/B	Econometric analysis to assess potentials and historic effects of PES on ecosystem services use and supply, biodiversity effects and payment involved
POLICIES TO RESTRICT RESOURCE USE/EMISSIONS: NITROGEN, WATER, FORESTRY, SUSTAINABLE AGRICULTURE, CLIMATE POLICY	B/C	Bio-economic modelling to assess behavioural impacts of policies on resource use and emissions in various economic sectors, and resulting impacts on biodiversity, ecosystem conditions and resource conditions, and estimation of economic costs involved. Focus on a particular resource or sector depends on the policy.

Note: * Policy categories: A = related to biodiversity protection; B = related to sustaining supply of ecosystem services and to building resilient ecosystems; C = related to stimulating sustainable use of ecosystem services.

3.4 Experiences with NCA for biodiversity-related policy-making

This section briefly outlines the current situation of compilation and use of biodiversity-related accounts. A global assessment of environmental economic accounting (UNCEEA, 2018) concluded that the number of countries experimenting with ecosystem accounts remains limited. About 14 countries officially compile SEEA-EEA accounts or modules. However, about 40 countries are experimenting with the SEEA-EEA accounts, often on a subnational level or not by national statistical agencies. A group of countries is also planning to initiate ecosystem services accounts. Many more countries compile accounts from the SEEA-CF but developed and developing countries focus on different areas. Developing countries focus on energy, water, environmental protection expenditures, timber and land

accounts, whereas the developed countries focus on energy, material flow, and environmental taxes and subsidy accounts.

Table 3.5 lists examples of countries experimenting with the SEEA experimental ecosystem accounts. The table shows that experience is growing but that, so far, the accounts have not been used to their full potential. This is understandable given that the ecosystem accounting guidelines are still very recent (Boxes 3.1 and 3.2).

Among the countries that already use ecosystem accounts for policy are:

- Mexico that uses it for monitoring purposes;
- Peru that applies the accounts for assessing the economy-wide effects of ecosystem degradation and;
- The Philippines that use their ecosystem accounts for assessing the importance of its mangroves for, among other things, coastal protection and fisheries (Table 3.5).

The Peruvian example is interesting as the species, ecosystem extent, ecosystem condition and ecosystem services supply and use tables for the area of San Martin in Peru show equity issues associated with access to resources, impacts of degradation and trends of threatened species and of sustainable ecosystem use (Conservation International, 2016; Portela et al., 2018; UNEP-WCMC, 2016). Indicators from these tables are deemed critically important for biodiversity conservation and sustainable water use, allowing for more holistic resource management, enabling improved monitoring and policy implementation. Importantly, the accounts were produced to make explicit the importance of natural capital to the economy.

In Australia, ecosystem accounting was used in: the Central Highlands of Victoria to assess the economic and ecological impacts of conserving versus those of exploiting the area (Keith et al., 2017); in the Great Barrier Reef region to assess the relationship between the environmental condition of the area and economic and other benefits (ABS, 2015, 2017); and for informing the public about the status and trends of environmental change in the State of the Environment Report of the Australian Capital Territory (Smith et al., 2017).

In other countries, such as South Africa, produced ecosystem extent accounts are used for spatial planning purposes, for example, for locating new protected areas and for identifying strategic water source areas (Driver et al., 2015). This experience shows that the accounts allow for more holistic and integrated land-use planning, that better consider biodiversity and the impacts of land-use management on biodiversity. The United Kingdom uses the ecosystem accounts to monitor changes in ecosystem services supplied and, so far, they have dedicated studies for protected areas as well as for particular ecosystems (farmland, fresh water and woodland) and for urban areas.

As the examples of Australia, Peru, the Philippines, South Africa and the United Kingdom show, several of the policy applications are at the subnational level. Also notable is that in some cases the policy applications are performed outside of the statistical offices and government agencies.

Many of the ecosystem accounts currently produced are experimental, with the objective to gain experience with the SEEA-EEA guidelines and not yet with a clear policy use in mind. This refers to the search for classifications of ecosystem, land cover or species, for indicators and units, the spatial and temporal scales that are relevant for policy-making and data sources that are practical and trustworthy. In this way, experience is gained with setting up accounts for species, ecosystem extent, ecosystem condition and ecosystem services.

For instance, the ecosystem accounts in Uganda show that by overlaying information on land-use decisions from the ecosystem extent accounts and information from the species accounts, entry points can be identified for biodiversity protection and eco-tourism policies in Uganda (UNEP-WCMC and IDEEA, 2017). The Mexican ecosystem extent, ecosystem condition and ecosystem services accounts provide information about soil and vegetation, at different points in time and at different spatial scales—nationwide, state-wide, municipal and special studies for Natural Protected Areas and Ramsar Sites. For ecosystem condition accounts, they focus on the 'priority components' soil, water, carbon and biodiversity. For biodiversity, they use an Ecological Integrity Index that measures the importance of the existence, protection and conservation of biodiversity, as well as the consequences of its decline or disappearance. Next, they present supply-and-use tables of ecosystem services in physical units and hybrid tables and experiment with tables in monetary terms, showing the relationship between ecosystems and the economy. Furthermore, Bond and Vardon (2018) set up butterfly accounts to experiment with alternative species classifications and spatial categories.

Table 3.5: Examples of biodiversity-related accounts

COUNTRY	ACCOUNT TYPE[A]	FOCUS	INTENDED POLICY USE
AUSTRALIA[1]	EA: biodiversity accounts	Species accounts for 5 regions that drain into the GBR for several animal, plant, fungi and protista groups.	To test setup of species accounts
AUSTRALIA, PORT PHILIP BAY[2]	EA: Marine and coastal ecosystem accounts	Ecosystem extent accounts (per broad habitat level, habitat complex and biotope compiles) and condition accounts (dissolved oxygen) for the entire area and for seagrass production. For ecosystem services provided by sea grass values are estimated (maintenance of nursery populations and provision of habitat) as well as carbon sequestered per hectare.	Pilot study to test accounting, but results help to understand the relationships between the marine and coastal environment and the social and economic wellbeing of Victorians
AUSTRALIA, ACT REGION[3]	CF accounts	Land-use/land-cover accounts, environmental condition accounts (indices for land, water and atmosphere), biodiversity accounts (trends in threatened species), water accounts (PSUT and assets), air emission accounts (greenhouse gasses and PM), solid waste accounts, environmental expenditure accounts.	Accounts to be used to meet the statutory obligations of the Commissioner for Sustainability and the Environment. The study shows what extra information the accounts provide, compare to alternative studies and expert judgement.
AUSTRALIA, GBR REGION[4]	EA: ecosystem accounts for GBR	Biodiversity, land cover, water pollution and a selection of ecosystem services (crops, fishing, aquaculture, timber, carbon, visitors) for the Great Barrier Reef. 2017 accounts also include condition accounts (marine condition scores, climate variables and pollutant loads) and expenditures on EGSS	Relate environmental condition to economic and other benefits provided by the region in order to reach ecologically sustainable use of the region.
AUSTRALIA, VICTORIAN CENTRAL HIGHLANDS[5]	CF + EA accounts	Land, water, carbon, timber accounts and production and use of ecosystem services, and information on biodiversity, tourism and agricultural production	Analyse the synergies and trade-offs between water supply, forestry, tourism and biodiversity conservation
AUSTRALIA, ACT REGION[6]	EA: Species asset account	Butterflies presence and abundance by species class, habitat type and season	State of the Environment Reporting
BOTSWANA[7]	CF: Water, mineral and energy accounts + EA: ecosystem account	Water accounts are finished; work on ecosystem, mineral and energy accounts is underway.	Accounts have helped to show the need for improved water demand management that avoids future water shortages, keeps water affordable and ensure water is available for wildlife.
BRAZIL[+]	CF + EA (pilots)	Water, energy and land accounts have been compiled. Pilots for ecosystem services accounts and for timber accounts.	
BHUTAN[# +]	CF + EA (ANCA project)	Material flow account and energy account. Pilot EA accounts under UNEP ANCA project. Plans for water and SEE AFF (agriculture, fisheries, forestry) accounts.	
CANADA[*]	CF: Land cover and land use	Land cover and land use for selected geographic areas, 1991 to 2011, incl. land cover and land-use data for selected geographic and track changes in the extent of built-up area in Canada's major cities	
CHILE[#]	CF + EA (ANCA project)	AFF accounts (agriculture, forestry, fisheries), air emissions and EPEA. Pilot EA accounts under the UNEP ANCA project.	Results will be reported regularly; environmental objectives will be monitored and they plan to include the results in their sustainable development plans.
COLOMBIA[*]	CF accounts; EA experiments	Land accounts, forestry accounts (in physical and monetary terms forest products, non-timber forest products and products derived from the transformation of wood logs), water use accounts in physical terms, solid waste accounts, air emission accounts. Environmental protection expenditure and resource management expenditure for the government, industries and public services, since 2009 to 2017, including environmental jobs and environmental taxes. Experiments with ecosystems services accounts for Orinoquia.	
COSTA RICA[* +]	EA: Ecosystem accounts; CF: water, energy accounts	Experiment with ecosystem accounting associated to tourism, crop production and carbon sequestration. Ecosystem extent, AFF, EPEA, timber, energy and water accounts finished.	Use accounts for monitoring policy progress.
EUROPEAN UNION[8]	EA: accounts for pollination and outdoor recreation	Experimental accounts at the EU level, currently focusing on outdoor recreation and crop pollination, looking at service potential, demand and use in a spatially explicit way.	Test how to set up these accounts, and how they differ per type of account
FRANCE[*]	CF: Environmental protection expenditure accounts; Forest accounts	Focus on biodiversity in the environmental protection expenditure accounts; Forest accounts	Used for calculating a new indicator on wealth: the artificialised land ratio
GERMANY[*]	CF: Environmental protection expenditure accounts, environmental goods and services; EA experiments	EPEA shows expenditure concerning 'Protection of biodiversity and landscape' (CEPA 6). Environmental goods and services sector (EGSS) with data on turnover, exports, gross value added and employment of corporations—except corporations of the agricultural sector—concerning protection of biodiversity and landscape (CEPA 6). Experiments with ecosystems and ecosystem services accounts.	

COUNTRY	ACCOUNT TYPE[A]	FOCUS	INTENDED POLICY USE
GUATEMALA[9]	CF accounts	Forest, water, fisheries, subsoil resources (hydro carbons, metallic, minerals, non-metallic minerals)	Accounts are used in modelling studies with IEEM, dealing with forestry and the SDGs.
INDIA[+]	CF + EA (pilots)	Land, water, minerals, forest (asset) accounts of the SEEA-CF and pilot projects with ecosystem accounts	
INDONESIA[10 +]	CF (SISNERLING)	SISNERLING contains timber, energy and mineral resources asset accounts, land-use/land-cover accounts in Sumatra and Kalimantan, water accounts for a watershed in Java, and EPEA/EGSS statistics. Currently work on land and water accounts. Experiment with account for peatlands,	Uses accounts in its medium-term development plan
NETHERLANDS, LIMBURG PROVINCE[11]	EA for broad selection of ecosystem services and ecosystem condition and extent accounts	Physical supply of ecosystem services (crops, fodder, meat, groundwater, PM10 capture, carbon sequestration, recreation, nature tourism), ecosystem condition accounts, and monetary supply and use tables of ecosystem services.	Monitor interdependencies between ecosystems and economic activities
NETHERLANDS[12]	EA for broad selection of ecosystem services and ecosystem condition and extent accounts	Biodiversity and condition accounts, monetary accounts for the EGSS and EPEA containing information on expenditures related to biodiversity and landscape protection	Test setup and usefulness of classifications
MAURITIUS[# +]	CF + EA (pilots under the ANCA project)	Material flow, water, energy and air emission accounts. Within the ANCA project, they pilot ecosystem accounts on ecosystem extent, ecosystem condition, water and biodiversity.	
MEXICO[13]	EA: Biodiversity account and ecosystem extent account	Ecosystem extent per ecosystem type and mean species abundance per ecosystem type	Test applicability of the GLOBIO model for preparing species abundance accounts
MEXICO[*]	EA: extent, condition and ecosystem services accounts.	Land account and ecosystem extent (coverage of soil and vegetation and changes over time for several scales); Condition accounts (for soil, water, carbon and biodiversity, and an ecological integrity index); Supply and use accounts of ecosystem services (in physical units, hybrid tables and experiments with valuation)	Obtain indicators for monitoring changes in biodiversity and ecosystem services
PERU[14]	EA: Ecosystem accounts	Ecosystem extent, condition accounts (fragmentation, biodiversity retained), biodiversity (invertebrates, vascular plants and vertebrates retained and biophysical and monetary ecosystem services supply and use tables for the region of San Martin.	Indicators from the accounts can be used to identify (i) ecosystem sources of water-related benefits; (ii) effects of ecosystems' degradation; and (iii) water use per beneficiary, in this way showing equity issues related to resource access or degradation. Biodiversity indicators show the status and trends of threatened species, as well as the status of ecosystems.
PHILIPPINES[15]	CF + EA: Minerals and ecosystem services accounts	Mineral accounts to learn about the value of subsoil assets; mangrove accounts and ecosystem and water accounts for the Laguna Lake basin to learn about the value of ecosystem services.	Mangrove accounts help the policy dialogue on the benefits of mangroves for coastal zone protection, disaster risk management, fisheries and tourism.
P.R. CHINA[+%]	CF + EA (pilot)	Natural resources balance sheets on land, forestry, water and mineral resources (equivalent to the SEEA-CF asset account). Pilots in eight areas from 2015–2016, and currently expanded to the national level. Currently piloting ecosystem accounts in 2 pilot provinces, Guangxi and Guizhou, for 6 ecosystem types (agricultural land, forest, grassland, inland water ecosystem, urban, marine). To be completed by 2020.	Energy accounts have their highest policy priority. Their main policy drive is on eco-compensation and 'ecological civilisation' for sustainable development.
RWANDA[9]	CF: Water and land accounts	Water and land accounts in Rwanda	Land accounts used for improving resource management.
SOUTH AFRICA[16]	EA: Land and ecosystem extent accounts	Land cover accounts, ecosystem extent accounts and land accounts	Test setup of these accounts and search for useful classifications. Showed that land cover not always corresponds with ecosystem unit.
SOUTH AFRICA[17]	EA: River extent and condition accounts	Extent accounts and condition accounts for South Africa's river ecosystems. Condition accounts showing the degree of modification using an aggregate ecological condition category and an ecological condition index. Extent accounts based on length of the river network, per river and river type.	Test the setup of the accounts (classifications and scale) and their use for monitoring and trend analysis of ecosystem conditions.
SWEDEN[18]	CF: Land accounts	Link land ownership to habitat type	To be used to define actors whose actions impact biodiversity and identify who is responsible for biodiversity management on each piece of land
SWEDEN[19]	CF: Monetary environmental protection accounts	Environmental protection expenditure accounts—specific breakdowns available for biodiversity and landscape expenditures since 2016; Environmentally motivated subsidies for the period 2000–2017.	For monitoring expenditures and subsidies.

COUNTRY	ACCOUNT TYPE[A]	FOCUS	INTENDED POLICY USE
SWEDEN[20]	EA: Land accounts including some ecosystem services and biodiversity	Land accounts by industry and experiments with ecosystem accounts (sequestration, blueberry production) and biodiversity accounts (groups of organisms per habitat)	Test the possibilities to setup the accounts
UGANDA[21]	EA: Ecosystem and biodiversity accounts	Land cover, ecosystem extent, 3 NTFPs, Chimpanzees, Elephants	Provide insight in state and trends in ecosystems and biodiversity in Uganda
UNITED KINGDOM[22]	EA: Ecosystem accounts for protected areas	Extent and condition accounts of 6 pilot areas, physical and monetary ecosystem services flow accounts (crops, livestock, wild foods, drinking water, timber, energy, air quality, flood protection, climate regulation, recreation, aesthetic). Condition accounts contain biomass/carbon, biodiversity (butterfly abundance and richness), accessibility (trail length, tranquillity) and conservation status (sites of favourable special scientific interest). Also studies available on land cover, land use and carbon stocks.	Test setup of the accounts (classifications and scale) and their use for monitoring, trend analysis, identifying hotspot areas and decision-support tools.
UNITED KINGDOM[23]	CF: UK Natural Capital Accounts	Ecosystem services accounts for the period 1997–2015 in physical and monetary terms, including energy (renewable and non-renewable), minerals, timber, crops, fish, water, air filtration, sequestration, recreation.	Test the setup of the accounts and monitor changes in ecosystem services
UNITED KINGDOM[24]	EA: Ecosystem accounts for farmland, freshwater and woodland	Ecosystem extent account, condition account, physical and monetary ecosystem services accounts and value of future flow of ecosystem services. Ecosystem services include crops, water, fish, timber, hydro and solar, peat, sequestration, air pollutant removal, recreation, and education.	Test the setup of the accounts and monitor changes in ecosystem services
UNITED KINGDOM[25]	EA: Ecosystem accounts for urban areas	Ecosystem extent (for various classifications), condition (favourable/ unfavourable; accessibility) and physical/monetary ecosystem services accounts (crops, water, fish, timber, sequestration, air filtration, noise regulation, urban cooling, recreation, aesthetic interactions, physical health) for urban areas.	Provides insights in differences between cities and importance of green areas for cities.
VIETNAM[#]	CF + EA (within ANCA project)	One-time compilation of material flow and timber account. One-time pilot project with ecosystem services supply. Part of ANCA project.	
ZAMBIA[*]	Water accounts	Physical and monetary supply and use tables for water. Preliminary forest accounts are being finalised	Accounts to be used for assessing whether water management practices are conducive to sustainable and resilient growth

Note: A) CF = from SEEA Central Framework, EA = from SEEA-EEA.

Note on sources: The information in this table was compiled by the authors based on the survey sent to countries and literature reviewed. * From own survey; [+] from UNCEEA (2018); % from personal communication with UNSD; [#] from ANCA project – http://www.teebweb.org/areas-of-work/advancing-natural-capital-accounting/; 1) Bond et al., 2013; 2) Eigenraam et al., 2016; 3) Smith et al., 2017; 4) ABS, 2015, 2017; 5) Keith et al. 2017; 6) Bond and Vardon, 2018; 7) Department of Water Affairs, 2017; 8) Vallecillo et al., 2018; 9) from WAVES Partnership website; 10) WAVES Partnership, 2017; 11) De Jong et al., 2016; 12) Statistics Netherlands, to be published; 13) Schipper et al., 2017; 14) Conservation International, 2016; 15) WAVES Partnership, 2016; 16) Driver et al., 2015; 17) Nel and Driver, 2015; 18) Steinbach and Palm, 2014; 19) www.scb.se; 20) Statistics Sweden, 2017; 21) UNEP-WCMD & IDEEA, 2017; 22) White et al., 2015; 23) ONS, 2017a; 24) ONS, 2017b; 25) ONS, 2018.

In addition, the European Commission pushes the member states to set up natural capital and ecosystem services accounts. Several experiments are being undertaken to set up ecosystem accounts, such as the ecosystem services, carbon and biodiversity accounts by Statistics Netherlands (yet to be published), to set up EU wide species accounts (UNEP-WCMC, 2017) or to set up monetary and physical ecosystem services supply-and-use tables for pollination and outdoor recreation (Vallecillo et al., 2018).

Table 3.5 shows that many countries use the SEEA Central Framework accounts for biodiversity-related questions. Among the most popular accounts are the land, water, forest and mineral accounts. Among other things, they are used for assessing whether water, land or forest management practices are conducive to sustainable growth and resilience. In Sweden, the land accounts are used to identify which landowners are responsible for biodiversity management on a specific plot, while in Botswana water accounts have been used to assess the water needs of wildlife on which a large tourism industry relies (Vardon et al., 2017b). Indonesia has used natural capital accounting in their medium-term development plan, which is committed to sustainable development and Indonesia's green growth trajectory. In this, the natural capital accounts are linked to a number of socio-economic issues, including forest resource management, water use, food production and security, and environmental degradation.

Several countries also integrate biodiversity more in the environmental protection expenditure accounts (EPEA) and in the environmental goods and services sector (EGSS). This includes France, Germany and Sweden. Sweden is working on environmental protection expenditure accounts and accounts of environmentally motivated subsidies with specific breakdowns for biodiversity and landscape. Sweden has also published land accounts that connect statistics on land use with economic actors and that can be used for analyzing investments done in the agricultural sector. These breakdowns also help to learn more about the importance of the environment and ecosystems for the wider economy. France, for example, uses their accounts for a new wealth indicator, that goes beyond GDP (Service d'information du Gouvernement, 2017).

These examples show that monitoring and trend analysis are among the first policy uses of biodiversity-related accounts. This may be monitoring threatened species or changes in ecosystem extent or condition. It may also be related to changes in land use or in water or forest management, both of which relate to economic activities having negative impacts on biodiversity. Table 3.5 shows that only few countries use the accounts for monitoring how changes in the biodiversity affect the supply of ecosystem services. Moreover, the examples in Table 3.5 show that only a few countries use the accounts for the more data demanding policy questions, such as showing the economic importance of biodiversity, evaluating the impacts of economic activity on biodiversity, analyzing impacts of different policy options using modelling or scenario exercises. For this type of use to gain momentum, more countries need to compile the accounts, for longer timeframes, along with developing the expertise for analyzing them.

Two final observations are that, the examples show that most countries are not yet at the stage where SEEA-related issues can be referenced explicitly in legislation or biodiversity strategies; they may currently be used for that, but not very visibly. Furthermore, less attention seems to be paid to species abundance accounts and, to our knowledge, no attempts have been made to generate genetic diversity accounts. For this information to find their way in policy, more experimental accounts are needed. Species abundance accounts may be especially important if overall biodiversity change is to be monitored more carefully.

3.5 Conclusions

In this paper, we provide an overview of potential and current uses of the SEEA natural capital accounts for biodiversity-related policy uses. This may be protecting biodiversity in conservation areas, sustaining the supply of ecosystem services, building resilient ecosystems, safeguarding food supply from agricultural biodiversity, and promoting sustainable use of ecosystem services by economic actors. The list of potential uses of the accounts is long and accounts from the SEEA Experimental Ecosystem Accounting, the SEEA Central Framework and the System of National Accounts are relevant for assessing the relevance of biodiversity for wealth, production, income and the effects of biodiversity on various government policies.

The review of activity shows that a growing group of countries is producing biodiversity-related accounts from the SEEA Experimental Ecosystem Accounting, for example accounts for ecosystem extent, threatened species and ecosystem condition. Ecosystem extent accounts are the most common type of ecosystem accounts, almost certainly because they can be produced using remote sensing data. While species level accounts were produced in a number of countries, they are less common and have focused on endangered species. To our knowledge, genetic diversity accounts are yet to be produced anywhere in the world. While experience is relatively limited, a range of biodiversity accounts have been produced, demonstrating that while there are some data issues, these can be overcome.

Unfortunately, so far, only few countries use the biodiversity-related accounts in policy development, implementation, review or management. This is perfectly understandable, given that the SEEA-EEA guidelines are still relatively new and that developing the accounts requires considerable time and capacity investments using data that is not readily available in many countries. That said, the experience to date indicates that there are some key policy areas that biodiversity accounting might be able to address. The clearest application relates to land-use management and prioritizing conservation areas. But maybe more importantly, in several countries the accounts have influenced policy-making by demonstrating the importance of biodiversity to economic activity and hence elevating its importance in the policy agenda.

Several potential uses deserve more attention. One of them is their use for keeping track of ecosystem resilience. However, the link between biodiversity and ecosystem service delivery is complex (UNEP-WCMC, 2015). In addition, while the use of ecosystem services by people

is important, information on the role of biodiversity to intermediate services (or intra- and inter-ecosystem flows as they are known in the SEEA) and ecosystem functioning and resilience, which are a broader part of ecosystem accounting, is challenging. This is due to non-linear and threshold effects and also there will often be time lags between changes in biodiversity stocks and resulting changes to the level of ecosystem service provision. Time lags will also exist between social and economic development pressures and their effect on stocks of biodiversity.

Another potential application that deserves special attention is including the monetary ecosystem accounts in policy analysis. This would enable more detailed and integrated policy analysis and ease comparisons of economic and ecological effects. Yet, capturing the entire value of the contribution of biodiversity to ecosystem services is extremely difficult, if not impossible. However, ecosystem production functions and hedonic pricing methods can be used to isolate the monetary value of biodiversity to ecosystem service flows into the economy. Even though this is likely to be possible for only a subset of economically important ecosystem services, it would enrich policy analyses of ecosystem changes.

Finally, the review shows that most applications of the ecosystem accounts do not involve the more demanding regression, econometric or modelling approaches. Monitoring changes of indicators extracted from the accounts is a first step. But the main advantage of the accounting system, it's coherent structure and linkage with the System of National Accounts, is especially exploited if used for analyzing relationships between multiple indicators, analyzing which economic sectors use or impact ecosystem services, or for forward looking analysis of future scenarios of change.

To fully exploit the potential of ecosystem accounts a number of issues should be addressed. These include:

- Integrating the accounts into national information systems and ensuring that the base data is regularly measured, just like many other measurements undertaken by statistical agencies (Portela et al., 2017).
- Demand-side guidance is necessary to help policymakers and policy analysist understand how to use accounts. The list of possible accounts is long, and the list of possible applications of each account for indicator development, analysis or policy use is even longer. The guidance would need to show how that the accounts can make a difference.
- More practical experience is needed on how the accounts can be used for trend analysis, econometric analysis, input-output analysis and bioeconomic modelling. Building the accounts is important, but actually using the accounts is equally important, also for policymakers to see how it may help them. Financial and technical assistance for countries undertaking such projects will be needed. It, moreover, also requires cooperation between policymakers, account compilers and researchers to learn which policy questions are most pertinent, which data are needed for that and how to analyze and report on them.

In conclusion, due to the characteristics of the biodiversity-related accounts, especially that it combines economic with biodiversity data, it can be used for several policy applications. Without many analytical steps, it can be used for implementing the NBSAPs, refining existing biodiversity strategies and management actions and, where necessary, developing new measures to conserve biodiversity. The accounts are also useful for showing the importance of biodiversity to the economy and for highlighting risks to the economy, and human well-being more generally, of declines in biodiversity. Finally, while there are challenges to the production of biodiversity the work to date shows that accounts can be produced and the key task is to insert biodiversity accounting into the machinery of government. In this it seems that biodiversity accounts can draw together information that will help achieve the Aichi Targets, NBSAP, national development planning and land-use planning. If this can be achieved, then biodiversity will have truly entered the mainstream of government decision-making.

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Appendix 3.1: Links between Aichi Targets and SEEA accounts

(Source Vardon et al., 2017a)

Aichi Target	Relevant SEEA accounts	Example indicators
1. By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	—	
2. 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.	All SEEA—National balance sheet showing values of natural resources along with the values of other assets (SNA and SEEA-CF); Ecosystem service accounts showing both physical levels and monetary values of services (SEEA-EEA); national development plans (or regional or State level)	Natural resources (land, fish, and timber) as a proportion of total wealth Ecosystem services as a proportion of GDP
3. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out, or reformed to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the CBD and other relevant international obligations, taking into account national socioeconomic conditions.	Environmental activity accounts—these accounts cover environmental protection expenditure, taxes, subsidies, and so forth (SEEA-CF)	Level of subsidies to industries (forestry, fishing, mining, and fossil fuels) impacting biodiversity Public expenditure on biodiversity conservation as a proportion of all public expenditures Level of PES
4. By 2020, at the latest, governments, business, and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of the use of natural resources well within safe ecological limits.	Physical asset and supply and use accounts for water, timber, aquatic resources, minerals, and energy (SEEA-CF); ecosystem extent and condition accounts (SEEA-EEA)	Proportion of ecosystems with improving condition Harvest levels as a proportion of regrowth rates (for renewable resources)
5. By 2020, the rate of loss of all natural habitats, including forests, is at least halved and, where feasible, brought close to zero, and degradation and fragmentation are significantly reduced.	Land cover/ecosystem extent accounts (SEEA-CF/SEEA-EEA); ecosystem condition accounts (SEEA-EEA)	Proportion of ecosystems with declining extent Proportion of ecosystems with declining condition
6. By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally, and applying ecosystem-based approaches, so that overfishing is avoided; recovery plans and measures are in place for all depleted species; fisheries have no significant adverse impacts on threatened species; and vulnerable ecosystems and the impacts of fisheries on	Physical asset and supply and use accounts for aquatic resources (SEEA-CF); ecosystem condition account; biodiversity accounts –species accounts (SEEA-EEA)	Trend in harvest levels as a proportion of regrowth rates Trend in the number of species threatened by fishing

Aichi Target	Relevant SEEA accounts	Example indicators
stocks, species, and ecosystems are within safe ecological limits.		
7. By 2020, areas under agriculture, aquaculture, and forestry are managed sustainably, ensuring conservation of biodiversity.	Emissions accounts (SEEA-CF); land cover/ecosystem extent and land-use accounts (SEEA-CF/SEEA-EEA); ecosystem condition account; biodiversity accounts and species account (SEEA-EEA)	Levels of emissions Proportion of native vegetation cover on land used for agriculture, aquaculture, and forestry Proportion of land managed for biodiversity conservation used primarily for agriculture, aquaculture, and forestry
8. By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	Ecosystem condition accounts (SEEA-EEA)	Trend in pollution loads
9. By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	Possible links to ecosystem condition and biodiversity accounts (SEEA-EEA) and environmental activity accounts (SEEA-CF)	Trend in the area of distribution of alien species Trend in the expenditure on control of alien species
10. By 2015, the multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	Water emissions account (SEEA-CF); ecosystem extent account of coral reefs and vulnerable ecosystems (Secades et al. [2014]); ecosystem condition account (SEEA-EEA); ecosystem services account (SEEA-EEA); biodiversity account—species diversity/population/extinction risk trends in coral and reef fish (adapted from Secades et al. [2014])	Trend in pollution loads Trend in water quality Percentage of ecosystems in declining condition
11. By 2020, at least 17 percent of terrestrial and inland water and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative, and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	Land cover/ecosystem extent and land-use accounts (SEEA-CF/SEEA-EEA); ecosystem condition account and ecosystem services account (SEEA-EEA); biodiversity accounts—species diversity/abundance accounts (SEEA-EEA)	Percentage of ecosystems in protected areas Percentage of ecosystems managed for conservation (that is, private conservation areas) Number of species found in protected areas
12. By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	Biodiversity accounts—species diversity/abundance accounts (SEEA-EEA)	Number of threatened species Area of distribution of threatened species

Aichi Target	Relevant SEEA accounts	Example indicators
13. By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socioeconomically as well as culturally valuable species, is maintained, and strategies have been developed and implemented to minimize genetic erosion and safeguard their genetic diversity.	Biodiversity accounts (SEEA-EEA)— genetic diversity account; not described in SEEA-EEA, practically difficult, but theoretically feasible	—
14. By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods, and well-being are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	Ecosystem condition account and ecosystem services account (SEEA-EEA)	Trend in ecosystem service levels (for example, water provisioning and water filtration services)
15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including the restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	Land cover/ecosystem extent account (SEEA-CF/SEEA-EEA); ecosystem condition account; ecosystem services account carbon asset account (SEEA-EEA)	Trend in carbon sequestration Trend in total carbon stocks
16. By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	Biodiversity accounts—genetic diversity account; not described in SEEA-EEA, but feasible; ecosystem services account (SEEA-EEA)	—
17. By 2015, each party has developed, adopted as a policy instrument, and commenced implementing an effective, participatory, and updated national biodiversity strategy and action plan.	Possible role for a biodiversity account (SEEA-EEA) in NBSAPs	—
18. By 2020, the traditional knowledge, innovations, and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity and their customary use of biological resources are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the CBD with the full and effective participation of indigenous and local communities at all relevant levels.	—	—
19. By 2020, the knowledge that the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of	Possible roles for ecosystem condition account; ecosystem services account (SEEA-EEA)	—

Aichi Target	Relevant SEEA accounts	Example indicators
its loss, are improved, widely shared, and transferred and applied.		
20. By 2020, at the latest, the mobilisation of financial resources to effectively implement the Strategic Plan for Biodiversity 2011–2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by the parties.	Environmental activity accounts (SEEA-CF)	Trend in expenditure on biodiversity conservation

Appendix 3.2: Survey results

1. WHICH ACCOUNTS HAVE BEEN PRODUCED IN YOUR COUNTRY THAT RELATE TO BIODIVERSITY PROTECTION OR SUSTAINABLE USE OF BIODIVERSITY? PLEASE PROVIDE DETAILS ABOUT THE TYPES OF ACCOUNTS.

NETHERLANDS	SEEA-EEA accounts are being developed, including the biodiversity and condition account. Both will be published as experimental accounts around November 2018. Furthermore, data on the monetary accounts for the EGSS and EPEA are compiled, containing information on the production and expenditure of services related to protection of biodiversity/landscapes.
SWEDEN	Environmental protection expenditure accounts have been compiled, with specific breakdowns for biodiversity and landscape expenditures. Also Land accounts and accounts showing the environmentally motivated subsidies are available.
MEXICO	SEEA-EEA accounts are being developed, which consist of the construction of progressive and successional accounts. The first are the land and ecosystem extent accounts, which will provide information on the coverage of soil and vegetation, as well as their changes in different points in time at nationwide, state-wide and municipal level; furthermore, special studies for Natural Protected Areas and Ramsar Sites are available. Furthermore, the condition accounts present how are the ecosystems through the so-called 'priority components': soil, water, carbon and biodiversity. The biodiversity account uses the ecological integrity index, generated by CONABIO, showing the importance of biodiversity, as well as the consequences of its decline. Supply and use account are compiled that present ecosystem services in physical units and in hybrid tables. These tables show the relationship between ecosystems and the economy. Finally, there are exercises of economic valuation of ecosystem services, whose objective is to assess the quantity of ecosystem services to the market prices that would have existed if the services were marketed and exchanged freely.
FRANCE	Biodiversity protection expenditure accounts and forest accounts
GERMANY	Environmental protection expenditure accounts (EPEA) show expenditures concerning 'Protection of biodiversity and landscape' (CEPA 6) for the general government and for partly non-specialised producers of ancillary services. The environmental goods and services sector (EGSS) module provides data on turnover, exports, gross value added and employment of corporations—except corporations of the agricultural sector—concerning protection of biodiversity and landscape (CEPA 6). The Federal Nature Conservation Agency (BfN) has initiated a project for the 'Integration of ecosystems and ecosystem services in the Environmental-Economic Accounts'.
AUSTRALIA	The ABS produced several publications that feature biodiversity accounts based on the SEEA. These include Experimental Environmental-Economic Accounts for the Great Barrier Reef (2017), Feature article in the publication Environmental-Economic Accounting for Agriculture (2015-16), London Group Paper – Butterfly Account for the ACT (2018), Another exampled based on SEEA but produced outside of the ABS: Experimental Ecosystem Accounts for the Central Highlands of Victoria (2017)
COLOMBIA	Colombia has asset accounts for 1) Mineral and energetic resources (iron, copper, nickel, energy coal, natural gas and oil) in physical terms from 2014 to 2016, 2) for land resource in physical terms for five coverage units (artificialised territories, agricultural territories, forests and semi-natural areas, wet areas and bodies of water) from 2002 to 2011, and 3) for wood resources in physical terms from 1990 to 2012. They also have flow accounts for 1) wood products in physical and monetary terms (timber forest products, non-timber forest products and products from transforming wood logs) from 2014 to 2016; 2) energy in physical terms (for natural energy inputs and energy products)from 2014 to 2016; 3) for water in physical terms for agricultural, manufacturing, public services and households, from 2014 to 2016 provisional; 4) for solid waste in physical terms for ordinary and dangerous waste, for manufacturing and households, and by treatment approach (landfills, incineration, recycling and new use and other treatments), from 2014 to 2016; 5) air emission in physical terms for combustion of energy and physical and chemical transformation, by gas (greenhouse effect, acidification, ozone precursors, air quality and heavy metals) from 2014 to 2016. Furthermore, they have Environmental activities account showing the environmental protection expenditure and resources management expenditure for the government, industries and public services, from 2009 to 2017. These also contain environmental jobs and environmental taxes. Finally, ecosystems accounts are being developed, jointly with the Institute of Hydrology, Meteorology and Environmental Studies and Ministry of Environmental and Sustainable Development.
SOUTH AFRICA	Land and ecosystem accounts in KwaZulu-Natal, and National River Ecosystem Account and Water Accounts (not yet published)
UNITED KINGDOM	A wide range of national level ecosystem accounts have been published in the UK, with more work underway. These include extent and condition accounts, ecosystem services accounts in physical and monetary terms, and asset values. In addition, a range of sub-national accounts have been compiled, both corporate accounts and ones for administrative areas. These have largely been based compiled using a Corporate NCA approach, but have used some data from the national level accounts and similar approaches to the SEEA.
ZAMBIA	Water Accounts: So far physical supply and use tables (PSUTs) for the period 2010–2016 have been compiled. There are plans to compile the pollution accounts and asset accounts for the same period. Furthermore, steps are being undertaken to have the water accounts produced annually.
CANADA	Land-cover and land-use accounts have been compiled for selected geographic areas, 1991 to 2011. These accounts include land cover and land-use data for selected geographic and track changes in the extent of built-up area in Canada's major cities
COSTA RICA	They are working on experimental ecosystem accounting associated to tourism, crop production and carbon sequestration.
MALAYSIA	The environmental expenditure accounts in the 5 years Malaysia Plan allocate a budget for biodiversity conservation.

2. HAVE THE ACCOUNTS BEEN USED IN POLICY PROCESSES RELATED TO BIODIVERSITY PROTECTION OR SUSTAINABLE USE OF BIODIVERSITY?

A. WHAT POLICY NEEDS HAVE THE ACCOUNTS HELPED ADDRESS? HAVE THEY BEEN USED FOR PROBLEM IDENTIFICATION, POLICY PREPARATION, POLICY REVIEW OR MONITORING?

B. WHICH INDICATORS WERE BASED ON THE ACCOUNTS?

C. HAVE THE ACCOUNTS BEEN USED IN ADDITIONAL ANALYSES, SUCH AS TREND ANALYSIS, MODELLING, EX ANTE POLICY ANALYSIS OR ANY OTHER ANALYSIS?

NETHERLANDS	The SEEA-EEA accounts are not yet available for policy use. These accounts will contain information from out nature statistics that are being used in policy. As the accounts will also contain spatial information and will contain information in an integrated way, it is expected that they will provide additional policy uses.
SWEDEN	
MEXICO	The Experimental Ecosystem Accounting will offer several types of indicators; for example, the water condition account provides information through three water quality indicators (Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solids), which are parameters generated by the National Water Commission (CONAGUA), for monitoring the country's water bodies. In addition, the sanitary indicator of faecal coliforms provides microbiological information and complements water quality analysis. For soil indicators will be generated on carbon stored in the different soil types (in physical and monetary terms). Also, supply of crops and livestock at municipal and state level are monitored. The trends of these indicators will be related to parameters such as erosion, vegetation condition, soil carbon, to learn how variations in these indicators affect the ecosystems.
FRANCE	The accounts are used for a *new Wealth indicator* monitoring: an artificial land cover ratio is determined.
GERMANY	Data on EGSS are shared annually with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).
AUSTRALIA	Accounts are not directly used for policy-making or reporting at this stage as biodiversity 'SEEA' accounting is a very new field of work in Australia.
COLOMBIA	Recently, the Ministry of Environmental and Sustainable Development regulated the Compensatory Rate for Timber Forest Utilization in Natural Forests. During this process, they used information on wood stocks and the flow of forest products from the Forest Account. The Forest Account has contributed to address the political need to standardise the collection of taxes aimed at conserving and managing natural forests harvested for timber purposes. The Forest Account was used specifically during the policy preparation process, and it is expected to be used as be input for monitoring the implementation of the TCAFM. Actually, the environmental economic accounts produce approximately 30 indicators related with different topics: http://www.dane.gov.co/index.php/estadisticas-por-tema/cuentas-nacionales/cuentas-satelite/cuenta-satelite-ambiental-csa/cuenta-satelite-ambiental-csa-indicadores. These indicators are used for the SDGs, Colombian Green Growth Policy and Solid Waste Integral Policy. Moreover, is an input for the Colombian Computable General Equilibrium Model for Climate Change.
SOUTH AFRICA	
UNITED KINGDOM	The accounts were widely cited in the UK Government's 25 Year Environment Plan published in January 2018, and also in the accompanying evidence annex. The plan endorses a 'natural capital framework' which closely follows the SEEA-EEA accounting framework, with the examples taken from the accounts used to illustrate the importance of the services we get from natural capital. It is intended that the plan will be monitored through a range of indicators, and that in due course—once the accounts are more firmly established—the indicators will include ones on the levels and values of ecosystem services taken from the accounts as well as a range of indicators on the condition of the assets which will be part of the accounts. They are also looking at using the environmental accounts more widely to create new indicators.
ZAMBIA	The initial draft results are being used to develop models for Water and forestry accounts by the Modelling TWG though these are WIP.
CANADA	
COSTA RICA	
MALAYSIA	The requirements for such accounts have been stipulated in the National policy on Biological Diversity (NPBD) for 2016–2025. It is essential that the accounts reflect the value biodiversity and ecosystem services generate to the economy and to wellbeing. The objective of the accounts is to come up with indicators that help to measure policy achievements and can become part of the reviewing and monitoring process. By 2025, the funds for biodiversity conservation from both government and non-government sources will have increased significantly compared to 2016.

3. HAVE THE ACCOUNTS INFLUENCED DECISIONS MADE OR THE ADOPTION OF POLICIES RELATING TO BIODIVERSITY?

NETHERLANDS	Not yet
SWEDEN	Not yet
MEXICO	Not yet
FRANCE	Not yet
GERMANY	Not yet
AUSTRALIA	Not yet
COLOMBIA	Not yet
SOUTH AFRICA	Not yet
UNITED KINGDOM	The two main impacts of the national level accounts to date have been to help to raise awareness of the importance of natural capital in terms of non-provisioning services (in particular, of the role of vegetation in urban and peri-urban areas), and to change the language of stakeholders (ecologists now much more routinely refer to stocks of assets and flows of services). In other words, they have changed the perceptions and language of those stakeholders involved in the formulation of policies and decisions which affect biodiversity. At sub-national level the accounting approach is used as a means to ensure that we not only preserve the natural assets owned by organisations compiling the accounts, but that we look to increase the value of the benefits we get from holding such assets. The twin objectives of conservation and value of services are key to this change in management style: land owners are now looking for estate managers to provide evidence that they are managing the estate in order to provide a wider range of services and to provide explanations if the total value of the services appears to be declining.
ZAMBIA	Not yet
CANADA	Not yet

COSTA RICA	Not yet
MALAYSIA	Yes, certain goals, targets and action in the policy need to be reviewed based on the financial report.

4. IS THE SEEA MENTIONED IN ANY LEGISLATION RELATED TO BIODIVERSITY POLICIES? PLEASE SPECIFY.

NETHERLANDS	No
SWEDEN	No
MEXICO	The National Development Plan highlights the measurement of the GPD, which is an indicator derived directly from SEEA Mexico. Similarly, in several public policies such as LGEEPA, ENBIOMEX, PROMARNAT, among others, mention is made of the results of SEEA Mexico.
FRANCE	No
GERMANY	No
AUSTRALIA	No
COLOMBIA	SEEA is not mentioned in any law. In 2017, some policy documents mention the need for environmental economics accounts for the environmental policies, such as policy documents of green growth and solid waste.
SOUTH AFRICA	No
UNITED KINGDOM	The 25 Year Environment Plan commits the UK Government to complete the development of natural capital accounts: the merits of placing the 25 Year Plan or the monitoring of the plan on a statutory basis are still being considered.
ZAMBIA	No
CANADA	No
COSTA RICA	No
MALAYSIA	No

5. HAS IMPLEMENTATION OF THE SEEA RESULTED IN THE ESTABLISHMENT OF NEW INSTITUTIONAL MECHANISMS AND ARRANGEMENTS? HAS THIS IMPACTED HOW THE ACCOUNTS ARE USED FOR POLICIES RELATED TO BIODIVERSITY PROTECTION OR SUSTAINABLE USE OF BIODIVERSITY? THIS MAY INCLUDE, BUT IS NOT RESTRICTED TO, FOR EXAMPLE NEW INSTITUTIONAL COOPERATION, NEW BUDGETARY RULES OR NEW POLICY-MAKING PROTOCOLS.

NETHERLANDS	No
SWEDEN	No
MEXICO	During the development of the Experimental Ecosystem Accounting, proposals and agreements have been generated with institutions interested in the project approach. For example, with the CONANP, with whom accounts were made at the level of Ramsar Sites and Natural Protected Areas. The Biofin Project (Finance for biodiversity) has been one of the projects in which the recommendations of an international initiative such as Biofin and the Aichi goals have been consolidated, together with the implementation of the SEEA-CF. The project has resulted in inter-institutional cooperation with representatives of several administrative units such as Biofin Mexico, UNDP, SEMARNAT, CONANP, CONABIO, CONAFOR, INECC, INEGI and sundries representatives in the technical group of both these institutions and other public entities, academia and the private Sector. In the same way, for the development of the Experimental Ecosystems Accounting in the country, a high-level group and a technical working group have been created with representatives from several institutions and agencies such as UNSD, GIZ, SEMARNAT, CONANP, CONAFOR, INECC, UNAM, CONAGUA, INEGI, among others, this with the purpose of broadening the project with contributions of information and opinions of experts of the environmental sector.
FRANCE	No
GERMANY	In general, the implementation of SEEA resulted in a more intensive cooperation with the German Environment Agency (UBA) and the Institute of International Forestry and Forest Economics of Thünen Institute (TI).
AUSTRALIA	The Australian Government recently finalised and published a strategy and action plan for a common national approach to SEEA-based Environmental Economic Accounting. The strategy sets out how a common national approach to the implementation of the United Nations System of Environmental-Economic Accounting will provide coherent and integrated data for decision-making by governments, business and the community. It is too early for this strategy to have had an impact on policies related to biodiversity protection or sustainable use of biodiversity, however the potential is certainly there.
COLOMBIA	In 2016 Colombia established a regulatory decree for regular production of statistical information. The policymakers recognise need of the new technical advances in environmental economic accounts, and this has been incorporated in the action plan of the institution. This need has been related with the water accounts, economic valuation of natural capital, materials flows accounts, green employments, etc.
SOUTH AFRICA	Through the development of the Land and Ecosystem Accounting in KwaZulu-Natal, and National River Ecosystem Account, there was the development and strengthening of the institutional cooperation between SANBI and Stats SA.
UNITED KINGDOM	No
ZAMBIA	No
CANADA	In the past, temporary funding to explore ecosystem accounts had led to a productive multi-department project (Measuring Ecosystem Goods and Services). StatCan and the Canadian Department of Fisheries and Oceans are working towards the development of limited Ocean Accounts, which include ocean ecosystem assets and services, which will therefore relate to marine and coastal biodiversity.
COSTA RICA	No
MALAYSIA	No

6. IS THE SEEA USED FOR OR MENTIONED IN YOUR NATIONAL BIODIVERSITY STRATEGY AND ACTION PLANS (NBSAPS) TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD)? IF SO, PLEASE ELABORATE.

NETHERLANDS	No
SWEDEN	No. We are now included in the scientific council for biodiversity IPSEP, and CBD are discussed or part of the agenda.
MEXICO	The results of SEEA Mexico are considered in several sections of the National Strategy on Biodiversity of Mexico and Action Plan 2016–2030. On the one hand, on the Strategic Axis 4. Attention to pressure Factors. The results obtained from both the measurement of the expenses in environmental protection and the estimation of the CTADA are highlighted. On the other hand, SEEA results are also mentioned in the section on the project Biofin Mexico Strategic Axis 5. Implementation of the 2016–2030 action Plan.
FRANCE	No
GERMANY	No
AUSTRALIA	Although SEEA is not mentioned, 'National biodiversity accounting' is mentioned in 'Australia's Biodiversity Conservation Strategy 2010–2030'. One of the outcomes identified in this strategy for implementing robust national monitoring, reporting and evaluation is 'an increased representation of biodiversity and ecosystem services and goods within national accounts' and action A20 in the report is 'develop a national biodiversity account, in conjunction with broader national environmental accounting and reporting systems.'
COLOMBIA	No, in Colombia the official information reported to the Convention on Biological Diversity (CBD) is the responsibility of the Research Institute of Biological Resources Alexander von Humboldt.
SOUTH AFRICA	No
UNITED KINGDOM	No. The progress in developing accounts will be referenced in 6th National Report to the CBD (including their use in managing the natural resources of the Overseas Territories).
ZAMBIA	No
CANADA	Yes. Coinciding with the requirements to meet Canada Target 17 of the 2020 Biodiversity Goals and Targets for Canada ('By 2020, measures of natural capital related to biodiversity and ecosystem services are developed on a national scale, and progress is made in integrating them into Canada's national statistical system'), Statistics Canada is working to validate and further develop the concepts and methods described in the SEEA-EEA. Since the adoption by Statistics Canada of the 'Framework for Environmental Statistics' in 2013, the agency has released new natural capital data for Canada's ecosystems in the publication Human Activity and the Environment. The publication includes data on ecosystem assets and flows of ecosystem services, analysed in the context of Canadian society. The publication presents analysis, data tables, charts, infographics and maps based on data from Statistics Canada and from other federal departments and the provinces. The publication provides useful information for policymakers and the general public, and is also used as an educational resource in school systems. In addition to releases through the above mentioned publication, data are released through Statistics Canada's publicly available online database, CANSIM (see, for example, the time series of renewable water stocks). Relevant publication include: 1) Statistics Canada, 2013, 'Measuring ecosystem goods and services in Canada,' Human Activity and the Environment, 2013, Catalogue no. 16-201-X. 2) Statistics Canada, 2014, 'What is the value of an ecosystem? Teacher's Kit for Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada,' Human Activity and the Environment – Teacher's kit, Catalogue no. 16-507-X. 3) Statistics Canada, 2014, 'Agriculture in Canada,' Human Activity and the Environment, 2014, Catalogue no. 16-201-X. 4) Statistics Canada, 2016, 'The changing landscape of Canadian metropolitan areas,' Human Activity and the Environment, 2015, Catalogue no. 16-201-X. 5) Statistics Canada, 2017, 'Freshwater in Canada,' Human Activity and the Environment, 2016, Catalogue no. 16-201-X. 6) Statistics Canada, 2018, 'Forests in Canada,' Human Activity and the Environment,2017, Catalogue no. 16-201-X.
COSTA RICA	No
MALAYSIA	No

4. Combining forces: Priority areas for collaboration

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4.1 Priority areas for Combining Forces

4.1.1 Introduction

Many approaches to natural capital in the public and private sector have been developing for some time and there is a substantial body of technical experience and expertise. However, the approaches are yet to have a significant influence on broader decision-making and are not a core part of standard management practice for business or government. One key challenge is that the various approaches have been developed quite independently, with little focus on integration or alignment[27].

In recognition of this, the 'Combining Forces' program was established to bring together the public and private sectors' thinking on natural capital (Natural Capital Coalition, 2017). The objective of Combining Forces is to foster a greater mutual understanding of different approaches to the assessment of natural capital and to co-ordinate efforts to ensure that our relationship with nature is accounted for and included in decision-making. At the core of Combining Forces is the belief that single and disparate voices on natural capital will not be sufficient to make the systemic changes in decision making that are needed. Currently, 25 organizations have pledged their support for, and are signatories to, the Combining Forces Joint Statement.

Given the significant and increasing concerns over the decline in natural capital, the moment could not be more opportune to establish clear priorities for action and to build collaborations around the way we inform the sustainable use of natural capital for the long-term benefit of people and the planet.

[27] The report was presented during the 3rd Natural Capital Policy Forum held 26 and 27 of November 2018 in Paris and is available on the NCC website: https://naturalcapitalcoalition.org/wp-content/uploads/2018/12/Combining-Forces-Priority-Areas-for-Collaboration_Print-PDF_28pg_Final.pdf

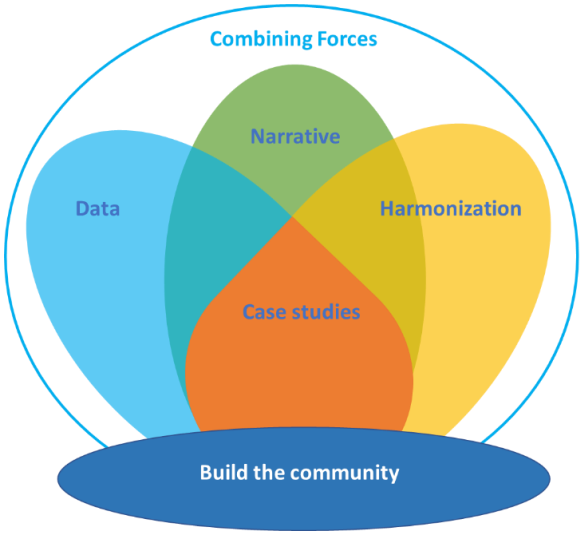
4.1.2 Five priority work areas

Informed by a consultation exercise involving workshops, webinars, interviews and a survey targeting key stakeholders from different areas of practice (see Section 4.8 Acknowledgements), this paper sets out five recommended priority areas for further work. These are opportunities for aligning approaches and collaborating on shared solutions to achieve the greatest positive impact. Although the areas highlighted by the consultation will be familiar to many, the intended focus is different from other activities already planned or underway due to the unique attention given to broad engagement across the public and private sectors as the basis for determining solutions and pathways to address the challenges.

The five recommended areas of work comprise one focused on 'process' (build the community) and four focused on 'content' (narrative, harmonization, data and case studies). Figure 4.1 shows how they inter-connect, and in particular how 'build the community' encompasses all four content-related work areas. How the work areas are to be undertaken, and by whom, is not the focus of this paper, although relevant links to existing initiatives are covered in Section 4.5.

An initial investigation period is strongly recommended to take stock of the current state of play within all five priority areas across the private and public sectors. This should then inform the design of a subsequent, more comprehensive work program, creating a set of key outputs. As further explored in Section 4.2, the final intended outcome is for broadly understood and coordinated natural capital approaches across private and public sectors that drive more efficient and effective decision-making about natural capital.

Figure 4.1. Overview of recommended priority areas



1. **Build the community: Further develop the ongoing integrated dialogue on natural capital.** More time and opportunities are needed to connect those people undertaking and developing public and private natural capital approaches, and in particular those working on the four content-focused priority areas. This should include engagement through other groups such as Green Economy initiatives, the international development community and infrastructure industries, all of whom are recognizing the benefits of a natural capital approach. Initial efforts should involve documenting existing fora and groups, supporting the development of effective networks and Communities of Practice to deliver the outputs of each area, and using these connections to ensure full coverage of the necessary issues. Subsequent efforts should then focus on coordinated implementation.
2. **Narrative: Jointly further investigate, promote and enhance the case for natural capital approaches and combining forces**. Current incentives and requirements for natural capital approaches are generally relatively weak for both the private and public sectors, although they are becoming stronger. Initial efforts should work with the Government Dialogue on Natural Capital that includes a stream of work to develop a positive narrative on natural capital. This priority area should then develop and roll out a strong communications story, highlighting: (i) where the justification for action is strongest, and (ii) how the actions and initiatives for undertaking a natural capital approach should best be strengthened. This is true for both public and private sectors. The narrative should highlight the need for joint management of shared dependencies on natural capital, in particular at a landscape level.
3. **Harmonization: Identify and detail what is needed to further harmonize approaches and develop standards.** An over-riding aim for the Combining Forces program is that private and public sector approaches and standards are better aligned to support integrated decision-making. Initial efforts should involve further investigation of existing draft and planned natural capital approaches and standards in more detail. These approaches include, for example, the System of Environmental-Economic Accounting (SEEA) (especially the Experimental Ecosystem Accounting, EEA), the Natural Capital Protocol, relevant International Organization for Standardization's ISO standards, Environmental Profit & Loss accounts (EP&Ls), corporate natural capital accounts[28] (CNCA), environmental balance sheets, the International Integrated Reporting Council framework, and relevant legislation (such as European Union Directives relating to non-financial reporting and environmental impact assessments). It should also explore how these approaches inter-relate and where greater synergies and alignment are most needed. Subsequent efforts should then explore and recommend what specific aspects should be aligned, what gaps need to be filled, and how best to implement the necessary changes.

[28] A specific natural capital balance sheet-based approach developed by the UK's Natural Capital Committee for landholding organizations.

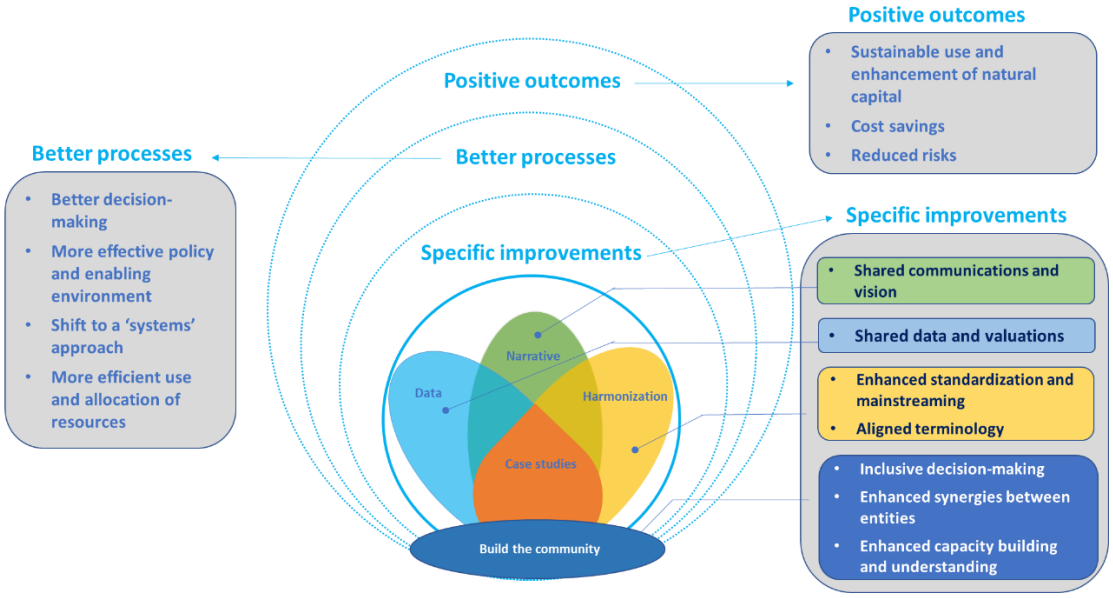
4. **Data: Clarify data needs, map data availability, streamline data collection and enhance data accessibility**. Data is at the heart of implementing all natural capital approaches, and considerable efficiencies and cost-savings could be made through more streamlined and coordinated data collection and provision. This is especially the case in relation to application of emerging sources such as remote sensing data, big data and use of artificial intelligence and machine learning. Initial work should involve reviewing and assimilating what we currently know about joint data issues and requirements, in particular drawing upon the case studies undertaken to date, the Natural Capital Coalition's Data Information Flow project, and findings of the initial stages of the other recommended work areas. Subsequent efforts should then investigate and report in more detail around joint data needs, availability, use of tools such as Integrated Valuation of Ecosystem Services and Trade-offs (InVEST) and Artificial Intelligence for Ecosystem Services (ARIES), as well as collection processes, data accessibility and governance.
5. **Case studies: Review and expand the case study program**. To fully understand the synergies, differences, benefits of, and needs for enhanced alignment between private and public-sector accounts, a more comprehensive suite of case studies is needed. An initial step should be to assimilate case study findings to date and identify key gaps that need filling, in part being informed by what comes out of the initial stages of the other recommended work areas and investigating finer details. Subsequent efforts should be to fill the gaps, in particular covering the potential for integration at a landscape level and should result in a complete set of accessible and informative cases that show detailed similarities and differences. Recommendations from these should then feed into the other recommended work areas.

This paper provides a starting point for describing the priority areas listed above, but it is clear from the consultation process that informed this paper that a more thorough and systematic joint scoping process is needed to take stock of existing efforts and review overall needs from both a private and public-sector perspective. The early stages of the Combining Forces program have highlighted that there is a significant gap in the understanding of different approaches that must be bridged. It is expected that the initial efforts will fine-tune the specifics for subsequent work required to deliver outputs across the recommended priority areas.

4.2 The benefits of Combining Forces

Continued and enhanced collaboration between the private and public sectors to better align actions on natural capital approaches will generate multiple benefits. These benefits are summarized in Figure 4.2 and are reflected in a set of specific improvements, better processes and positive outcomes each related to advancement of the Combining Forces program. They would arise through building upon the synergies and closing the gaps described in Section 4.3.

Figure 4.2. Benefits of the Combining Forces program



4.2.1 Specific improvements

We propose that advancing in the five priority areas will result in a variety of specific improvements, including:

- **Shared communications and vision.** Greater reach and comprehensiveness of engagement both within the natural capital community and more broadly, should be possible through jointly developed common language and narrative. Developing a shared vision of success early on will help inform alignment of approaches and all other work areas.
- **Shared data and valuations.** Opportunities to share data and jointly commission data collection and valuation studies could lead to significant cost-efficiencies and avoidance of duplicative efforts. Harnessing the particular strengths of both the private and public sectors should reap further dividends in moving forward on this challenging issue.
- **Enhanced standardization and mainstreaming.** More aligned approaches will promote further standardization and allow better comparison through enhanced consistency. This should encourage and facilitate both consistent government and business decisions and reporting and disclosure on the nature and value of natural capital impacts and dependencies.
- **Aligned terminology.** Collaboration and alignment will help improve consistency in the use of terms, explain why differences in terminology exist and promote exchange of data and ideas. Amongst other things this may ease company survey response burden and establish common data requirements stimulating commercial and public data supply.

- **Inclusive decision-making.** Combining Forces can provide an opportunity for other groups that are not always included, such as indigenous communities, to be heard.
- **Enhanced synergies between entities.** Combining Forces can help identify and enhance synergies within and between different entities. This is true for both the private and public sectors, and can result in multiple efficiencies, cost savings and realization of opportunities.
- **Enhanced capacity building and understanding.** Greater collaboration should lead to a better understanding of many of the complex issues involved, and significant opportunities for shared learning. The collaboration is also a safe space for testing ideas and provides a good opportunity to learn from each other. Various challenging topics such as determining and setting of natural capital thresholds (i.e. acceptable limits of change) would benefit from joint insights provided by both the public and private sectors.

4.2.2 Better processes

These improvements will help create better processes around public and private sector management of natural capital. The better processes include:

- **Better decision-making.** As mentioned by many stakeholders during the consultation, the specific improvements should result in overall better approaches to, and a stronger evidence base for, decision-making.
- **More effective policy and enabling environment.** The improvements should lead to better and more effective policy development and implementation, as well as enhanced enabling conditions. The latter include the much-needed and stronger incentives and regulatory mechanisms to make it more worthwhile (financially and otherwise) for companies and governments to adopt practices that support more sustainable use of natural capital.
- **Shift to a 'systems' approach.** The improvements will also encourage and facilitate a more widely adopted and much needed paradigm shift towards a 'systems approach' to environmental management at a local, landscape and national level. The Combining Forces program should be a powerful catalyst to help to drive a common language and appropriate framing for this shift.
- **More efficient allocation and use of resources.** Furthermore, the specific improvements should result in more efficient allocation, use of, and development of both organizational resources and natural capital resources. The former would, for example, arise through streamlining and sharing of data and use of standard training and capacity building approaches. The latter would arise from making better decisions about who should use natural capital resources and in what way, to broaden benefits to a range of different stakeholders.

4.2.3 Positive outcomes

Effective implementation across the five priority areas should ultimately result in a range of positive outcomes generated through the specific improvements and better processes. This includes more sustainable use, and the enhancement of, natural capital over the long term. In addition, it would likely lead to cost savings and reduced risks for both the private and public sectors in the short term and, perhaps more significantly, in the longer term. Indeed, the costs of inaction are likely to be far greater.

4.3 The relationship between approaches

The relationship between private and public sector natural capital approaches has been the subject of a various investigations[29]. These reveal many and varied synergies and gaps between private and public sector natural capital approaches[30]. An initial set of approaches are shown in Figure 4.3 which highlights the relationships among some of the key frameworks and approaches. These approaches are also summarized in Table 4.1, with relevant synergies and gaps described further below.

4.3.1 Inter-relationships and comparison of approaches

At a very broad level, natural capital approaches for the private and public sectors can be used in two main ways. On the one hand, some approaches are used primarily[31] for compiling accounts, reporting and disclosure and undertaking comparisons over time. The latter can be within and across companies, sectors and countries. On the other, some approaches are used primarily for internal decision-making, for example in making choices between alternative scenarios. Both applications can be termed as 'natural capital assessments', whilst the former is also commonly referred to as 'natural capital accounting'.

One of the findings of previous work is that bigger differences have emerged among approaches related to the use for accounts, reporting and disclosure, whereas the approaches adopted for decision-making show greater similarities (Spurgeon, 2015).

[29] Including for example Obst (2015), Spurgeon (2015), Vardon *et al* (2016), IDEEA Group (2017), Natural Capital Coalition (2017), Vardon *et al* (2017a and 2017b) and in the recent Government Dialogue work.

[30] Multiple tools also exist for private and public sector use (e.g. Input-Output analysis, InVEST), but these are not reviewed here. The Natural Capital Toolkit references a range of relevant tools.

[31] It is important to note that potential uses of accounts/disclosure can also include informing decision-making. For example, financial accounts are used for decisions by investors and internally by companies, and government environmental accounts can be used to inform a broad range of decisions.

The aim of the Combining Forces program is to identify ways in which approaches from both sectors and for different primary purposes can benefit each other, thus breaking down the distinctions inherent in the figure, by focusing on complementarities.

The transitional blue shading in Figure 4.3 indicates that whilst the Natural Capital Protocol is primarily focused on private sector decision-making, it is also applicable to private sector accounting and disclosure. In addition, it can potentially be used in a public decision-making context. Similarly, the blue shading for the System of Environmental Economic Accounts indicates that it very much applies to government reporting, but it also has strong potential application to private sector accounting and disclosure and can play a role in internal decision-making, especially in a public sector context.

Accounting/disclosure

These approaches equate closely with 'financial accounting' and the 'System of National Accounts'. These approaches typically look at stocks of natural capital comparing two points in time (e.g. balance sheets and asset accounts) and record the changes in stocks between the two points in time and the associated flows of services and benefits (e.g. Environmental Profit & Loss accounts and ecosystem service supply and use accounts).

Key desirable features include repeatability and consistency to allow for comparison (e.g. between years, companies or countries) and assessment of performance and outcomes over time. As such, there is considerable benefit to be gained from consistency, so standardization of definitions, measurement boundaries (e.g. of assets and income) and rules around valuation is of very high importance.

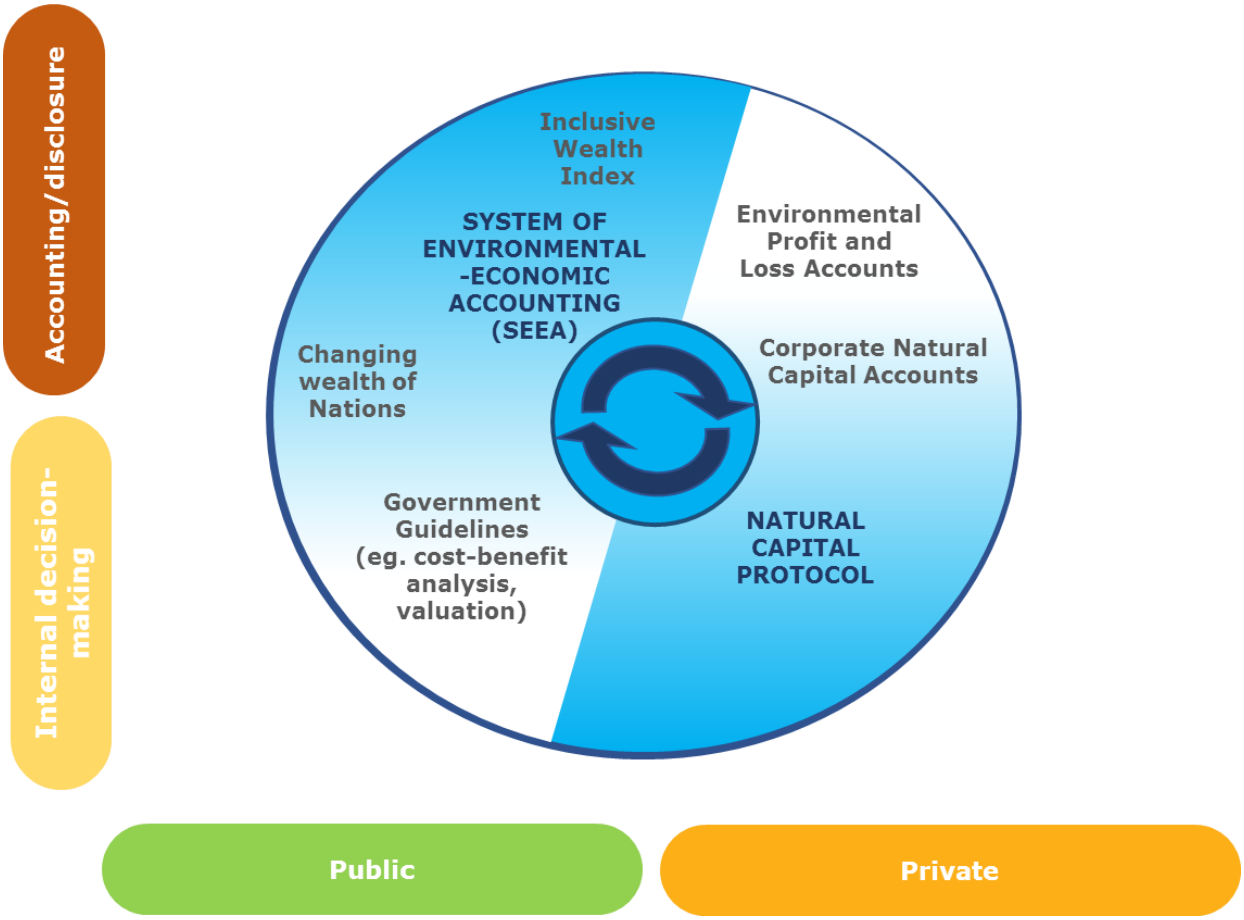
Internal decision-making

These approaches equate closely to 'management accounting' and approaches for 'option/investment appraisals'. In the private sector, the Natural Capital Protocol (hereafter the 'Protocol') has been developed specifically to support companies to include their relationship with natural capital within decision-making through a non-prescriptive, process-based approach. In the public sector, there are numerous government guidelines and manuals setting out different approaches for incorporating the environment and natural capital in policy decisions, for example in cost-benefit analyses (e.g. OECD, 2006; HM Treasury, 2013; and OECD 2018). There is less need for a prescriptive and consistent approach between organizations when undertaking such assessments, as long as the best decision is made. Given the vast spectrum of potential internal decisions to be made in so many different contexts, the critical issue here is that measurement boundaries and approaches to valuation simply need to be 'fit for purpose'.

Key desirable features thus include flexibility while sticking to key principles. However, there are benefits from having consistency to techniques and approaches within decision-making, as evidenced

by the existence of many guidelines and books on management accounting and environmental valuation techniques. When trying to demonstrate 'creating shared value' or when managing shared dependencies, transparency and standardization of approaches would certainly be beneficial, especially in the eyes of stakeholders

Figure 4.3. Inter-relationships between natural capital approaches



The ideal end point is that the information created through natural capital approaches is useful and in this respect it will be important to establish where there is most need for consistency, and where it makes sense to retain flexibility. As with standardization of financial accounts, there will likely be continuous updates and adjustments required, but progress requires making the first step. Efforts to harmonize assessment of environmental costs and benefits and associated monetary valuation at an international level covering the private and public sector have already begun through the draft development of ISO 14007 and 14008 with a focus on describing flexible, process-based approaches, including delineation of potential valuation options.

Table 4.1. Frameworks for natural capital assessments for private and public sectors

Framework/ Approach		Type	Leading organizations	Objective	Content and focus	Valuation approach
Public Sector						
System of Environ-mental-Economic Accounting (SEEA)	SEEA Central Frame-work	Primarily accounting/disclosure	United Nations; European Commission; Food and Agriculture Organization; Organization for Economic Development & Cooperation; International Monetary Fund; World Bank Group	To develop sets of accounts that complement standard economic accounts and inform on the relationship between the economy and the environment.	A prescriptive international statistical standard to develop sets of four linked accounts covering: • Environmental flows (natural inputs, products & residuals); • Stocks of traded environmental assets (mineral & energy, land, soil, timber, aquatic, other biological & water); • Economic accounts showing links with national accounts • Environment related expenditures. These accounts are linked to the System of National Accounts.	Residuals (i.e. pollutants) measured in physical terms. Exchange[32] values for all other values and costs. Includes expenditures.
	SEEA Experimental Eco-system Accounting (EEA)[33]	Primarily accounting/disclosure	United Nations; European Commission; Food and Agriculture Organization; Organization for Economic Development and Cooperation; and World Bank Group	To complement the SEEA Central Framework by adding information on: - Ecosystem extent & condition and biodiversity, - Non-market ecosystem services and associated values.	A prescriptive international statistical standard to develop sets of five linked accounts covering: • Ecosystem extent, • Ecosystem condition, • Ecosystem services, • Monetary ecosystem assets, • Thematic accounts (land, water, carbon and biodiversity) These accounts can be developed at any geographic scale.	Ecosystem elements measured in physical terms. Exchange values (even for valuing non-monetary transactions of ecosystem services). Welfare values[34] also used depending on the purpose of analysis.

[32] Exchange values can be defined as *'the current transaction values or market prices for the associated goods, services, labor or assets that are exchanged*. (UN et al, 2014a). Exchange values can be estimated for non-monetary transactions based on prices that would apply if a market had existed.

[33] Revised EEA due in 2020

[34] Welfare values can be defined as '*The total (or gross) economic gain associated with the quantities of a product that are transacted. They include both the consumer and producer surplus. The concept of welfare economic value differs from that of exchange value as a result of the inclusion in the former of consumer surplus'*. (UN et al, 2014b).

Inclusive Wealth Index	Accounting /disclosure	UN University & United Nations Environment Programme (UNEP)	To measure sustainability of country's growth. Going beyond GDP by including welfare values of changes in three capitals.	A prescriptive methodology to develop integrated country accounts covering three capitals: (i) Produced capital, (ii) Human capital and (iii) Natural capital. Natural capital includes: • Agriculture. • Timber & non-timber forest resources. • Fisheries. • Fossil fuels. • Metals and minerals. Periodic series available since 1990 (to 2014) for 140 countries.	Mainly exchange values but also welfare values (for non-timber forest products and for carbon adjusted damages).
Changing Wealth of Nations	Accounting/disclosure	World Bank Group	To measure sustainability of country's growth. Going beyond GDP by including welfare values of changes in four assets. (three capitals).	A prescriptive methodology to develop integrated country accounts covering four assets: (i) Produced capital, (ii) Human capital, (iii) Natural capital and (iv) Net foreign assets. Natural capital includes: • Sub-soil assets (fossil fuels, minerals) • Agricultural land. • Protected areas. • Forests (timber and some non-timber forest products). Annual and periodic series available since 1995 (to 2014) for 141 countries.	Exchange values mainly but welfare values used for protected areas (proxy values) and non-timber forest products.
Government cost-benefit and environmental valuation guidelines	Decision-making	National government departments	Guidance on how to incorporate natural capital impacts in project & policy appraisals.	Typically includes methodology and process guidance covering areas, such as cost-benefit analysis and environmental valuation.	Welfare values and/or physical units.
Private sector					
Natural Capital Protocol	Primarily for decision-making. Can inform accounting/disclosure	Natural Capital Coalition	Standardized framework for businesses to measure & value natural capital impacts & dependencies	Non-prescriptive process-based guidance covering four stages: • Why? (Frame) • What? (Scope) • How? (Measure & value) • So what? (Apply)	Exchange and/or welfare values.

				Covers impacts and dependencies.	
Environmental Profit and Loss Accounts	Primarily for accounting /disclosure. Can inform decision-making	Various companies & consulting firms[35].	To show the true value to society of a company's annual environmental impact.	Currently a non-prescriptive framework typically covering: • Carbon emissions • Water use • Water pollution • Land use • Air pollution • Waste	Welfare values
Corporate Natural Capital Accounts	Primarily for accounting/disclosure. Can inform decision-making	UK government's Natural Capital Committee	Supports land owners to assess & record the extent & value of natural capital assets & costs to maintain them.	Prescriptive method to build a balance sheet account, including: - Natural capital asset register (assets, size and condition) - Physical flow account - Monetary accounts - Maintenance cost account	Identifies exchange values to the company and welfare values to society Includes expenditures
Draft frameworks					
Draft ISO 14007[36] Environmental management: Determining environmental costs & benefits. Final due out 2019	Primarily decision-making. Can inform accounting/disclosure.	International Organization for Standardization (ISO)	Guidance for organizations for assessing environmental costs & benefits of impacts & dependencies.	Will address environmental aspects, impacts and dependencies of the activities, products and services an organization determines are to be included among its environmental costs and benefits.	Exchange and welfare values.
Draft ISO 14008[37] Monetary valuation of environmental impacts & related environmental aspects. Final due out 2019	Primarily decision-making. Can inform accounting/disclosure.	International Organization for Standardization (ISO)	Guidance for organizations on principles and requirements for monetary valuation of environmental impacts.	Will provide a framework that includes principles, requirements and guidance for established methods of monetary valuation of environmental impacts and related environmental aspects.	Exchange and welfare values. Focuses on valuation rather than costing methods.

[35] The luxury good company Kering was the first to publish a detailed Environmental Profit and Loss Account in 2013 (for PUMA), the methodology for which has since been made publicly available for other users (Kering, 2016).

[36] These ISO Standards are excluded from Figure 3 because they are still being drafted and have yet to be made publicly available.

[37] As per note above.

4.3.2 Synergies and differences in approaches

Natural capital approaches adopted by the private and public sectors share a number of important synergies with considerable potential to be further harnessed. At the same time, they also have several key differences, some of which could be resolved, whilst others should justifiably be retained. In some cases, synergies and differences can relate to the same topic. A selection of synergies and differences identified through the consultation and review process are described in the boxes below.

Box 4.1. Synergies in natural capital approaches

Objectives. Ultimately, both private and public sectors undertaking natural capital assessments have a common goal to better understand natural capital impacts and dependencies and to incorporate these understandings in improved decision-making – to ensure more sustainable use of natural capital. The most closely aligned private and public sector approaches in terms of methodology and outputs are Corporate Natural Capital Accounts and UN Experimental Ecosystem Accounting, which both attempt to develop accounts detailing habitat asset area, extent and associated environmental values. Linked to this asset-based approach is the increasingly recognized common objective to use natural capital approaches at a landscape level to inform the management of shared natural capital dependencies (e.g. water).

Data needs. Potentially significant synergies exist between the type of data available and used by both businesses and governments. This topic deserves greater investigation to explore how useful it may be, especially in terms of government accounts, potentially drawing upon on an aggregation of business level data. Localized spatial data is where most synergies may perhaps exist, in particular in relation to Corporate Natural Capital Accounts, the ecosystem accounting component of UN System of Environmental Economic Accounting and landscape level assessments.

Valuation approaches. Both public and private sectors use a variety of valuation techniques to attempt to value natural capital. 'Exchange' and 'transaction' valuation approaches used in public sector approaches are the same or similar to 'financial' or 'private/business' values used by the private sector, as covered in the Protocol. The range of welfare valuation techniques used is typically the same in both private and public decision-making approaches that incorporate welfare values, i.e. social costs and benefits, for example in extended Cost Benefit Analysis.

Communication goals. Considerable synergies exist for private and public sectors to jointly communicate the importance of adopting a natural capital approach. This includes the need to enhance natural capital stocks to maintain flows of benefits and the advantages of using a value-based approach that accounts for context. Aligned terminology would certainly help in this respect.

Box 4.2. Differences in natural capital approaches

Objectives. Whilst the ultimate objectives are typically the same (see above), some differences in objectives exist too. The public sector tends to be more interested in stocks of assets whereas the private sector has tended (to date) to be more focused on assessing their impacts on natural capital (both direct operations and along the value chain).

Type of value assessed. Public sector natural capital accounts following the SEEA adhere to using 'exchange' values for monetary valuation to support integration into standard economic accounts, while, in theory, wealth accounting approaches use shadow prices that incorporate social costs and benefits. Most private sector natural capital accounts tend to focus on welfare values, for example in Environmental Profit and Loss accounts, although both welfare and exchange values are accommodated in Corporate Natural Capital Accounts.

Terminology. There are many examples of different terms and definitions used in the different approaches (e.g. use of 'residuals' vs 'impact drivers' or 'business outputs' and the terms 'natural capital' vs 'environmental assets'). What is needed here is a systematic assessment of terms used, guidance on any differences, and recognition of which terms need greater harmonization in the future.

Geographic and organizational scope. Public sector accounts are usually applied at a national level, but in principle can be applied at a sector, state, city, borough, catchment or site (e.g. protected area) level. Private sector accounts are often applied at an organization, supply chain, project and/or product level thus potentially take into account sites and impacts across countries. Generally, although not commonly perceived, public and private sector approaches can usually be applied to whatever scale is desired.

Other differences. These include the degree of prescriptiveness, for example, both the System of Environmental Economic Accounting and Corporate Natural Capital Accounts have standard definitions and measurement boundaries, whilst the Protocol and Environmental Profit and Loss accounts are much more flexible (the latter having no specific prescriptive guidance available yet, although this may change in coming years). Also, the private sector tends to focus more on business specific topics, whereas the public sector generally takes a broader perspective since it must consider a range of views. Potentially, a key role of public sector accounts may be to help businesses understand what issues may be most material in their context (e.g. providing information to farmers in a catchment that there are issues around water scarcity or concerning climate change effects).

4.4 Key challenges and opportunities

The consultation identified a number of challenges and opportunities associated with the Combining Forces program. Characterization of the key challenges and opportunities has been used to inform the recommended work areas. Table 4.2 sets out how each of the five work areas both deal with the challenges and harness the opportunities.

Table 4.2. Challenges and opportunities that the Priority Areas cover

Area	Challenges	Opportunities
Build the community Further develop the ongoing integrated dialogue on natural capital.	• **Crowded space.** It is a large and growing space with so many new initiatives. • **Silos.** Existing communities can be siloed, not interact, and be skeptical of each other. • **Weak business incentives.** It can be difficult to engage businesses on the topic – especially as there is a lack of incentives for them to do so.	• **Cross learning.** Communities of Practice to cover different topics (e.g. leveraging government statistics community's experience on concepts and definitions) • **Business input.** Needed to help mainstream public accounts and make them more business relevant. • **Closer global connections.** To initiatives such as IPBES[38]. • **Grow capacity**. There is a current lack of technical capacity which could be addressed through joint efforts.
Narrative Jointly further investigate, promote and enhance the case for natural capital approaches and combining forces.	• **Weak incentives.** Weak current enabling environment and lack of incentives for businesses to better manage impacts on. • **Conflicting terminology.** Disagreement around terminology. • **Different interests.** Different core interests (e.g. public sector for welfare, private sector for profits). • **Lack of understanding of interests.** The different sectors don't fully understand each other's interests (e.g. around motivations and shared benefits).	• **Identify workable incentives.** Mutually agreeable and workable incentives and regulations both sectors can support. • **Enhance key links**. Build on interest in climate change, resource scarcity, biodiversity decline, circular economy, plastic pollution, Sustainable Development Goals and sustainability risk assessments. • **Raise awareness of uses.** How natural capital assessments can be used. • **Leverage dependency angle.** Focus on dependencies for both public and private sector to clarify beneficiaries and inform better incentives for ecosystem management.
Harmonization Identify and detail what is needed to further	• **Early stages.** Discussions about standardization are at an early stage.	• **Draw knowledge from UN System of Environmental Economic Accounting (SEEA).** The UN SEEA has significant technical detail to offer to support harmonization.

[38] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

harmonize approaches and develop standards.	• **Lack of systematic approach.** Research to look across the different approaches and particularly at the connecting aspects. • **Multiplicity of approaches.** Many different approaches, techniques and applications. • **Weak business incentives.** Investor interest is gaining traction and will help incentivize businesses, but businesses still perceive weak incentives to engage.	• **Design systematic approaches**. There is scope to harness UN processes to work towards standardization. • **Capture many benefits.** Much potential to gain efficiency and effectiveness through increased standardization. • **Use learnings from business.** Potential for learning from businesses (e.g. simple processes and guidance, and how to apply the concept of 'ecosystem thresholds').
Data Clarify data needs, map data availability, streamline data collection and enhance data accessibility.	• **Variability of data volume.** Lack of relevant data available on some things, and too much on others. • **Accessing data.** Finding and accessing existing data, including issues around cost of collecting and obtaining data, and data confidentiality. • **Extensive data requirements.** So much potential data needed e.g. spatial, hydrology, biodiversity, toxicity.	• **Partnerships.** Potential for forming partnerships to collect data and undertake research jointly. • **Leverage government research**. Capitalize on extensive government research on economic development and encourage interest in natural capital. • **Efficiency gains**. Gain in efficiencies and save costs through shared data work and undertaking of meta-data analysis to make data more useful to others. • **Better sharing of existing data.** Investigate and make more data available on private sector environmental expenditures and in general on environmental values.
Case studies Review and expand the case study program.	• **Breadth of topic.** So many different potential approaches, scales and organizational aspects to cover.	• **Partnerships.** Develop public-private partnership pilots at national and sub-national levels and link to Green Economy. • **Potential for landscape approach.** Investigate how natural capital accounting can assist landscape approaches for public and private benefit through evaluating and managing shared dependencies on natural capital. • **Various other potential roles.** Use cases to investigate private sector environmental expenditures, explore links to the Sustainable Development Goals, and communicate the benefits and challenges of natural capital approaches.

4.5 Links with existing initiatives

To ensure implementation of the priority work areas is effective and worthwhile, it is essential to avoid duplication of effort and to co-ordinate with related initiatives - collaborating where appropriate and practicable. As such, potential links the work areas have with other existing initiatives are set out below. This in particular includes links with the Government Dialogue where some obvious synergies exist.

Build the community: Further develop the dialogue on natural capital.
This work area will need to leverage the many difference initiatives around the world including the green economy community. It will link through the Coalition's regional platforms, the EU Horizon 2020 programs on private and public sector natural capital accounting, the Government Dialogue and World Bank and UN work on natural capital and wealth accounting, as well as the Platforms for Business and Biodiversity Partnership of the Convention on Biological Diversity. The Natural Capital Coalition, as the home of the natural capital movement, is a focal point to bring this learning together.

Narrative: Jointly further investigate, promote and enhance the case for natural capital approaches and combining forces.
This work stream should work with the existing Government Dialogue Narrative Workstream, which is focusing on the need for a positive natural capital narrative to capitalize on the enormous potential the natural capital concept has to accelerate and guide transformative economic changes. A key question will be whether to develop a separate broader narrative, a single unified narrative, or one narrative with adaptations depending on the audience.

Harmonization: Identify and detail what is needed to further harmonize approaches and develop standards.
This work area should work with and build on the Government Dialogue Accounting Workstream, which is focusing on the links between natural capital accounting being undertaking by governments and the private sector. It should also involve close liaison with the various financial standard setters such as Financial Accounting Standards Board (FASB), International Financial Reporting Standards (IFRS) and the International Accounting Standards Board (IASB) as well as sustainability standard setters such as Climate Disclosure Standards Board (CDSB), Sustainability Accounting Standards Board (SASB), International Integrated Reporting Council (IIRC), Global Reporting Initiative (GRI), and others such as the Reporting 3.0 initiative, Corporate Reporting Dialogue and International Organization for Standardization (ISO). There are also links with the work of the UN Statistics Commission in terms of statistical standards, in particular the System for Environmental-Economic Accounting, and in relation to Sustainable Development Goals indicators.

Data: Clarify data needs, map data availability, streamline data collection and enhance data accessibility.

This work area should involve working closely with the ongoing collaborative projects being run through the Natural Capital Coalition including the Data Information Flow project and the supplementary information being developed on Biodiversity. This will avoid duplication of effort and jointly leverage resources. Connections should also be made with the many relevant European Union projects such as: Mapping and Assessment of Ecosystems and their Services (MAES), Knowledge Innovation Project – Integrated Natural Capital Accounting (KIP-INCA), Operational Potential of Ecosystems Research Applications (OPERAs), Operationalization of Natural Capital and Ecosystem Services (OpenNESS) and Enhancing Ecosystem Services Mapping for Policy and Decision Making (ESMERELDA), as well as the Group on Earth Observation (GEO) initiatives such as Earth Observation for Environmental Assessment (EO4EA), and the many other modelling initiatives such as Integrated Valuation of Ecosystem Services Trade-offs (INVEST), Artificial Intelligence for Ecosystem Services (ARIES) and the NatCap[39] Project of Stanford University.

Case studies: Review and expand the case study program.

This work area should involve reviewing and expanding case studies and pilot studies from the existing Government Dialogue on Natural Capital (both Narrative and Practice Workstreams). In addition, it should review case studies developed as part of the International Finance Corporation/Natural Capital Coalition Country Level Assessments, the ongoing EU-funded UN project on Natural Capital and Valuation of Ecosystem Services, the World Bank Wealth Accounting and the Valuation of Ecosystem Services (WAVES) Partnership, Conservation International's Ecosystem Values and Accounting (EVA) project as well the array of country and regional initiatives. The Natural Capital Hub, which is the central global repository for private-sector case studies and which also provides links to other repositories hosted across the community, will be a key resource.

Who should be involved?

Involvement of the private (business and finance) and public sectors, as well as members of non-government organizations, academia, consultants, international organizations and standard setters, in the alignment process is critical to ensure joint ownership of the outcomes and to ensure a richness of inputs.

4.6 Next steps

Having identified five priority areas for action, the Combining Forces program now needs to scope out how each of these areas should best be developed. As mentioned, this will include

[39] Natural Capital

taking stock of ongoing initiatives, reviewing existing materials in more detail and developing a suitable collaborative plan for furthering each area, working together with, and leveraging, existing initiatives. A focus must be placed on securing regular and tangible outputs to continually reinforce the possibilities and recognize that we must build on and connect the broad, if disparate, set of natural capital approaches that exists.

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This study has been undertaken through the following organizations on behalf of the Natural Capital Coalition:

Sustain Value is a UK based natural and social capital consultancy firm established in 2011. We specialize in helping businesses identify, value and manage environmental and social impacts and dependencies. We provide highly cost-effective support to clients throughout the world, operating through a flexible global network-based structure drawing upon a diverse range of independent experts and researchers. All projects are led by James Spurgeon, who has 25-years' experience valuing environmental and social issues for clients in different sectors in the UK and internationally.

IDEEA Group is committed to building the capacity of governments, businesses and the community in environmental-economic accounting and specialize in the development and implementation of the UN System of Environmental-Economic Accounting at business, regional and national scales. We improve the understanding of how people and society connect to the environment by integrating information about ecosystems and natural capital into their choices and decision making.

ICAEW is a world leading professional membership organization that promotes, develops and supports over 178,500 chartered accountants and students worldwide. We provide this community of professionals with the power to play its part to build and sustain strong economies. Training, developing and supporting accountants throughout their careers, we ensure they have the expertise and values to meet the needs of tomorrow's businesses. Our profession is at the heart of the decisions that will define the future, and we contribute by sharing our knowledge, insight and capabilities with

others. That way, we can be sure that we are helping to build robust, accountable and fair economies across the globe.

The **Natural Capital Coalition** is a unique global multi-stakeholder collaboration that brings together leading initiatives and organizations to harmonize approaches to natural capital and grow a supportive enabling environment for natural capital thinking. The Coalition represents almost 300 organizations.

5. Natural capital for governments: what, why and how

Martin Lok, Ministry of Agriculture, Nature and Food Quality, Netherlands
Emily Benson, Green Economy Coalition
Mark Gough, Natural Capital Coalition
Sofia Ahlroth, The World Bank
Oliver Greenfield, Green Economy Coalition
Joseph Confino, Natural Capital Coalition
Wouter Wormgoor, Ministry of Foreign Affairs, Netherlands

5.1 Introduction – What is natural capital?

This paper explains what natural capital is, why it is relevant for governments, and how they can act on it[1]. It is written to clarify and demonstrate the opportunities of implementing natural capital approaches in different policy areas. Four key messages stand out:

1. Wealth and wellbeing depend on natural capital
2. Natural capital generates environmental, economic and social returns that contribute to achieving policy ambitions, providing that policy is managing trade-offs between those returns
3. Governments have seven levers to maximize the returns that natural capital delivers
4. Many governments already support natural capital approaches to support their ambitions and contribute to achieving SDGs

This paper is written to inform policy makers in diverse areas, ranging from planning and economy to development and labour, what opportunities natural capital approaches can deliver to improve their decisions. The paper builds on experiences of countries from all regions in the world and is developed with senior policy decision makers working in different contexts on a wide area of topics in mind, ranging from planning, economic development and finance to industry policy and more. Therefore, this paper is purposely generic, and presents the arguments for the relevance of natural capital in different contexts, that can be adapted later to more specific audiences if necessary.

[1] This report was presented during the 3rd Natural Capital Policy Forum held 26 and 27 of November 2018 in Paris. The final version of the report is available on the NCC website: https://naturalcapitalcoalition.org/wp-content/uploads/2019/02/GDNC2018-005-WS3-Natural-capital-for-governments-Final-28-02-2019.pdf

5.1.1. Managing 'capitals' is the frontline of government leadership in the 21st century

In increasingly globalized systems our national economies face increasing systemic risks[2] but also new opportunities. Risks today stretch further and further beyond our own borders. Deforestation in the Amazon is disrupting rainfall in the USA[3] and global climate change is likely to trigger more extreme weather events around the world.[4] Equally, opportunities are emerging as our economies respond to resource scarcity. For example, the global green bond market is set to reach US$ 250 billion by the end of 2018.[5] And Philippines mangroves prevent damages to homes and industry to a value of more than US$ 1 billion annually.[6] Grasping these new opportunities while also managing the risks is the frontline of leadership in the 21st century.

Meeting national and global ambitions requires us to manage a range of assets or 'capitals'[7] at the same time, short- and long-term. That includes our material goods, infrastructure and revenue (Financial/Physical capital), our communities and workforces (Social/Human capital), and our natural resources, ecosystems and ecosystem services (Natural capital, see Box 5.1).

Box 5.1 What is natural capital?

Natural capital is another term for the stock of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, minerals) that yield a flow of benefits to people. The broad range of services provided by natural capital include food, water, energy, shelter, medicine, and the raw materials we use in the creation of products. It also provides less obvious services such as clean air, flood defence, climate regulation, pollination and recreation**.** [8] Ecosystem services are the multiple benefits we derive from well-functioning ecosystems and describe our critical dependence on nature for our basic needs, wellbeing and prosperity that natural ecosystems create.

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[2] For example, see the World Economic Forum (WEF) Global Risks Report 2018: https://www.weforum.org/reports/the-global-risks-report-2018

[3] https://e360.yale.edu/features/how-deforestation-affecting-global-water-cycles-climate-change

[4] http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=354

[5] https://www.bloomberg.com/professional/blog/blossoming-green-bond-market-growing-toward-250-billion-year/

[6] Similarly, studies in France show that investing in coral reefs as a means of protecting coastal flooding is worth 600M€/year in oversea territories (Report here, p. 5 (In French)

[7] We follow the International Integrated Reporting Council, that identifies six different capitals. See: http://integratedreporting.org/what-the-tool-for-better-reporting/get-to-grips-with-the-six-capitals/

[8] https://naturalcapitalcoalition.org/natural-capital/

5.1.2 Natural capital is essential for achieving wealth and wellbeing.

Evidence now shows how essential natural capital is for all aspects of an economy. Even by conservative estimates, in low income counties natural capital accounts for up to 50% of national wealth while in high income non-OECD countries it amounts, on average, to 30% of their wealth[9]. Yet, traditional measures of progress such as GDP fail to show this underpinning value of natural capital to an economy.

Using the concept of natural capital helps to make the underpinning value of our natural resource base visible for decision makers. Natural capital accounting and assessments (see Box 5.2) provide a strategic lens for taking responsibility for the connections between the economy and our environment, equipping us with a sustainability metric fit for the 21st century. Information on the state of natural capital provides important practical information for evaluating different policy trade-offs, investment objectives and financial risk management.

However, it is important to stress that using the concept of natural 'capital' to highlight the economic value of nature does not preclude nature's other important values, which include cultural and spiritual values as well as a natural heritage perspective and the intrinsic value of nature beyond what humans need. It rather provides an additional lens for understanding how economic and social outcomes are dependent on natural capital (Figure 5.1).

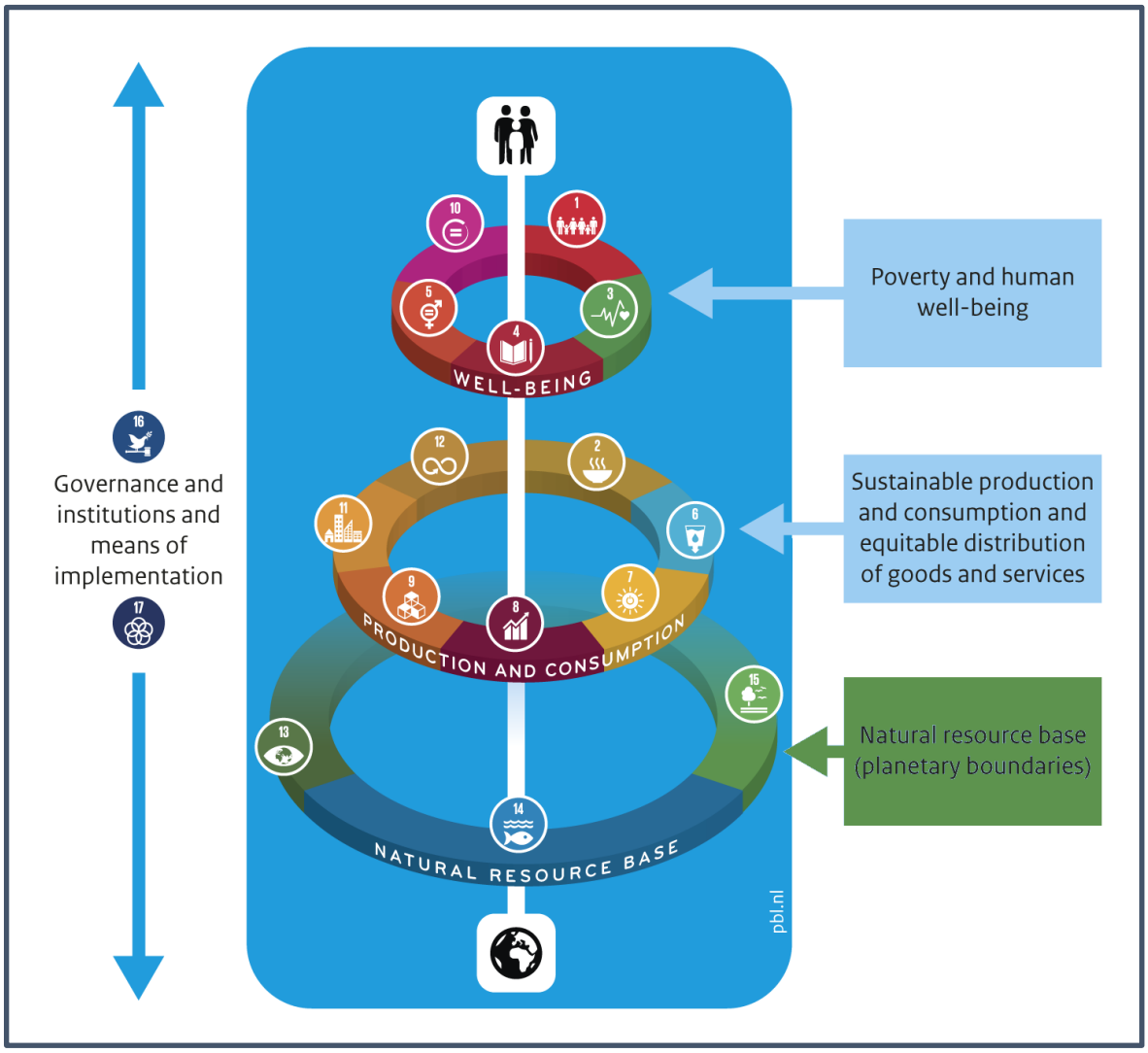
Box 5.2 Accounting and assessing natural capital

Natural capital accounting: Compiling consistent, comparable and regularly produced data using an accounting approach on natural capital and the flow of services generated in physical and monetary terms to show the contribution of the environment to the economy and the impact of the economy on the environment. The System of Environmental Economic Accounting (SEEA) is the agreed statistical framework for natural capital accounting. The SEEA uses the same accounting principles and structure of the System of National Accounts, which is the basis for GDP as well as other macro-economic indicators including produced assets. This enable countries to better understand how the environment underpins wealth and economic activity and to monitor environmental degradation and its costs.

Natural capital assessment: The process of assessing natural capital impacts and dependencies. The scope can be broad and it is primarily about providing information to inform decisions. The data used can be both accounting data and other types of data and statistics.

[9] The Changing Wealth of Nations, World Bank 2018 https://openknowledge.worldbank.org/bitstream/handle/10986/29001/9781464810466.pdf?sequence=4&isAllowed=y

Figure 5.1. Our societies and economies depend on natural capital



Notes: This figure is adapted from *"Towards a safe operating space for the Netherlands" (PBL, 2018).* It goes back to the 'SDG wedding cake', developed by Pavan Suhkdev and Johan Rockström. It was adapted by PBL to strengthen the message that human wellbeing depends on sustainable production and consumption, which are in turn depends on a natural resource base. Or, in terms of multi-capitals: Social and human capital depend on financial/physical capital that in turn depends on natural capital.

5.2 Why does natural capital matter for governments?

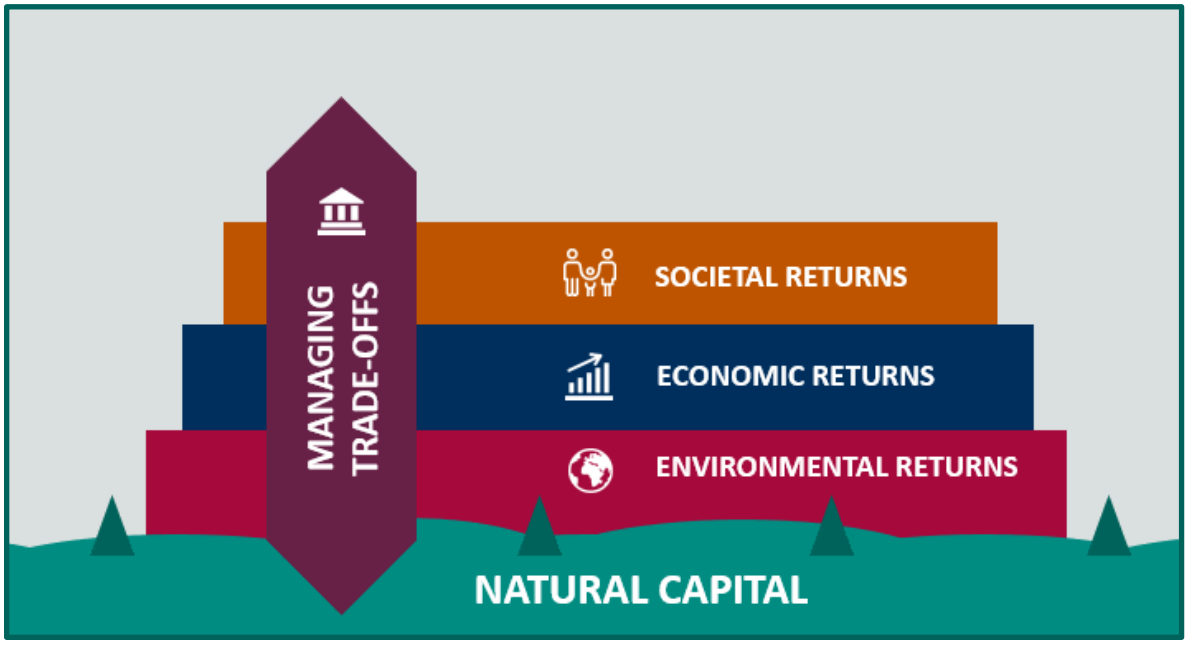
5.2.1 Natural capital generates multiple returns

Businesses and financial organizations are already incorporating natural capital into their strategy. Governments have much to gain from taking action on natural capital. Several policy objectives can be achieved by good natural capital management, including:

- ✓ New jobs and livelihoods
- ✓ Poverty reduction
- ✓ Improving people's well-being
- ✓ Reduced pressure on public health systems
- ✓ Better information to manage competing economic demands
- ✓ Delivering multiple national and global policy goals
- ✓ Increased ecological resilience
- ✓ More resilient businesses and financial markets
- ✓ Innovation and investment

Natural capital supports achieving these objectives through the 4 returns it can generate (Figure 5.2).

Figure 5.2 Natural capital generates multiple returns



5.2.2 Natural capital generates societal returns

Poverty alleviation: As all people are dependent on healthy natural systems, in general poor people are the most vulnerable to environmental failure (often caused by excessive use of

natural systems by rich people). Well designed, natural capital-based mechanisms, such as Payment for Ecosystem Service schemes and social conditional transfer initiatives, can incentivize change in the way people use nature and provide new and direct income for the poorest.

> **Examples |** China's Eco Compensation schemes; Brazil's Bolsa Floresta Programme, and India's Rural Guarantee Employment scheme have all had proven benefits for poor communities.

Jobs and livelihoods: Restoring ecosystems and natural species is generating new jobs and livelihoods in both rich and poor countries. In some instances, ecological restoration is generating more than traditional industries such as mining and the oil and gas industries. For example, in the USA natural capital restoration initiatives support 33 jobs per $1 million invested, relative to 5.2 jobs per $1million invested in oil and gas industries[10];

> **Examples |** South Africa's Working For Water schemes employ over 50,000 people a year while restoring 1 million hectares of land; and Rewilding Europe is creating new business and jobs in tourism by restoring nature.

Public health and wellbeing: A healthy environment is critical for mental and physical health. By investing in natural capital, governments can reduce their public health bill as well as invest in societal wellbeing.

> **Example |** London's parks alone save the city over £950 million per year by reducing disease risk through higher levels of physical activity and improved mental health.

5.2.3 Natural capital generates economic returns

Business and industry: Returns will only be delivered if business and industry are managing their dependencies on natural capital. Supporting businesses to understand their dependency on natural capital helps them build resilience into their business models (e.g. anticipating price changes, informing strategy and supply chain decisions) as well as driving circular economies, new markets and partnerships.

> **Examples |** Olam International has launched a Living Landscapes Policy (OLLP) to prompt a "Net-Positive" approach to agricultural supply chains and landscape management.

[10] For example, some US natural capital restoration initiatives from 2006-2013 are estimated to have supported between 6.8 and 39.7 jobs per $1 million invested (BenDor et al. 2015) – with an average of 17.6 jobs per $1 million. The number of jobs supported depended substantially on the geographic, ecological, economic and regulatory context - but overall compares highly favourably with the estimated 5.3 jobs supported per $1 million invested in US oil and gas during 2007 (Pollin et al. 2009)

Sustainable wealth: Natural capital is essential for all aspects of an economy, yet only a tiny proportion of that value is 'visible'. As states before, natural capital accounts for up to a third to a half of national wealth. At the sector level, that dependency tends to be much higher (see how the transport sector depends on natural capital for example[11]).

> **Examples |** £1 million spent on Agri-environment schemes in the UK has returned £25 million in natural capital benefits[12]; and Investing in key natural systems, such as peatland restoration, is estimated to generate 4:1 benefit to cost ratio over a 40 year period [13].

Benefits and cost savings: Large scale natural capital investment schemes have proven good for the economy. By choosing to invest in 'green infrastructure' over manmade 'grey infrastructure' governments can also reduce their expenditure and enhance flows of benefits and resilience.

> **Example |**Green Infrastructure solutions form an essential element in a portfolio of solutions to increase the resilience of industrial business operations and often demonstrate financial advantages compared to gray infrastructure due to a reduction of initial capital expenses and ongoing operational expenses and can be used to strategically recapitalize aging assets.

Innovation and investment: Financial markets are already responding to the risks and opportunities of natural capital. There has been a sharp increase in green bonds and mutual funds to invest in companies offering solutions to natural capital problems (e.g. waste bio-refineries, biodiversity conservation banks)[14]. These products are driving new markets for natural capital investment.

> **Examples |** A novel insurance policy to protect coral reef has been developed in Mexico. And Washington DC's Environmental Impact Bond supports green space to absorb stormwater which is bringing a 3.43% return for investors.

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[11] Allianz, 'Measuring and Managing Environmental Exposure, A Business Sector Analysis of Natural Capital Risk'. https://safety4sea.com/wp-content/uploads/2018/06/Allianz-Measuring-And-Managing-Environmental-Exposure-A-Business-Sector-Analysis-of-Natural-Capital-Risk-2018_06.pdf

[12] Natural England, "Agri-Environment Schemes in England 2009," Defra, UK, 2009, 120, http://www.naturalengland.org.uk/Images/AE-schemes09_tcm6-14969.pdf.

[13] The UK Natural Capital Committee, Third report to the Economic Affairs Committee, 2015. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/516725/ncc-state-natural-capital-third-report.pdf

[14] https://naturalcapitalcoalition.org/wp-content/uploads/2018/04/Connecting-Finance-and-Natural-Capital_Supplement-to-the-Natural-Capital-Protocol-1.pdf

5.2.4 Natural capital generates environmental returns

Resilience: Social and economic returns will only be delivered if natural systems can continue to adapt and function as human activity increases. Enhancing ecological resilience is essential for our life (e.g. pollinating our crops, providing us with medicines). Mangroves, salt marshes, peat bogs, tropical forests are examples of key ecosystems that ensure essential nature-based solutions for adapting to climate change.

> **Examples |** Ecological restoration projects have been proven to increase biodiversity and ecological services by 44% and 25% respectively[15].

Traditional and intrinsic values of nature: When well-managed, implementing a natural capital approach can help to strengthen knowledge of traditional and intrinsic values of nature.

> **Example |** Assessing Ecosystem Services helps indigenous groups in the Amazon to identify impacts, to defend their territory and make and influence decisions.

5.2.5 The three returns will only be maximized if policy manages trade-offs

In delivering the environmental, economic and societal returns, trade-offs can occur. E.g. economic returns can be achieved at the expense of societal returns that can at the same time be achieved at the expense of environmental returns. Policies role is to manage these trade-offs, by ensuring that the necessary information is available and taking into account by decision makers.

Information and decision making: A reliable physical inventory or stock of a nation's natural capital, including its physical extent, condition and economic value, and how that supports wealth creation, is essential for deciding what kind of growth you want particularly in context of competing economic demands.

> **Examples |** Guatemala's Forest accounts link forest resources with the economy, Nigeria's Forestry principles address climate and forest protection, and Australia's Water accounts inform policy to tackle impact of drought.

Multiple policy aims: Natural capital accounting and assessments offer a systemic approach for understanding how public investments support each other. For example, how investment in biodiversity can support innovation in agricultural policy and how this is profitable for both economic development as biodiversity.

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[15] Rey Benayas JM (et al), Enhancement of biodiversity and ecosystem services by ecological restoration: a meta-analysis. Science. (2009). https://www.ncbi.nlm.nih.gov/pubmed/19644076

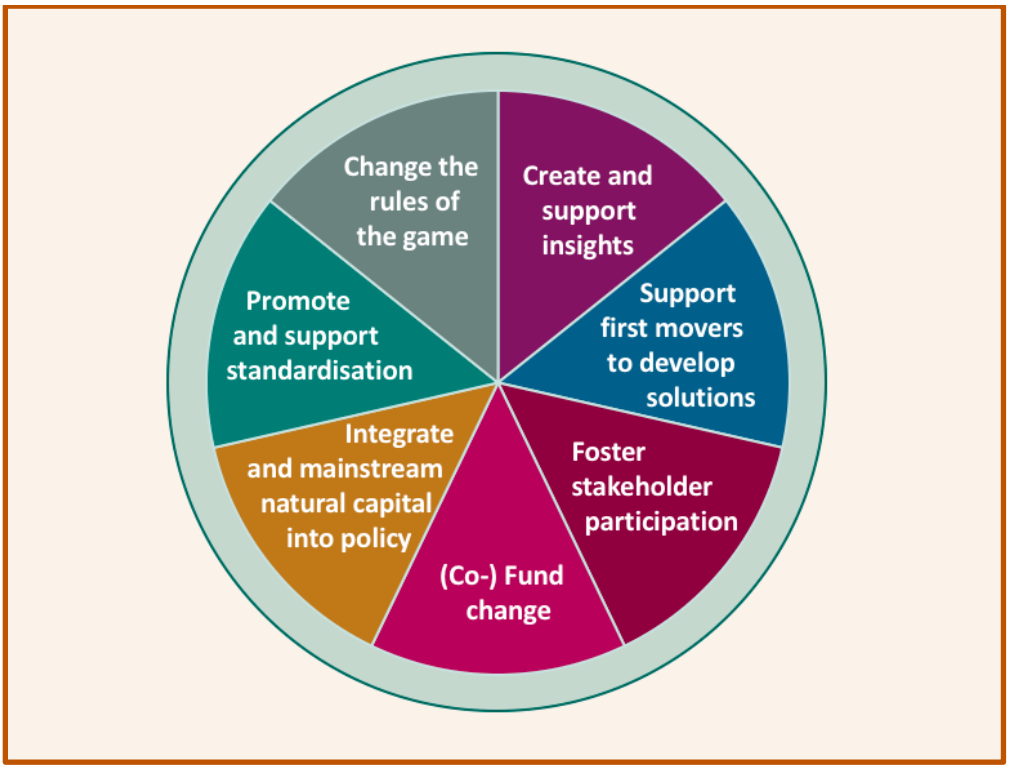
Examples| The EU adopted a Pollinators Initiative that sets the framework for an integrated approach to pollinator decline, that focuses both on action plans for habitats as well as mitigate action in several sectoral policy areas, including agriculture, climate change and health.

5.3 How can governments act on natural capital?

5.3.1 Governments have seven key levers to speed and scale-up the transition

All stakeholders – government, businesses, finance institutions, communities - depend on natural capital and many are starting to take action. Government intervention is essential for speeding and scaling up the transition. Seven levers for change can be distinguished (Figure 5.3). Some levers are focusing on information and planning, others on levelling the playing fields and getting action on the ground. Every country is unique, and change will require a different combination of actions in each context.

Figure 5.3 Seven key levers for change



5.3.2 Create and support insights

To better understand its relationship with nature governments could and should monitor and support insights in economic and societal dependencies from natural capital and promote a dialogue on values and valuation of natural capital.

1. Compile a consistent, comparable and regularly produced national natural capital account based on the UN-SEEA framework. The insights from such accounts can be used to identify and manage risks for achieving SDGs and other policy targets, at both (sub)national and corporate level.

   Examples | Many countries are implementing the UN-SEEA framework to complement GDP. Among them Australia developed several natural capital accounts, including for Marine and Coastal Ecosystems (Port Phillip Bay) and Victoria's Parks; Brazil developed Environmental-economic accounting for water and EEB-services. Japan has been supporting a research for developing an Accounting system to record values of ecological stocks and ecosystem services and the Netherlands developed a SEEA-EEA based Carbon-account.

2. Develop and adopt a framework that links natural ecosystems and socio-economic systems through the flow of ecosystem services. Offer guidance how to integrate these services into decision making.

   Examples | UK's Forest Enterprise has used natural capital approaches to Assess alternative options for changing the landscape through planting new forests. The EU maps ecosystems and their services in the context of its project Mapping and Assessment of Ecosystems and their Services (MAES).

Natural capital accounting can provide insights for both by public and private actors. How the approaches can be compared is described in *Accounting for Natural Capital*, a narrative focusing on creating more alignment between public and private accounting approaches.

5.3.3 Support first movers and develop solutions

3. Support front running private actors to share knowledge and develop solutions by creating business learning circles and public-private partnerships to experiment with natural capital accounting and assessments and promote upscaling.

   Examples | Japan started a Community of Learning for Natural Capital Valuation and Netherlands a Community of Practice Financial Institutes & Natural Capital that both supported the private sector to implement natural capital approaches. Botswana founded a Water accounts community of practitioners to share knowledge and exchange country experiences, and the EU Business@Biodiversity Platform brings together government, non-government organizations and business representatives to discuss experiences on natural capital accounting, innovation and finance.

4. Support upscaling by bundling tools, knowledge hubs and streamline innovation funds.

   Example | Israel created a Functional toolkit supporting companies to implement environmental guidelines.

5.3.4 Foster stakeholder participation

5. Enhance public participation and democratic decision making on the environment and natural capital in order to raise awareness of the added value of different approaches for taking the value of nature into account and to develop a common understanding of the do's and don'ts with respect to valuation of nature.

   Examples | In Brazil the PainelBio Initiative played an important role in the participative construction and implementation of the National Strategy and Plan of Action for Biodiversity. And the Netherlands organized a Natural Capital Dialogue on pros and cons of a capital-approach.

6. Create public-private partnerships to scale and speed-up change.

   Examples | United Kingdom developed sectoral Sustainable Growth Agreements to work directly with businesses to engage them in Scotland's One Planet Prosperity policy implementation. Costa Rica supported Water accounting for decision making by business, and Australia a farm applying natural capital accounting to increase farm gate profits.

5.3.5 (Co-) fund change

7. Develop new government investments in specific ecosystems or ecosystem services. Alternatively, develop public-private partnerships for blended finance proposals, e.g. by setting up finance facilities with credit lines for natural capital conservation or by supporting projects and businesses to reach market maturity ("bankable projects").

   Examples | New Zealand created a Freshwater Improvement Fund to improve water quality in one of its rivers, and Israel an Open Spaces Conservation Fund to restore open spaces.

5.3.6 Integrate and mainstream natural capital into policy

8. Develop macro indicators and/or information systems alongside economic indicators such as GDP and integrate information on the state and change of the country's natural resources to its economic growth in order to inform policy on green growth and sustainable consumption and production.

   Examples | New Zealand developed a Living Standards Dashboard to connect natural capital to their Wellbeing Framework and uses natural capital insights to inform its Sustainable seas program. Similarly, Scotland (United Kingdom) formally included natural capital growth as an indicator of success in its National Performance Framework, France had included a carbon footprint and soil sealing as environmental indicators in a Dashboard of 10 complementary wealth indicators, and the Netherlands used natural capital data to create a broad Monitor of well-being.

9. Create institutional links to mainstream natural capital in other policies (e.g. by breaking down the silos between ministries, provide means for data sharing, create channels for integrating different policy areas and establishing interdepartmental steering committees). Another option is to use the insights from natural capital accounts that are developed to prioritize the national agenda.

    Examples | Mexico created an Inter-Ministerial Commitment to reduce deforestation and Scotland (United Kingdom) a One Planet Prosperity Regulatory Strategy to integrate nature in its regulatory framework.

5.3.7 Promote and support standardization

10. Promote and support standardization of tools and methods to incorporate natural capital considerations into socio-economic decisions.

    Examples | Japan developed Guidelines for Private Sector Engagement in Biodiversity. And Germany a Handbook on the evaluation of environmental damages and the Netherlands an Environmental Prices Handbook with standardized environmental prices for natural resources

11. Encourage research coordination and support to academia and advocate the implementation of Open Data in all sectors. By this governments help to establish a level playing field and can scale up practices.

    Examples | New Zealand Sustainable Seas is one of the NZ Government's eleven National Science Challenges that are designed to frame and deliver a more strategic approach to the government's science investment by targeting a series of long-term goals. The EU supports Oppla, a web-based community and innovation hub for sharing knowledge about natural capital, ecosystem services and nature-based solutions.

5.3.8 Change the rules of the game

12. Promote inclusion of natural capital related non-financial information in decision making and reporting of companies. Such regulation increases insights in impacts and dependencies on natural capital and triggers innovation.

    Examples | France has pioneered Mandatory disclosure on climate change since 2015 and biodiversity since 2017, while transposing an EU directive on non-financial information in French law. Also France adopted a National strategy to eliminate deforestation from the French supply chain that contains non-mandatory objectives about increasing the monitoring and reporting of deforestation by companies (all links refer to texts in French).

13. Develop price and market incentives (including tax incentives and sustainable procurement) to promote sustainable use of natural capital.

Examples | Sweden and South Africa green their tax policies using insights from their natural capital accounts. Brazil developed a System of Incentives for Environmental Services and is ensuring proper values for socio-economic products through its Minimum Guaranteed Price Policy for Socio-Economic Products.

14. Develop regulation to ensure proper natural capital management and enshrine the protection of natural capital into legal frameworks and business requirements.

    Examples | Brazil supports the Review process of the forest compensation law. France is currently reinforcing the strategic and operational character of its National ecosystem assessment (the EFESE program) to influence decisions in all sectors. And the Australian and Netherlands governments have supported the development and implementation of an international Standard on Biodiversity Offsets, through collaboration with several organizations in the Business and Biodiversity Offset Program.

5.4 What's next?

5.4.1 Government leadership is essential

The first two chapters of this document shows why natural capital is the underlying layer of sustainability on which both society and the economy depend. As such, enterprises and industries, communities and citizens, public sectors and local authorities all need to be alert to their dependency on natural capital and enabled to act. Only through proactive government leadership can collective action take place at scale.

5.4.2 The transition is under way

The third chapter of the document shows with over 50 examples from 18 different countries natural capital approaches are underway and decision makers in governments are already seeing the results, from jobs to cost savings, from poverty alleviation to better public health (etc.). Thus, contributing to our economic and societal national ambitions as well as our global commitments (see Appendix 5.1). However, there is still much work to be done. Natural capital is not merely a question for environmental ministries but needs to be mainstreamed and 'hard-wired' into the core government strategies, policy, and investment decisions.

5.4.3 Next steps

Governments can build on all experiences gained so far by developing a natural capital policy approach that is tailored to their specific context and needs, Focusing on the returns of natural capital and levers of change that are most relevant in its national/local context (societal,

economic or environmental). In doing so governments need to address two key questions, both at the level of an individual government, but also internationally:

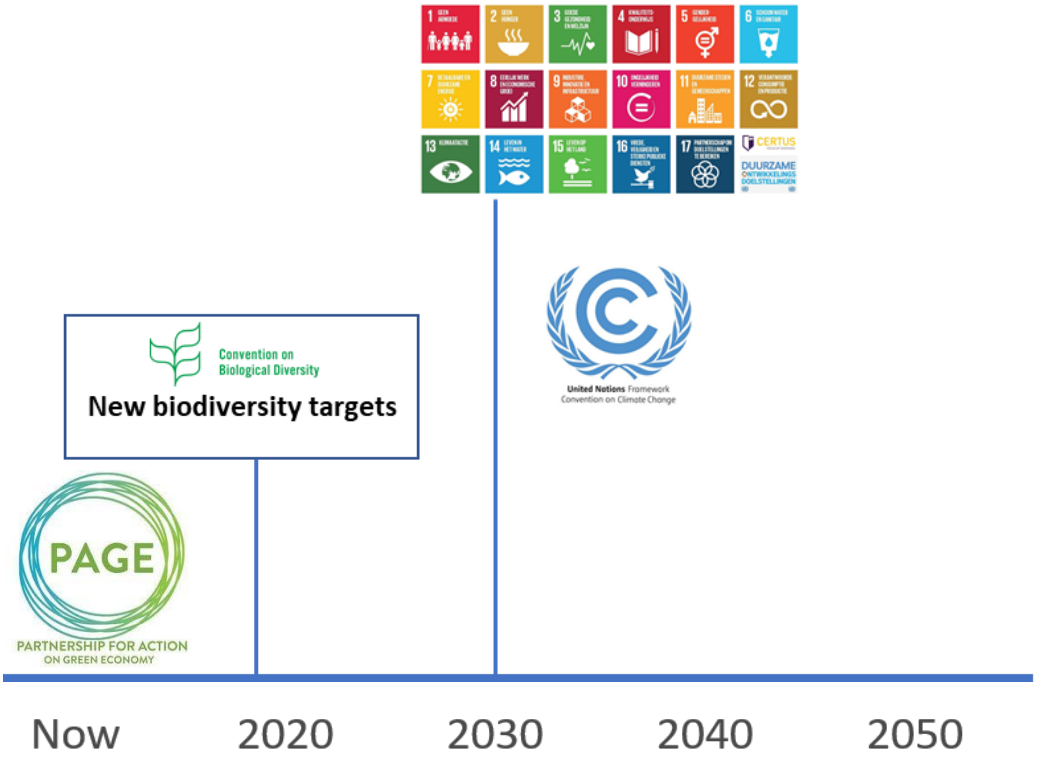
1. Is my policy-mix to manage the trade-offs between the different returns of natural capital adequate?
2. Are all relevant policy makers needed to manage the trade-offs involved in an appropriate way?

The first question focuses on the interdependencies of the different returns that effect the contribution of these returns to the achievement of the – also interdependent – Sustainable Development Goals. The second question focuses on mainstreaming natural capital approaches into biodiversity, climate change and SDG policies and may require more targeted narratives for which this paper provides building blocks and relevant examples.

5.4.4 Time to act

In 2020 new global biodiversity targets will be set and SDG goals and indicators will be updated. Therefore, now is the time for governments to act and mainstream natural capital approaches into these policy areas, by taking decisive steps at national, regional and global level. The momentum is building. The future is at our doorstep. What contribution can you make?

Figure 5.4 Time to act



Appendix 5.1 SDG-contribution of the presented examples of natural capital approaches

This table provides an indication of SDG contributions from all examples presented in this document. The SDGs are presented in an order derived from Figure 5.1. SDGs related to the natural resource base (13, 14, 15) are at the bottom of this table; SDGs related to production and consumption (2, 6, 7, 8, 9, 11, 12) and related to poverty and human well-being (1, 3, 4, 5, 10) in the middle, while SDGs related to governance and institutions and means of implementation (16, 17) are presented at the top. The examples are presented in order of appearance in the document.

			1 Eco Compensation (China)	2 Bolsa Floresta Programme (Brazil)	3 Rural Guarantee employment scheme (India)	4 Working for water schemes (South Africa)	5 Rewilding Europe (EU)	6 London Parks (United Kingdom)	7 Living Landscapes Policy OLAM (United Kingdom)	8 Agri-environment scheme (United Kingdom)	9 Investing in key natural systems (United Kingdom)	10 Green infrastructure solutions	11 Insurance policy to protect coral reefs (Mexico)	12 Washington DCs Environmental Impact Bond (USA)	13 Ecological restoration projects	14 Assessing ecosystem services (Brazil)	15 Forest accounts (Guatemala)	16 Forestry principles (Nigeria)	17 Water accounts (Australia)	18 Pollinators Initiative (EU)
	16	PEACE, JUSTICE AND STRONG INSTITUTIONS																●	●	
	17	PARTNERSHIPS FOR THE GOALS															●			
	1	NO POVERTY	●	●	●	●										●	●			
	3	GOOD HEALTH AND WELL-BEING						●												
	4	QUALITY EDUCATION																		
	5	GENDER EQUALITY																		
	10	REDUCED INEQUALITIES																		
	2	ZERO HUNGER	●	●	●	●			●	●									●	●
	6	CLEAN WATER AND SANITATION				●					●								●	

			1 Eco Compensation (China)	2 Bolsa Floresta Programme (Brazil)	3 Rural Guarantee employment scheme (India)	4 Working for water schemes (South Africa)	5 Rewilding Europe (EU)	6 London Parks (United Kingdom)	7 Living Landscapes Policy OLAM (United Kingdom)	8 Agri-environment scheme (United Kingdom)	9 Investing in key natural systems (United Kingdom)	10 Green infrastructure solutions	11 Insurance policy to protect coral reefs (Mexico)	12 Washington DCs Environmental Impact Bond (USA)	13 Ecological restoration projects	14 Assessing ecosystem services (Brazil)	15 Forest accounts (Guatemala)	16 Forestry principles (Nigeria)	17 Water accounts (Australia)	18 Pollinators Initiative (EU)
	7	AFFORDABLE AND CLEAN ENERGY																		
	8	DECENT WORK AND ECONOMIC GROWTH	●	●	●	●	●		●								●	●		●
	9	INDUSTRY, INNOVATION AND INFRASTRUCTURE										●								
	11	SUSTAINABLE CITIES AND COMMUNITIES										●			●	●	●			●
	12	RESPONSIBLE PRODUCTION AND CONSUMPTION							●	●	●		●				●	●	●	●
	13	CLIMATE ACTION									●	●		●	●			●		
	14	LIFE BELOW WATER					●						●		●					
	15	LIFE ON LAND	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●

			19 Natural capital accounts for Marine and Coastal ecosystems (Australia)	20 Natural capital accounts for Victoria Parks (Australia)	21 Environmental-economic accounting for water (Brazil)	22 Accounting system for values of stocks and services (Japan)	23 SEEA-based Carbon-accounts (Netherlands)	24 Assess alternative options for changing the landscape (United Kingdom)	25 Mapping and Assessment of Ecosystems and their Services (EU)	26 Community of Learning for Natural Capital Valuation (Japan)	27 Community of Practice Finance & Biodiversity (Netherlands)	28 Water accounts community of practitioners (Botswana)	29 EU Business@Biodiversity Platform (EU)	30 Functional toolkit (Israel)	31 PainelBio Initiative (Brazil)	32 Natural Capital Dialogue (Netherlands)	33 One Planet Prosperity policy implementation (United Kingdom)	34 Water accounting for decision making by business (Costa Rica)	35 Applying natural capital accounting to increase farm gate profits (Australia)	36 Freshwater Improvement Fund (New Zealand)	37 Open Spaces Conservation Fund (Israel)
	16	PEACE, JUSTICE AND STRONG INSTITUTIONS	●	●	●	●	●	●	●									●	●	●	●	●
	17	PARTNERSHIPS FOR THE GOALS							●	●	●	●	●		●	●	●					
	1	NO POVERTY										●			●						
	3	GOOD HEALTH AND WELL-BEING																●				●
	4	QUALITY EDUCATION																				
	5	GENDER EQUALITY																				
	10	REDUCED INEQUALITIES																				
	2	ZERO HUNGER	●	●	●							●			●					●		
	6	CLEAN WATER AND SANITATION	●	●	●	●						●			●			●			●	
	7	AFFORDABLE AND CLEAN ENERGY																				
	8	DECENT WORK AND ECONOMIC GROWTH					●	●	●	●	●		●	●	●	●	●			●		
	9	INDUSTRY, INNOVATION AND INFRASTRUCTURE						●	●	●	●		●	●				●				
	11	SUSTAINABLE CITIES AND COMMUNITIES													●							●
	12	RESPONSIBLE PRODUCTION AND CONSUMPTION	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	13	CLIMATE ACTION	●	●	●	●	●	●		●	●			●				●	●			
	14	LIFE BELOW WATER	●	●						●	●		●	●	●		●					
	15	LIFE ON LAND	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

			38 Living Standards Dashboard (New Zealand)	39 Sustainable seas program (New Zealand)	40 National Performance Framework (Scotland, United Kingdom)	41 Dashboard of 10 complementary wealth indicators (France)	42 Monitor of well-being (Netherlands)	43 Inter-Ministerial Commitment to reduce deforestation (Mexico)	44 One Planet Prosperity Regulatory Strategy (United Kingdom)	45 Guidelines for Private Sector Engagement in Biodiversity (Japan)	46 Handbook on the evaluation of environmental damages (Germany)	47 Environmental Prices Handbook (Netherlands)
	16	PEACE, JUSTICE AND STRONG INSTITUTIONS	●			●	●	●	●			
	17	PARTNERSHIPS FOR THE GOALS	●	●	●		●	●	●	●	●	●
	1	NO POVERTY				●						
	3	GOOD HEALTH AND WELL-BEING	●		●		●		●			
	4	QUALITY EDUCATION				●						
	5	GENDER EQUALITY										
	10	REDUCED INEQUALITIES										
	2	ZERO HUNGER										
	6	CLEAN WATER AND SANITATION									●	●
	7	AFFORDABLE AND CLEAN ENERGY									●	●
	8	DECENT WORK AND ECONOMIC GROWTH	●		●	●	●	●	●	●	●	●
	9	INDUSTRY, INNOVATION AND INFRASTRUCTURE	●		●		●	●	●	●	●	●
	11	SUSTAINABLE CITIES AND COMMUNITIES										
	12	RESPONSIBLE PRODUCTION AND CONSUMPTION	●	●	●		●	●	●	●	●	●

			48 Oppla (EU)	49 Mandatory disclosure on climate change and biodiversity (France)	50 National strategy to eliminate deforestation from supply chains (France)	51 Greening tax policies (Sweden)	52 Greening tax policies (South Africa)	53 System of Incentives for Environmental Services (Brazil)	54 Minimum Guaranteed Price Policy for Socio-Economic Products (Brazil)	55 Review process of the forest compensation law (Brazil)	56 National Ecosystem Assessment (France)	57 international Standard on Biodiversity Offsets (Australia/Netherlands)
	16	PEACE, JUSTICE AND STRONG INSTITUTIONS		●		●	●	●	●	●	●	●
	17	PARTNERSHIPS FOR THE GOALS	●	●	●							●
	1	NO POVERTY						●	●			
	3	GOOD HEALTH AND WELL-BEING									●	
	4	QUALITY EDUCATION										
	5	GENDER EQUALITY										
	10	REDUCED INEQUALITIES									●	
	2	ZERO HUNGER						●	●			
	6	CLEAN WATER AND SANITATION	●									
	7	AFFORDABLE AND CLEAN ENERGY	●									
	8	DECENT WORK AND ECONOMIC GROWTH	●		●			●	●		●	●
	9	INDUSTRY, INNOVATION AND INFRASTRUCTURE	●		●							
	11	SUSTAINABLE CITIES AND COMMUNITIES									●	●
	12	RESPONSIBLE PRODUCTION AND CONSUMPTION	●	●	●	●	●	●	●	●	●	●

			38 Living Standards Dashboard (New Zealand)	39 Sustainable seas program (New Zealand)	40 National Performance Framework (Scotland, United Kingdom)	41 Dashboard of 10 complementary wealth indicators (France)	42 Monitor of well-being (Netherlands)	43 Inter-Ministerial Commitment to reduce deforestation (Mexico)	44 One Planet Prosperity Regulatory Strategy (United Kingdom)	45 Guidelines for Private Sector Engagement in Biodiversity (Japan)	46 Handbook on the evaluation of environmental damages (Germany)	47 Environmental Prices Handbook (Netherlands)	48 Oppla (EU)	49 Mandatory disclosure on climate change and biodiversity (France)	50 National strategy to eliminate deforestation from supply chains (France)	51 Greening tax policies (Sweden)	52 Greening tax policies (South Africa)	53 System of Incentives for Environmental Services (Brazil)	54 Minimum Guaranteed Price Policy for Socio-Economic Products (Brazil)	55 Review process of the forest compensation law (Brazil)	56 National Ecosystem Assessment (France)	57 international Standard on Biodiversity Offsets (Australia/Netherlands)
	13	CLIMATE ACTION	●		●	●	●	●		●	●	●	●	●	●	●	●			●	●	●
	14	LIFE BELOW WATER	●	●	●		●		●	●	●	●	●	●						●	●	●
	15	LIFE ON LAND	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●