PBL Netherlands Environmental
Assessment Agency

Natural capital accounting for the sustainable development goals

Current and potential uses and steps forward

Policy study

Natural capital accounting for the sustainable development goals
Current and potential uses and steps forward

Arjan Ruijs, Martijn van der Heide and Jolanda van den Berg

PBL Netherlands Environmental Assessment Agency

WAGENINGEN UNIVERSITY & RESEARCH

WAVES

System of Environmental Economic Accounting

Natural Capital Accounting for the Sustainable Development Goals.
Current and potential uses and steps forward.

The Hague, 2018
PBL publication number: 3010

Corresponding author
arjan.ruijs@pbl.nl

Authors
Arjan Ruijs (PBL), Martijn van der Heide and
Jolanda van den Berg (WUR)

Acknowledgements
We would like to thank Sofia Ahlroth, Steve Bass, Volkert Beekman, Frank Dietz, Bram Edens, Paul Lucas, Michael Vardon and the attendants to the *2nd Policy Forum on Natural Capital Accounting for Better Policy* for their valuable suggestions and comments. Moreover, we would like to thank Gerhard Bouwer and Amanda Driver for their help with Chapter 5.

Graphics
PBL Beeldredactie

Layout
Xerox OBT, The Hague

Production coordination
PBL Publishers

PBL Netherlands Environmental Assessment Agency is the national institute for strategic policy analysis in the fields of the environment, nature and spatial planning. We contribute to improving the quality of political and administrative decision-making by conducting outlook studies, analyses and evaluations in which an integrated approach is considered paramount. Policy relevance is the prime concern in all of our studies. We conduct solicited and unsolicited research that is both independent and scientifically sound.

Contents

MAIN FINDINGS

Natural Capital Accounting for the Sustainable Development Goals 81

FULL RESULTS

1 Introduction 12

2 Challenges to achieve the Sustainable Development Goals 16

3 Natural capital accounts for developing SDG indicators 18

4 Natural capital accounts for analysing integrated SDG policies 24

5 Institutional process 28

6 Conclusions and steps forward 32

References 34

Appendix: The SDGs 36

MAIN FINDINGS

Natural Capital Accounting for the Sustainable Development Goals

Introduction

The '2030 Agenda for Sustainable Development' aims to transform our world for the better. It defines 17 Sustainable Development Goals (SDGs) and 169 sub-targets.[1] The SDGs are directed at improving the lives and future prospects of everyone, everywhere. Designing and implementing policies to attain the SDGs demands substantial policy effort. As the spectrum of the 2030 Agenda is broad, including economic, social and environmental aims, it is essential to have a thorough understanding of the interrelationships and interdependencies as well as trade-offs between these aims. This includes the impact the economy has on the long-term health of natural systems. Economies need nature: economic prosperity and human well-being are underpinned by natural capital, such as water, forests and minerals.

Natural Capital Accounting, or environmental-economic accounting, is a tool that can help public and private actors to gain an understanding of the interaction between the economy and the environment. It can be used to measure the state of ecosystems, flows of ecosystem services as well as changes in stocks and flows of natural resources in relation to economic changes. The natural capital accounts (NCAs)[2] comprise a system of accounts that include supply and use tables, functional accounts (e.g. environmental protection expenditure accounts) and asset accounts for natural resources.[3] Accounts may be compiled in both physical and monetary terms.

This report, prepared for the *2nd Policy Forum on Natural Capital Accounting for Better Policy*, held on 22 and 23 November 2017 in the Netherlands, provides a brief overview of current and potential uses of NCAs in national policy processes for the SDGs. Natural capital accounting in itself does not create mechanisms to achieve the SDGs. Yet, it can provide a practical framework, valuable elements, lessons, and practices that can be used to develop and implement the policies or governance arrangements needed to attain the SDGs at a country level. We investigated the current or potential role played by natural capital accounting in the design and implementation of evidence-based SDG policies. We also examined the institutional arrangements necessary for an environment in which NCAs can improve policies directed at achieving the SDGs.

Challenges to achieve the Sustainable Development Goals

Natural capital accounting can play various roles in national SDG policy processes. In structuring our analysis, we distinguished four challenges that countries face when aiming to achieve the SDGs and for which NCAs may provide relevant information, or for which the process of producing natural capital accounts creates the right environment. These challenges relate to (a) the monitoring of status and trends in the SDG indicators, (b) identifying the interlinkages – trade-offs and synergies – between the SDGs, (c) evaluating (ex ante and ex post) whether SDG policy or governance arrangements contribute to the SDGs as intended, and (d) creating an institutional environment such that the SDGs can be achieved.

A number of interesting observations can be distilled from the scientific and international literature about the SDGs and the examples discussed during the 2nd Policy Forum, which can be summarised in three general lessons about how natural capital accounting can help countries address these SDG challenges. These observations may help countries understand how they could implement and use NCAs to improve their SDGs policies.

Focus on Monitoring status and trends

We observed most attention being directed to using NCAs for the monitoring of status and trends ('challenge (a)'). Several indicators can be derived from NCAs to monitor progress. To date, the focus is mostly on measuring progress and achieving a target (report cards), and less on developing implementation strategies for achieving the SDGs (policy tools). This is partly due to fragmented data collection and monitoring activities, as the agencies responsible for SDG achievement and monitoring often differ per SDG. Natural capital accounting is seen as a useful integrated information framework used for informing the SDG policy process and ensuring integration and consistency between several of the SDG indicators—especially where different custodian agencies are involved.

Current use of NCAs for monitoring the progress of SDGs is largely limited to those related to the environment (SDGs 6, 13, 14 and 15), not all of which currently are quantitatively measurable. But examples from Rwanda, Botswana, Brazil, the Netherlands and Sweden show that NCAs, potentially, could be used for estimating SDG indicators related to agriculture, energy, employment and sustainable production and consumption (SDGs 2, 7, 8, 9, 11, and 12).

The 2030 Agenda stresses that the SDGs and sub-targets are interrelated and mutually dependent and must be considered and implemented collectively. Internationally, there is growing attention for the positive and negative interactions between SDGs (related to 'challenge (b)'). Network analyses show that targets related to sustainable agriculture, and access to water, energy and infrastructure turn out to be decisive targets, having positive feedback effects for many other targets. As such, these specific SDGs have the potential to also further the progress towards other SDGs. However, some synergies are stronger than others, and advancement in some goals could hinder that in other areas, leading to conflicts and trade-offs. For example, efforts to end hunger and achieve food security (SDG 2) could involve agricultural practices that limit the availability of renewable energy, namely biomass (SDG 7), and perhaps even have a negative impact on limiting deforestation (SDG 15).
This kind of information helps policymakers to prioritise policy interventions, assess trade-offs and support careful policy design. At this stage, NCAs are mainly used during the policy process of monitoring and awareness-raising, and there is limited evidence of them being used in more integrated national level policy-making aimed at achieving the SDGs, collectively.

Costa Rica is an example of one of the countries actively promoting the use of NCAs to show the relationship between their national sustainability objectives. Also in the Australian Central Highland forests of Victoria, on a subnational level, natural capital accounting has helped to identify hotspots for protection, where the contribution of the tourism industry and of water and carbon to the economy far exceeds that of native timber production.

Natural capital accounts are helpful for policy preparation

The challenges (b) and (c) on trade-offs and synergies and on policy and governance arrangements are especially linked to the stages of the policy-making process of identifying, implementing and reviewing policy responses. Within the context of the 2030 Agenda, there is a growing attention for these challenges, but, thus far, we observed limited attention for the potential role of NCAs with regard to these challenges nor for their use in the policy-making process. This despite the fact that NCAs may provide important input for the analytical methods in designing, implementing and reviewing evidence-based SDG policies, such as trend analysis, forecasting, footprint analysis, integrated assessment and general equilibrium analysis.

The methods currently promoted internationally for analysing the potential impacts of possible SDG policies, however, do not, or hardly take into account the potential use of natural capital accounting and the NCAs most needed to do so (e.g. physical flow or asset accounts). Moreover, most national SDG processes do not take the methods into account that most closely relate to the setup of NCAs, such as footprint, input-output and general equilibrium analysis. These methods have in common that they are all systems-based approaches that are particularly suitable for analysing synergies and trade-offs of a broad range of SDG policies, from pricing measures, to regulations, to technological developments and changes in consumption behaviour. There are, however, some exceptions to this lacuna. Guatemala, Costa Rica and Rwanda, for example, have experimented with the 'integrated economic-environmental modelling' (IEEM) framework to analyse policy alternatives. The structure of the data used in the IEEM general equilibrium model is consistent with the setup of NCA supply and use tables. In addition, Indonesia currently uses a system-dynamics model to evaluate policy interactions, which especially uses the stock and flow accounts.

Next to this, there is still an unexploited potential of analytical methods, such as cost-benefit analyses, integrated assessments and econometric analyses, for which NCAs may provide important data that also can be helpful during the SDG policy process, to review policies, examine trends and explore future development scenarios.

Institutional challenges

Challenges (a), (b) and (c), in one way or another, are directly related to the stages in the policy-making process. However, thinking only from such a 'managerial' and purely analytical perspective will raise the risk of overlooking key institutional issues – challenge (d) is meant to counter this. By examining how NCAs are currently being used or implemented in several countries, for example those supported by WAVES and UNSD, we found that there are several hurdles that prevent an institutional environment in which natural capital accounting could help improve policies directed to achieve the SDGs. For example, in South Africa and Indonesia, as in many other countries, SDG implementation is aligned with the National Development Plan. Even though coordination of these plans is usually done by a high-level steering group, implementation is often hampered by poor coordination and siloed, top-down implementation of activities, scattered data that may well be of poor quality or not shared with others, and a lack of skills to use data to their full potential.

The broad range of institutional experiences, to date, has taught us that setting up natural capital accounts can be helpful for building institutional coordination, as natural capital accounting brings rigour to foundational data, strengthens statistical skills and appeals to policymakers due to the data's direct link with the national accounts. Moreover, we also found that natural capital accounting and national SDG processes can benefit from one another as both use a systems-based policy framework and need collaboration well beyond departmental and organisational boundaries. The SDG policy process may give a boost to setting up a process to render NCAs. In order to create mutual benefits for both the 2030 Agenda and the natural capital accounting process, it is crucial that tools used to implement NCAs should not be limited to criteria, methods, and techniques. In addition, they should also cover governance issues to create shared ownership and institutional cooperation, and to involve those who use the accounts, in order to create a demand-led process for the production of NCAs. This helps to develop an institutional environment in which NCAs may provide the evidence base needed for designing national SDG policies.

Conclusions

Experience, to date, has given a clear indication that NCAs are under-exploited in national SDG policy processes. Given the coherent and structured setup of NCAs, it can help these processes by promoting a systems-based approach and create institutional conditions for more integrated data compilation, analysis and policy-making. Although not complete and perfect yet, indicators and analytical methods to support national SDG processes do exist and are available to countries to help them develop their NCAs. In addition, increasing the use of NCAs for SDG policies requires national SDG policy processes that move beyond monitoring and look at synergies and trade-offs, transcend ministrial levels, allow for learning by doing, and create institutional conditions to foster transition to a system of integrated SDG policy-making. Here, SDG and NCA development processes can be aligned to support each other. Both processes go beyond the mandate or competences of one single institution or ministry, are dependent on organisations skilled at collecting data, compiling accounts, analysing information, and require strong political support and powerful lead agencies to promote evidence-based policy-making across sectoral boundaries.

Notes

1 See the appendix for a list of the 17 Sustainable Development Goals.

2 NCA is short for *natural capital account*, following the System of Environmental-Economic Accounting Central Framework (SEEA) and SEEA Experimental Ecosystem Accounting (SEEA EEA). NCAs include the physical and monetary accounts, but also the thematic and economic accounts as described in United Nations et al., (2014a,b).

3 Supply and use tables offer a detailed picture of the economy by providing insight into the production process, and by showing the use of goods/intermediate goods and services and the income generated from their production. The tables report the incoming and outgoing flows. Functional accounts focus on economic activity undertaken for a particular purpose. They deal with the identification of flows relating to environmental activity in monetary terms. Asset accounts report how the opening and closing stocks of a natural resource differ.

FULL RESULTS

ONE

Introduction

This study was conducted in preparation of the *2nd Forum on Natural Capital Accounting for Better Policy*, held on 22 and 23 November 2017 in The Hague. The report provides a brief overview of how Natural Capital Accounting is currently being used, and describes how it could contribute to attaining the Sustainable Development Goals (SDGs).[1] The SDGs are the core of the '2030 Agenda for Sustainable Development', adopted at the United Nations Sustainable Development Summit in September 2015. The 2030 Agenda is a broad sustainability action plan for all countries, focusing on the poverty–development–environment nexus and with an overarching objective of leaving no one behind. It contains 17 Sustainable Development Goals (SDGs) – see Figure 1.1 and the appendix – consisting of 169 sub-targets, including ending poverty and hunger, improving health and education, combating climate change, environmental sustainability and inclusiveness (United Nations, 2015). These goals, along with their targets and indicators, provide a detailed dashboard for the transition to sustainable development (Costanza et al., 2016).

Governments, businesses and others are working on the 2030 Agenda. Individual countries are called upon to translate global ambitions into long-term visions with clear targets and integrated policy agendas based on national circumstances (Gable et al., 2015). This process is multifaceted, with work being done to create awareness, set targets, design and implement policies, and to monitor progress. So far, internationally, there is much emphasis on developing a solid framework of indicators and the underlying data needed to monitor progress of the SDGs and inform policy.

UNSD (2015) states that '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'. Hence, designing and implementing the SDGs also requires an understanding of these interlinkages. This includes the impact of the economy on the long-term health of natural systems. After all, economic prosperity and human well-being are underpinned by natural capital (e.g. biodiversity, including ecosystems that provide essential services like water, food, fibres, carbon sequestration and soil fertility).

Natural capital accounting provides such an integrated approach. It measures the changes in the stock of natural capital, on various scales. But perhaps more importantly, it integrates the value of ecosystem services into accounting and reporting systems at a national level (rather than maintaining a strict borderline between the economic sphere and the natural environment). As such, natural capital accounts (NCAs) provide insights into the economic importance of natural capital in wealth creation, employment, livelihoods, and poverty reduction. Through NCAs, the contribution of natural capital to economic development as well as SDGs can be made explicit (Bann, 2016) – see also the text box 'Natural capital accounting and the System of Environmental-Economic Accounting'.

A growing number of countries are compiling natural capital accounts to inform economic decision-making on natural resources. Many countries also want to use the accounts as a basis for compiling indicators to monitor progress of sustainability policies and for assessing *ex ante* the possible effects of new policies related to for example the SDGs. Natural capital accounting in itself does not create mechanisms to achieve the SDGs. Yet, it can provide a framework for information, valuable elements, lessons, and practices that can be used to develop and implement the policies needed to achieve the SDGs.

For this study, we investigated the design and implementation of evidence-based SDG policies – new or existing policies linked to or embedded in the 2030 Agenda – and the report outlines their current use of NCAs. It also identifies and describes opportunities for NCAs to fill gaps in information, in current SDG policy

Figure 1.1
The Sustainable Development Goals

Source: sustainabledevelopment.un.org

Natural capital accounting and the System of Environmental-Economic Accounting

The internationally agreed methodology for natural capital accounting is the System of Environmental-Economic Accounting (SEEA). SEEA is a central framework that contains the standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics on the environment and its relationship with the economy. It guides the compilation of consistent and comparable statistics and indicators for policymaking, analysis and research (United Nations et al., 2014a). The SEEA allows for compiling physical and monetary accounts for a range of natural resources, such as minerals, timber, and fisheries, and linking these to the System of National Accounts. It distinguishes between physical flow accounts, functional accounts and asset accounts. The physical flow accounts record the flows of natural inputs, products and residuals within the economy and those between the environment and the economy. These include water and energy used in production and waste flows to the environment. The physical flows are placed within the structure of a physical supply and use table, showing which products are supplied and used by the various industries and households. Functional accounts record the many transactions between industries, households and governments that concern the environment. Examples include green investments, environmental restoration and recycling. 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, aquatic, soil, water and land resources. In addition, the SEEA Experimental Ecosystem Accounts (SEEA EEA) present a framework for integrating biophysical data and linking changes in ecosystems to human activity (United Nations et al., 2014b). The ecosystem accounts summarise information about the extent and quality of ecosystems, their changing capacity to operate as a functional unit and their delivery of benefits to humanity.

The World Bank-led WAVES partnership and the work programme by the United Nations Statistics Division (UNSD) promote sustainable development by mainstreaming the value of natural capital accounting in development planning and national accounting systems. WAVES and UNSD use the SEEA to produce NCAs in countries as an important tool to inform economic decision-making on natural resources. Both organisations work to build capacity in individual countries to implement the SEEA and to demonstrate its benefits to policymakers. Next to this, UNSD in conjunction with the UNEP TEEB office, UN regional commissions and the CBD initiate pilot testing of the SEEA EEA and ecosystem valuation in a number of countries.

Source: see also *www.wavespartnership.org*, under Natural Capital Accounting resources, and *unstats.un.org/unsd/envaccounting/eu_project/*.

processes. In addition, we examined the institutional hurdles that prevent the creation of an environment in which NCAs could improve national policies towards achieving SDGs. In such an environment, NCAs may help to create systems-based, integrative governance arrangements spanning multiple departments, involving public and private actors, and on various spatial scales. From these analyses, we were able to derive a number of general observations that may help other countries in evaluating their position and how to use NCAs to improve their SDGs policies.

To identify current and future use of NCAs in policies to achieve the SDGs, the report first identifies four policy challenges in relation to national SDG processes (Chapter 2). Subsequently, it focuses on the indicators and analytical methods that are or could be used to address these challenges and, in particular, on how NCAs may contribute to this difficult task (Chapters 3 and 4). Chapter 5 illustrates the institutional hurdles countries may experience when shaping an environment in which NCAs may help to improve policies directed towards achieving SDGs. Our methodology comprised desk research, literature reviews and policy analyses, in Chapter 5 complemented by interviews and lessons learned from the 2nd Policy Forum.

It must be noted that the processes of both the SDGs and natural capital accounting are still in their infancy. Widespread application of NCAs and robust policy on SDGs both take time and can therefore not be expected to be accomplished in the short term (Virto et al., 2018). This has also affected which literature could be used for this report. We consulted the scientific literature, international reports, for example, by the World Bank, United Nations and OECD, as well as websites related to SDG indicators and SDG policy analyses. The available literature from any source reporting on national SDGs or natural capital accounting processes is still limited. To stay as close as possible to the SDG policy process and the focus of the 2nd Policy Forum, as well as because of time constraints, we decided not to explore the literature on green growth or sustainable development, which may also provide insights into how NCAs could support more integrated policy-making.

We focused mostly on *national* SDG processes, whereas, internationally, the UNSD (2015), United Nations (2017), World Bank (2017) and OECD (2016, 2017) have put much emphasis on creating coherent *international* indicator databases to measure progress towards the SDGs. Furthermore, for reasons of brevity, our analysis was limited to a macroeconomic perspective. Natural capital accounting for business – here defined in its widest sense as ‘taking the environment into account in business decision-making and reporting’ – has not been included explicitly.

Notes

1 This forum was jointly organised by the World Bank WAVES partnership, the United Nations Statistics Division, the Dutch Ministry of Foreign Affairs and PBL Netherlands Environmental Assessment Agency.

TWO

Challenges to achieve the Sustainable Development Goals

To achieve the Sustainable Development Goals (SDGs), countries face many challenges. We distinguish four SDG-related policy challenges for which the natural capital accounts (NCAs) provide relevant information, or for which the process of producing NCAs creates a suitable environment. Of course, more types of policy challenges can be defined, but here we restrict ourselves to those that have a direct link with NCAs. The four SDG policy challenges are:

a. What is the status and trend of the SDGs?
b. What are the interrelationships –trade-offs and synergies – between the SDGs? Not only between achieving different goals, but also between various socio-economic groups.
c. Which policies or forms of governance are available to achieve the goals? This can be a broad range of governance arrangements, such as introducing economic or regulatory instruments, creating institutions, stimulating innovation or instigating transition.
d. How to create the right institutional environment for SDGs to be achieved?

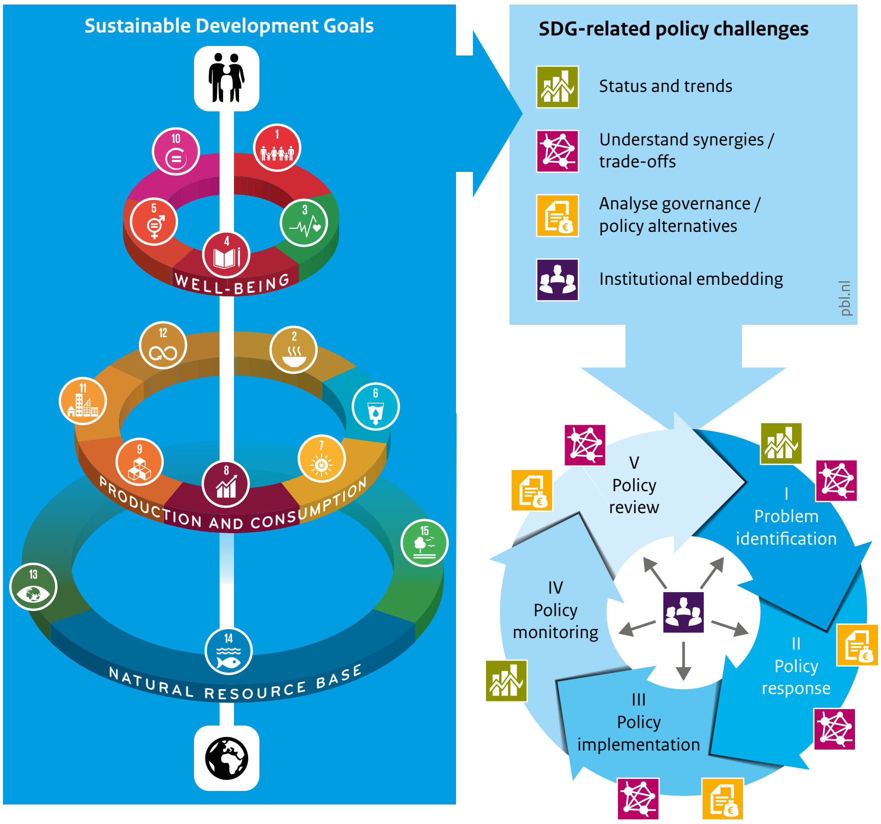
The first challenge relates to all SDGs. The second and third focus on the relationships between the SDGs and the policies and governance arrangements to exploit synergies or prevent trade-offs between SDGs – see Figure 2.1.

Broadly speaking, there are four clusters of SDGs (e.g. Waage et al., 2015; Oldekop et al., 2016; Reid et al., 2017; PBL, 2017), with one cluster of SDGs focusing on social objectives (SDGs 1, 3–5 and 10), one cluster focusing on sustainable production and consumption (SDGs 2, 6–9, 11, 12), and a third cluster addressing the management of the natural resources base (SDGs 13–15). A fourth cluster is more intersecting and contains the goals addressing governance and the institutional perspective (SDGs 16 and 17). The fourth policy challenge, relates to this fourth cluster of SDGs.

The four policy challenges may occur at various stages of the policy cycle (Vardon et al., 2017) – see Figure 2.1. Challenge (a) (about status and trends), is especially relevant when problems are identified (i) and progress is monitored (iv). The policy challenges (b) and (c) (about the trade-offs and synergies and the forms of governance) are typically related to policy response (ii), policy implementation (iii) and policy review (v). Interestingly, and as presented in the case studies and synthesis presented by Vardon et al. (2017), NCAs have been or could be used during all stages of the policy cycle. For example, NCAs can be deployed to quantitatively evaluate trends (for issue or problem identification), identify entry points for interventions and set targets (for policy response), as well as monitor and evaluate the impact of the interventions chosen (for policy monitoring and policy review).

Challenge (d) intersects with all stages of the policy cycle. Thinking only of the policy use of the accounts would risk crucial institutional issues being overlooked. According to Termeer et al. (2017), such crucial institutional risks

Figure 2.1
SDG clusters and SDG policy challenges throughout the policy cycle



Source: PBL

include rigid and fragmented instead of systems-based policy problem frames, lack of leadership and authority to collaborate beyond departmental and organisational boundaries, inadequate resources and skills, lack of involvement from marginalised groups and local communities, inflexible governance processes and the absence of conditions to foster the transition towards a system of integrated SDG policy-making that addresses path dependence. Challenge (d) deals with the institutional risks so that an environment for improving policies directed at achieving SDGs can be created via NCAs production.

Natural capital accounts for developing SDG indicators

SDGs are reflected in more than 200 performance indicators. Together, they form a framework that includes indicators for reporting on an international level, plus a range of national and thematic indicators that may be compiled by individual countries, based on their available capacity and policy priorities. On a national level, indicators are mainly used for monitoring, serving as barometers to gauge national progress towards achieving the SDGs. This chapter discusses three general observations: (1) NCAs may deliver a broad range of SDG indicators, including those that go beyond the natural resource base (SDGs 6, 13, 14 and 15); (2) most attention, so far, seems to have been paid to measuring progress towards achieving a certain target. Although there is increasing attention for the relationships between SDGs, this is more often related to measurement rather than management purposes; and (3) monitoring the progress towards achieving SDGs by using existing natural capital accounts mainly occurs top down rather than bottom up.

Observation 1: NCAs may provide a broad range of SDG indicators, including those that go beyond the natural resource base (SDGs 6, 13, 14 and 15).

As an information system, NCAs provide the data required to determine a broad range of indicators for several SDG targets. Table 3.1 shows that natural capital plays a role in most SDGs. Bann (2016) gives examples of how NCAs could support the achievement of SDGs. For instance, for SDG 6 (clean water and sanitation) many of the indicators can be directly measured using the SEEA Water methodology. More specifically, target 6.3 ('Improved water quality by reducing pollution'), can be assessed against a SEEA-Aligned Global Indicator related to the percentage of waste water that undergoes treatment and draws information from the water accounts, namely the physical supply and use tables (PSUT) and the water emission accounts. Similarly, a fisheries account could provide information for the conservation and sustainable use of the oceans and marine resources (SDG 14) by assessing the value of stocks over time, alternative management practices and employment opportunities. Forest accounts can also provide information for a number of the SDGs – in particular SDG 15.2, which says that, by 2020, a country should promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase reforestation. Another goal is SDG 15.9, which calls for ecosystem and biodiversity values to be integrated into national and local planning, development processes, poverty reduction strategies and accounts, for which ecosystem and biodiversity accounts provide essential information.

The SEEA central framework (CF) comprises three main types of accounts, with each focusing on a different aspect of the interaction between the economy and the environment: the physical flow accounts (physical supply and use tables); functional accounts for environmental transactions (e.g. environmental protection expenditure accounts); and asset accounts for natural resources in physical and monetary terms. The SEEA Experimental

Ecosystem Accounts (EEA) have a number of additional types of accounts, including ecosystem extent and condition accounts. It appears that all accounts are useful for estimating some of the SDG indicators. For some SDGs, the accounts directly related to the resources (e.g. the asset accounts for water, forests and fish) are obviously suitable. However, the usefulness of other accounts extends beyond the obvious examples, such as the material flow and emission accounts (see Table 3.1).

Due to the fact that NCAs produce consistent and internationally comparable statistics, they are useful to guide the development and estimation of a broad range of SDG indicators – not only those related to the management of natural resources, but also those connected to other SDG clusters (see Figure 2.1). This is reflected in the experiences in some of the countries participating in the 2nd Policy Forum, such as Rwanda, Botswana, Indonesia, Costa Rica, Brazil, the Netherlands and Sweden, who use their resource and environmental accounts for SDGs related to agriculture, energy, employment and sustainable production and consumption.[1]

Despite this broad application of NCAs for SDG-indicator development, we would like to make four critical remarks. Firstly, not for all SDG indicators progress can already be assessed quantitatively, and certainly not all can be determined using NCAs. A Dutch report compiled in 2017 by Statistics Netherlands ('Measuring the SDGs: An Initial Picture for the Netherlands') describes the baseline measurement of Dutch progress in achieving the targets set for the SDGs. This report shows that, currently, 37% of the SDG indicators can be measured using the available data, some of which are based on the Dutch environmental accounts. For many indicators, data must still be collected, while several others cannot be measured quantitatively or have no established methodology or standard (Lucas et al., 2016).[2] Here, it is worthwhile to note that the SDG process started from the goals to be achieved and not from the indicators that can be measured or from a common measurement framework. Furthermore, not all goals are equally relevant to all countries. Hence, not all countries translate the global goals into national targets, neither do they use all or the same indicators to monitor progress.

Secondly, NCAs provide just one source of information from which SDG progress can be assessed. There are also other ways of compiling data or determining SDG indicators. Despite the positive experiences with NCAs for estimating SDG indicators, knowledge of NCAs and their merits for producing indicators are unknown to the many working on the SDGs. A recent UN report about data requirements for the SDGs does not even mention NCAs as a possible source of information (SDSN and TRENDS, 2017). Raising awareness of NCAs in this community remains one of the key issues.

Thirdly, despite the fact that there is plenty of theoretical work on how NCAs can contribute to SDG-indicator development, and despite the growing number of countries working on it, in practice, users cannot always be certain about how adequately the developed indicators measure the monitored phenomena.[3] The reason for this is that it is ambiguous whether the role of monitoring is merely aimed at describing trends in SDG indicators, or whether the monitoring is to report on accountability with regard to societal and policy developments underlying the trends observed (Lucas et al., 2016).

Fourthly, although NCAs help to create an improved evidence base on the links between biodiversity and ecosystems on the one hand and economic and human wellbeing on the other, its use concentrates mainly on environmental SDGs, less on economic SDGs and hardly on societal SDGs. Moreover, a causal relationship between SDG policy action and environmental performance is difficult to establish, which means that providing information for policy decision-making processes through accurate accounting is a challenging task. Natural capital brings an added dimension to our understanding of the economic role of ecosystems and biodiversity and also reveals important gaps in knowledge about how these important assets should be managed to be beneficial for implementing the SDGs.

Observation 2: Most attention, so far, seems to have been paid to measuring progress towards achieving a certain target. Although there is increasing attention for the relationships between SDGs, this is more often related to measurement rather than management purposes.
Of the challenges mentioned in Chapter 2, monitoring status and progress towards achieving the SDGs receives, by far, the most attention in the literature (e.g. SDSN, 2014; UNSD, 2015; Bann, 2016; Graveland et al., 2016, 2017). Supported by the custodian agencies for the various SDGs, many countries produce national reviews and assessment reports on how they are currently performing with respect to the SDG goals and targets.[4] Most national performance reports focus on achieving a target (a report card), and less on developing implementation strategies for achieving the SDGs (policy tools). Moreover, so far, little is documented about the experience with NCAs used in comparing critical trade-offs in ecosystem service provisioning. Perhaps more importantly, there is limited evidence about whether the four environmental SDGs can be achieved simultaneously or whether they conflict, let alone how realising these environmental SDGs can either promote or detract from the realisation of the societal or economic SDGs.

Table 3.1

Use of NCAs for estimating the SDG indicators and targets

Type of natural capital or economic domain	Type of account	SDG 2. Zero hunger (agriculture)	SDG 6. Clean water and sanitation	SDG 7. Affordable and clean energy
Land	**Asset accounts#**	% land under sustainable agriculture		
Energy	**PSUT***			- population with access to energy - % renewable energy in energy consumption - energy intensity
	Economic accounts*			- % of population with access to energy
	Asset accounts#			- % of population with access to energy
Water	**PSUT* + Economic accounts***		- % of population using water/ sanitation services - water use efficiency - time spent on water collection - % of waste water treated	
	Asset accounts#		% of water resources used	
Materials	**Material Flow accounts***			
	Emission accounts*		% of water bodies with good ambient water quality	
	Air emission accounts*			carbon intensity
	Solid waste accounts*			
Aquatic resources	**Asset accounts#**			
Agriculture, forestry and fisheries	**All+*#**	value of production per labour unit		
Environmental activities	**Environmental protection expenditures accounts***			
	Resource management expenditures accounts*			
	Environmental taxes and subsidies accounts*			
Ecosystems	**Condition accounts@**			
	Ecosystem extent accounts@		% change in wetland extent	
	Ecosystem services accounts@			
	Biodiversity accounts@			
UN System of National Accounts (SNA)	**All**	agricultural orientation index	water-use efficiency	
	Value added			energy intensity
	Tourism			

Notes:+ Part of the physical flow accounts; * part of the functional accounts; # part of the asset accounts. @ the ecosystem accounts include also other types of accounts. Source: Based on the 'broad-brush' analysis of SEEA relevant SDG indicators, submitted to the Inter-Agency and Expert Group on the SDGs on 7 September 2015 (https://unstats.un.org/unsd/envaccounting/ceea/).
Note that we added the column on SDG 13, as the broad-brush analysis did not consider SDG 13 on climate action.

SDG 8. Decent work and economic growth	SDG 9. Industry, innovation and infrastructure	SDG 11. Sustainable cities and communities	SDG 12. Sustainable production and consumption	SDG 13. Climate action	SDG 14. Life below water	SDG 15. Life on land (ecosystems)
		- efficient land use - share of built up area			coverage of protected areas	- forest + protected area - sustainably managed forestry - green cover index
	energy intensity					
			fossil fuel subsidies			
-resource productivity -material efficiency	intensity of material use per unit of value added		material footprint		nitrogen-use efficiency	
	carbon emissions per unit of value added					
		-% of solid waste collected	national recycling rate			
					% of fish stocks of a sustainable level	
					fisheries as % of GDP	
		- % of budget dedicated to both natural heritage and sustainable buildings		contribution to mitigation funds for developing countries	research budget for sustainable marine technology	
		- % of budget dedicated to natural heritage				
			fossil fuel subsidies		fishery subsidies	
						trends in land degradation
						plans and processes that integrate biodiversity and ecosystem service values
	- energy intensity - carbon emissions per US dollar		fossil fuel subsidies			
- % of GDP from tourism - tourism employment			residual flows related to tourism			

This is in contrast with the basic premise of the 2030 Agenda that 'the Sustainable Development Goals and targets are integrated and indivisible' (2030 Agenda for sustainable development, Paragraph 55), meaning that that they are interrelated and mutually dependent, and must be considered and implemented as a whole.
To understand how the SDGs interact, insight into synergies and trade-offs between the SDGs is needed. These are the synergies and trade-offs that may arise between economic, environmental and social goals, as well as between 'here' and 'elsewhere' and between 'now' and 'later'. So far, this has remained underexplored in the literature. Only by comparing indicators for various regions or countries or over a series of years can trade-offs and synergies be shown. As NCAs are particularly useful for explicitly demonstrating the interdependence between the economy and natural capital in an integrated, coherent framework, they are capable of showing the trade-offs and synergies between the SDGs, over time and between various locations.

Internationally, there is increasing attention for the interrelationships between the SDG targets, with research on interlinkages, for example, in ICSU (2017), Zhou and Moinuddin (2017), Niestroy (2016) and Nilsson (2016a, 2016b). This material shows which SDGs are especially interrelated and reinforce or counteract one another. For example, on the basis of a social network analysis of 108 of the 169 SDG targets, Zhou and Moinuddin (2017) conclude that the targets having the strongest links with other targets are those related to the following subjects:[5]

- agricultural productivity (target 2.3),
- sustainable food production (target 2.6),
- access to safe drinking water (target 6.2),
- access to energy (target 7.1), and
- resilient infrastructure (target 9.1).

For all these analyses, data were not taken from NCAs but from global data sets, such as those from the UN Sustainable Development Solutions Network, World Bank Development Indicators, Millennium Development Goals Indicators, Global Health Observatory and the Food and Agricultural Organization statistics.[6]

Individual countries may conduct similar analyses to assess which targets are central for their situation, provided that sufficient data are available. For this purpose, the System of National Accounts and various types of natural capital accounts can be used to determine part of the required indicators, if they are available for a sufficiently long series of years and for sufficient natural resources and ecosystem services.
To that end, the extent and condition accounts of the SEEA EEA and the supply and use tables of the SEEA CF show changes in the targets over time, such as for targets related to crop production, greenhouse gas emissions, share of renewable energy, protected areas, land cover, water quality, water use intensity and waste generation.

Measuring interlinkages provides evidence about the policy themes that should be prioritised because of their reinforcing effects on various targets and about the themes for which attention should be paid to counteracting negative effects. Costa Rica is one of the few countries actively promoting the use of NCAs to show the relationships between their national sustainability objectives.[7] These measurements, however, only provide a starting point for learning which policy instruments or governance arrangements are useful for managing these synergies and preventing trade-offs. They do not foster change. For that, further analysis is needed, as for example has been done for the case of the Central Highlands forests in Australia. Here, NCAs helped to find hotspots where environmental protection had to be assessed against competing land uses. In the study it was found that the contribution to the economy of industries such as tourism, water and carbon far exceed that of native timber (Keith et al., 2016). Additional policy analyses can also be performed to assess the effects of the various policy instruments available – see also Chapter 4.

Observation 3: Monitoring the progress of SDGs by using existing natural capital accounts is mainly top down, and less bottom up.
So far, the bottom-up approach has dominated the formulation of the SDGs. However, the SDGs can also be seen as a top-down international agenda. Achieving the goals requires both a top-down and bottom-up process. As many problems and solutions are probably most pertinent at the regional level, effort is needed to decentralise analysis and data-driven monitoring.
Of course, country-specific targets also require country-specific indicators. It is, however, essential that these indicators are developed locally by a participative process to generate more transparent governance and greater accountability. Locally conceived indicators might be the best way forward to achieve the country-specific targets (Fitchett and Atun, 2014). Such a participative and 'inclusive' process, however, takes time and is not always an easy task.

SDGs are thus likely to be realised through locally driven plans that reflect the priorities and contexts of individual countries, and which are based on a bottom-up perspective from policymakers and practitioners. As the economist Jeffrey Sachs says in his Kapuscinski lecture on sustainable development: 'There shouldn't be anything top-down in the Sustainable Development Goals. They should inspire actions of individuals, businesses, NGOs, governments, local authorities, everyone'.[8]

However, despite some regional applications focusing on, for example, land use in Kwazulu Natal or the management of the Laguna Lake basin in the Philippines, NCAs mainly support national policymakers. It is hardly used for, say, raising awareness among practitioners or private actors (except for natural capital accounting at a corporate level). So, from a bottom-up perspective, NCAs appear to provide less value added than from a top-down viewpoint. Although this observation seems to go beyond the scope of this document – with its emphasis on national governmental use of NCAs – it is important, nevertheless. It is claimed that for monitoring and attainment of SDGs, a multi-stakeholder approach is needed in which 'private companies, academia, multilateral institutions and civil society support governments with the production, cleaning, composition, dissemination and analysis of data' (SDSN & TRENDS, 2017: 4). As such, the information that NCAs reveal, namely the relationship between natural capital stocks and the flows of benefits which they generate, is not only relevant for policymakers or business decision makers. The question, therefore, is how NCAs may contribute positively to changing our *own individual* behaviour so that SDGs come within reach?

Notes

1 For the presentations prepared for the Policy Forum, see https://www.wavespartnership.org/en/2nd-forum-natural-capital-accounting-better-policy.

2 The SDG indicator framework distinguishes three categories of indicators, called Tiers. For Tier 1, methodologies have been established and data are produced regularly. For Tier 2, the methodologies have been established, but data are not regularly produced by countries. For Tier 3, which covers 35% of the indicators, no methodologies or standards have been established yet.

3 A major consequence of this is that it appears difficult to develop indicators that satisfy the needs of the policy-makers, and, hence, are relevant and useful for policy decisions.

4 See https://sustainabledevelopment.un.org/memberstates.

5 Whether interlinkages are reinforcing, counteracting or something in between is based on a comparison of the correlations between each pair of targets. These targets are the most influential in the sense that they play multiple central roles in terms of having wider connections with other targets by exerting and receiving influences, and place at strategic positions in connecting with other influential targets (Zhou and Moinuddin, 2017). Note that it depends on the scope of your analysis which targets are found to be central targets. For example, the CD-LINKS project focuses on the links between climate change and the SDGs (www.cd-links.org) which results in other dominating targets.

6 See unsdsn.org, data.worldbank.org/data-catalog/world-development-indicators, mdgs.un.org, www.who.int/gho and www.fao.org/faostat.

7 See https://www.wavespartnership.org/en/2nd-forum-natural-capital-accounting-better-policy for the Costa Rican presentation during the 2nd policy forum.

8 http://kapuscinskilectures.eu/lectures/new-age-of-sustainable-development/.

Natural capital accounts for analysing integrated SDG policies

The previous Chapter shows that internationally, most emphasis has gone into analysing status and trends of the SDGs for awareness raising and monitoring purposes – the first policy challenge identified in Chapter 2 – and that there is limited attention for synergies and trade-offs, the second policy challenge. While NCAs have already been used for developing certain indicators for the SDGs, potentially more indicators could be derived from the accounts. In this Chapter, we investigate in more detail the role of NCAs for assessing synergies and trade-offs between the SDGs and designing governance arrangements to achieve the SDGs – the second and third policy challenges identified.

For this, we list methods that are regularly used for economic policy analysis and that could also be used to analytically assess potential SDG policies. This list is not exhaustive, but is limited to those analytical methods that could potentially use data from NCAs. Using this list, we investigate which methods are currently used or promoted to analyse the SDGs.

Methods to analyse the SDGs
Table 4.1 shows a (not exhaustive) list of analytical methods that are potentially available for analysing the policy challenges identified in Chapter 2. These methods provide useful insights for one or more stages of the policy cycle. They are applied regularly to a broad range of policy analyses and problems, but as the SDG policy process is still in its infancy, their use for analysing the SDGs has been limited to date. All these methods can use information that can be found in natural capital accounts. However, if accounts are not available, they can also be based on other data sources. That is, for most methods, the required data not necessarily have to be presented in the form of an account. Only for footprint analysis, input-output analysis and general equilibrium analysis, can the accounts be almost directly incorporated in the analyses.

From the literature review, three general observations can be distilled about current policy use of NCAs for achieving the SDGs, reported below (observations 4, 5 and 6).

Observation 4: The methods currently promoted for assessing the SDGs seem to pay limited attention to the potential uses of NCAs.
Since the adoption of the SDGs, several UN organisations as well as a number of other consortia have developed models to analyse the SDGs and assess the effects of SDG policies. The common thread among this suite of models is that they all attempt to promote a more systems-based approach in the SDG process and span the boundaries of the SDG process over the various scales and multiple institutions. They can also be used to show the importance of including multiple stakeholders in the process and of adapting existing policies to better consider their system-wide effects. To illustrate this, and to add some concreteness, we briefly present three examples.

Table 4.1

Overview of phases for which the research methods provide relevant insights and for which the accounts provide relevant data.

<-- Increasing integration of multiple issues <--

Policy cycle	1. Identification of issues *Why take action?*	2. Policy response *How to solve the natural capital problems?*	3. Policy implementation *What action to take?*	4. Policy monitoring *What results are achieved?*	5. Policy review *How to adapt the policies?*	Accounts required
Indicators	√			√		*All types of accounts*
Interaction / network analysis	√			√		*Thematic extent and condition accounts*
Trend analysis	√			√		*Time series for thematic extent and condition accounts*
Projections / extrapolations	√			√		*Time series for thematic accounts*
Footprint analysis	√			√		*Supply and use tables for particular resources or ecosystem services*
Scenario Analysis	√	√			√	*Time series for thematic extent and condition accounts*
Integrated assessment	√	√			√	*Suite of natural capital extent, condition and supply and use accounts*
Business case		√	√		√	*Suite of natural capital and economic accounts*
Cost-Benefit Analysis		√	√		√	*Suite of natural capital and economic accounts*
Econometric analysis		√	√		√	*Time series analysis of a suite of natural capital accounts*
System Dynamics model		√	√		√	*Suite of natural capital accounts*
Environmentally Extended Input Output Analysis		√	√		√	*Time series analysis of a suite of natural capital accounts*
Partial Equilibrium models		√	√		√	*Full set of NCAs and the SNA*
General equilibrium models		√	√		√	*Full set of NCAs and the SNA*

First, UN-DESA has developed a suite of tools to address interlinkages that influence trade-offs and synergies between sustainable development policies, including the SDGs.[1] These include economic models, environmental models, integrated assessment analyses and system dynamics models that rely on social accounting matrices.[2] Second, the UN Development Group provides an SDG Acceleration Toolkit, which provides a suite of models and system-level diagnostics for analysing interconnections among SDGs.[3] This also contains a tool focusing on the water-energy-food nexus and a dynamic social accounting matrix approach to explore interrelationships between investment planning and economic and environmental SDGs. A third example of an integrative approach, capable of analysing and elucidating the dynamic effects of interdependencies and that is grounded in systems thinking, is the iSDGS model from the Millennium Institute and the Stockholm Resilience Centre (Collste et al., 2017).[4] This model also uses a social accounting matrix to simulate economic flows and to balance supply and demand. Its 'environment modules' track pollution due to production processes and assess renewable and non-renewable natural resource use and environmental degradation.

All three of these modelling approaches are used for national level assessments focusing on development planning and policy questions related to the SDGs.
For most of these models, the natural capital accounts can readily be incorporated in the social accounting matrices, or provide otherwise useful information for the models or approaches (e.g. through some of the physical flow or asset accounts on CO_2 emissions, water, energy or materials use). However, most of the models do not mention the potential use of these accounts. It is not that the models do not recognise this potential, but the models were developed without the accounts in the first place and so are not dependant on the accounts.
The supply and use tables are especially suitable for the suite of models mentioned above, given their direct link

with the System of National Accounts and the social accounting matrix that is the basis of many of the modelling approaches. Yet, as long as countries lack natural capital accounts, or focus on extent, condition or thematic accounts instead of supply and use tables, other sources of information are needed on trends and uses of natural capital by the economic sectors, such as national or international statistics or survey data.

Observation 5: Those analysing SDG policies, seems to pay limited attention to the methods that most closely relate to the setup of NCAs.
Of the methods listed in Table 4.1, footprint analysis, input-output analysis (IO) and general equilibrium analysis (GE) are the methods most closely related to the setup of the natural capital accounts. Their data needs are consistent with the setup of the supply and use tables. However, our literature search shows that currently these methods are little used for assessing SDG policies. The main reason for this is that the SDGs were launched in 2015 and it requires time to gear the models to the sustainability issues presented. Clearly, finding a 'match' between appropriate methods and the reality of SDGs in order to solve practical problems is a time-consuming process.

It is expected that more material footprint analyses will emerge in the coming years as SDGs 8 and 12, on economic growth and on responsible consumption and production, have proposed indicators based on the material footprint (e.g. Statistics Sweden, 2016). Besides that, the water, carbon, ecological, and biodiversity footprints are also useful for monitoring targets related to SDG 6 on water, SDG 13 on climate action and SDG 15 on life on land. These footprint indicators show the links between consumption or production and the environment and are helpful for prioritising and targeting SDG policies (e.g. Hoekstra et al., 2017; Wilting et al., 2017), but their usefulness for SDG monitoring still remains to be seen. For these footprint analyses, the supply and use tables linked to the system of national accounts can be used to relate intermediate resource use and emission to end users (Edens et al., 2015).

Natural capital accounts can also be used for IO and GE models that focus on natural resources. The environmentally extended input-output table or the environmentally extended social accounting matrix used in a GE model is based on the supply and use tables from the natural capital accounts. Moreover, for some of the constraints the models need data from a range of accounts included, land cover, energy and water accounts.

The use of IO and GE models for resource-related issues is not new (e.g. Dobos and Floriska, 2007; Vaz, 2017), but the availability of NCAs makes it easier to set up models that are capable of analysing the interrelationships between the economy and natural capital. IO analysis is seldom applied for analysing SDGs, even though UN ESCAP (2015) promotes its use. IO analysis is easier to set up than a GE model and provides – despite its known simplifications – good first order estimates of the effects of changes in demand, technological growth or economic instruments.

A growing number of GE models is used for analysing the environmental and economic effects of SDG-related policy choices at national or regional levels. Examples include the IEEM model (Banerjee et al., 2016) and the Inclusive Green Economy Model (IGEM) from the UNEP Partnership for Action on Green Economy (PAGE).[5]
The IEEM model was, for example, used to assess the interlinkages between policies related to food security, sustainable agriculture and water and sanitation in Guatemala (Banerjee et al., 2017), the relationship between sustainable park management and tourism in Rwanda and for taxing emissions in Costa Rica.[6] IGEM is an instrument for achieving the transition towards inclusive green growth and that can also contribute to achieving the SDGs. It has been used *inter alia* in Peru to assess policies to achieve sustainable development, diversify the economy and create employment.[7]

The above models rely especially on the supply and use tables of the natural capital accounts. As an alternative to this, system-dynamics models are set up. Indonesia currently uses a system-dynamics model to evaluate policy interactions, based on the stock and flow accounts. Furthermore, an example of a widely applied approach that can take advantage of the ecosystem accounts, is the InVEST model.[8] InVEST uses land use maps and information on soil, water, erosion, etc. that can be derived from the ecosystem extent and condition accounts, to assess in a spatially explicit way the consequences of alternative land use choices and to identify areas where investments in natural capital can enhance simultaneously human development and nature conservation. An example where InVEST is used for an analysis of SDGs is the Myanmar Natural Capital Assessment that used it for multiple scale development planning and for strategic environmental assessment (Mandle et al., 2016). Moreover, the Green Growth Knowledge Platform (Narloch et al., 2016) and the WAVES Forest Accounting Sourcebook (WAVES, 2017) mention InVEST as a tool for ecosystem services modelling and valuation that can be based on information from NCAs and used for SDG assessment. Lastly, the IEEM model also uses InVEST to include some of the biophysical feedback effects in the model.

These examples illustrate a growing number of models that directly depend on NCAs – whether they are the supply and use tables or the ecosystem extent and condition accounts – that are particularly suitable for analysing the natural-capital-related SDGs. The disadvantage of these modelling approaches, however, is that they require strong analytical skills and that it takes time to set up and produce policy ready results. Because not many of those working at statistical agencies nor policymakers have the skills or time to successfully develop or apply the types of modelling mentioned above, this task has to be taken up by or in conjunction with other institutions.
Many international organisations already assist with model development, but to come to actual policy use of these modelling results, it is important that national research institutions or universities have the skills and resources for linking models to NCAs, in order to analyse the natural-capital-related SDGs. A growing awareness about the potential value of these modelling approaches in the SDG processes may provide triggers to further develop and spread these approaches.

Observation 6: There is an unexploited potential of methods that directly use natural capital accounts and that are helpful in various stages of the policy cycle.
After the modelling methods, there is an unexploited potential of other methods that could contribute to various stages of the policy cycle. The stage of problem identification and policy monitoring can be strengthened by retrospective analyses (e.g. *trend analyses*) and prospective analyses (e.g. *trend extrapolations and forecasts*). For this, time series are needed for the different indicators. As many countries, currently, do not possess a sufficiently long time series of accounts, these accounts cannot yet be used to their full potential. Over time, ongoing production of accounts will address this issue. In the meantime, if trend data are not available from natural capital accounts, other data sources may be used for trend analysis, such as the UN Global Indicators Database, the World Bank World Development Indicators or OECD databases. These global data sets are, however, not restricted to national use and they are now also being applied for international comparisons.

In addition, *scenario analysis* may provide further insight into potential synergies and trade-offs between various goals and targets (Joshi et al., 2015; Lucas et al., 2016). Scenario analysis shows the need for policy integration to reach coherence between the SDGs. For this, the natural capital accounts can be used to predict natural capital developments for given scenario assumptions, but if not available, other data sources and assumptions can be applied. To evaluate the environmental and economic consequences of a range of scenario assumptions, other analytical methods, as discussed above, can also be considered. Finally, for reviewing policies, *econometric analyses* can be developed to look backwards at the causality of relationships between interventions and economic and natural capital developments. For such analysis the micro-level data underlying the accounts are usually necessary. That is, the data underpinning the accounts, rather than the aggregate accounts are needed for such analyses.

NCAs can be used for all types of analyses such as these. However, to date few countries have enough accounts available for a sufficiently long period of time to do this. As such other ways to structure data are most used, mostly based on international data sets. However, due to the coherence of the SEEA framework, NCAs are more reliable and better show the extent of the linkages between sector activities and resource use and the economic, environmental and social consequences of changes therein than most other data sets. These insights are important for reaching SDG policy coherence.

Notes

1 See https://un-desa-modelling.github.io/.
2 A social accounting matrix shows the flows of economic transactions between industries, households and governments. The matrix can be extended to also record the interactions between the economy and the environment. It is based on the system of national accounts and the natural capital accounts.
3 See http://undg.org/2030-agenda/sdg-acceleration-toolkit/.
4 See www.isdgs.org.
5 An example of a GE model at a global scale is the IFPRI model for analysing the water-energy-food nexus (see e.g. Willenbockel, 2016) that is used to assess the impact of climate change mitigation scenarios on energy prices, economic growth, food security and water availability.
6 See https://www.wavespartnership.org/en/2nd-forum-natural-capital-accounting-better-policy for more information about the IEEM model.
7 See https://www.wavespartnership.org/en/2nd-forum-natural-capital-accounting-better-policy for more information about the IEEM model.
8 See www.naturalcapitalproject.org

Institutional process

This chapter focuses on the institutional hurdles that may prevent the development of an environment in which NCAs are able to improve policies directed to achieving the SDGs – policy challenge (d) identified in Chapter 2. To this end, we illustrate what difficulties the SDG process may face at the country level, and particularly the difficulties countries have in overcoming problems with the availability and quality of data, including data sharing mechanisms. This description is based on an internet search, interviews with resource persons in South Africa – see text box 'NCAs and SDGs in South Africa' – and discussions during the 2nd Policy Forum.

Observation 7: Natural capital accounting creates suitable institutional conditions

Until now natural capital accounting has played a limited role in national policy and in the SDG processes in particular. There are several hurdles preventing an institutional environment in which NCAs can help to improve policies directed at achieving SDGs. Hurdles evident in many countries include:
- poor availability and quality of data;
- insufficient staff with the necessary skills;
- insufficient cooperation and dialogue between statisticians, researchers and policymakers;
- lead agencies lacking the authority to enforce data sharing;
- a lack of communication tailored to particular audiences, including policymakers and the wider population.

That said, we found that setting up NCAs can be helpful for creating suitable institutional conditions. Some even see it as a potential game changer. Natural capital accounting brings rigour to foundational data, strengthens statistical skills and appeals to policymakers due to their direct link with the national accounts. Moreover, we also perceive that the natural capital accounting and national SDG processes can benefit one another as both use a systems-based policy framework and require collaboration beyond departmental and organisational boundaries. Therefore, implementing NCAs should not be limited to the technical details, but should also cover governance issues as well. This will help to create shared ownership and institutional cooperation, improve skills and competences in various institutions, and to involve those who use the accounts so that a demand-led and iterative process is created. This helps to develop a suitable institutional environment in which NCAs can provide the evidence base needed for designing successful national SDG policies.

NCAs and SDGs in South Africa

In recent years, South Africa has experienced a slowdown of its economic growth. This impedes the country's efforts to address the huge challenges it faces: unemployment, poverty, and inequality. Moreover, Reuter et al. (2016) reports that 34% of terrestrial ecosystems, 65% of marine bio zones, 80% of wetlands and 82% of rivers are under degradation threat. South Africa aligned the SDGs with its National Development Plan (NDP 2030), which was affirmed in 2015. The development of the NDP 2030 involved a broad multi-stakeholder consultation process and provides a long-term strategic framework. The plan aims to eliminate poverty and reduce inequality by 2030. A range of national policies contributes to the implementation of the NDP 2030, including policies underlying a green economy planning, such as the New Growth Path.

Implementation of the NDP 2030 appears to be hampered by a number of institutional hurdles. These include:

- Limited human and budgetary capacities for the implementation of policy, plans and programmes through all spheres of government, due to low economic growth.
- Poor coordination and integration of programme implementation, where failure to comply with governance arrangements to foster integrated implementation, monitoring and review of the NDP 2030 on the part of sectoral departments are without consequences and where the lead agency DPME lacks the opportunity to impose sanctions to enforce compliance and participation.
- Shortage of skills in key sectors of the economy and a lack of a measurement culture in the public sector, which hampers monitoring the efficacy of policy decisions and limits sustainable development.
- Weak or non-existent data to support the monitoring of implementation NDP programmes. Data gaps on key NDP programmes exist or the data available is of poor or unknown quality. For example, only 62% of Tier I and Tier II SDG indicators could be reported on, and many of them only as proxy indicators or as qualitative judgements. And when quantitative data exist, it appears that reporting on indicators is not being done as regularly as is required (see also Footnote 5).

Availability of data and information on ecosystems is quite strong, but natural capital and ecosystem accounting are still in their early days. Natural Capital Accounts include energy, fisheries and minerals. A water account is underway. Various governmental bodies play a role in natural capital accounting, see Table 5.1. South Africa also joined the global initiative to advance the SEEA Experimental Ecosystem Accounting, led by the United Nations Statistical Division (UNSD). For this, land and ecosystem accounts have been set up in KwaZulu-Natal, jointly with the South African National Biodiversity Institute (SANBI) and Statistics South Africa (Stats SA), working in partnership with national departments and the provincial conservation authority Ezemvelo KZN Wildlife. The initiative goes together with a broad stakeholder consultation for discussing the results, including the government, civil society, academic and private organisations. Results from this are rendering input for the National Biodiversity Assessments, whereby NCAs are being used for mapping and classifying ecosystem types.

Table 5.1:
Roles of governmental bodies in natural capital accounting

Ministry/Agency	Notes
	Agriculture
Agricultural Research Council	Established procedural guidelines for the implementation of a long-term land-cover updating and change monitoring programme for South Africa.
	Environment
Department of Agriculture, Forestry, and Fisheries (DAFF-Fisheries)	Collects fish stock data for over 200 species and provides data for fisheries accounts.
Department of Environmental Affairs and Tourism (DEA/DEAT)	Performs the role of lead agent in environmental governance. Conducted a baseline valuation report on biodiversity and ecosystem services in 2012. *Involved in Ecosystem Accounting efforts.*
South Africa National Biodiversity Institute (SANBI)	Led the National Biodiversity Assessment of 2011. *Involved in Ecosystem Accounting efforts.*
	Planning/Science
Council for Scientific and Industrial Research (CSIR)	Established procedural guidelines for the implementation of a long-term land-cover updating and change monitoring programme for South Africa. *Involved in Ecosystem Accounting efforts.*
	Statistics/Finance
Statistics South Africa	Produces South Africa's natural resource accounts. *Involved in Ecosystem Accounting efforts.*
Treasury	Works with the UNDP BIOFIN programme.
	Water
Department of Water Affairs and Forestry (DWAF)	National monitoring programs for chemical water quality and water levels in dams.
Department of Water and Sanitation	*Involved in Ecosystem Accounting efforts.*
	Wildlife/Biodiversity
South African National Parks	Assisted with the National Biodiversity Assessment.
Ezemvelo KZN Wildlife	*Involved in Ecosystem Accounting efforts.*

Source: Reuter et al., 2016:146.

From the interviews with resource persons in South Africa we learned that the added value of natural capital accounting includes:
- Strengthening of and bringing rigour to the foundational data for the National Biodiversity Assessments, for example by requiring consistent time series data on land cover.
- Identifying data gaps.
- Integrating social, economic and environmental data and information.
- Strengthening the position of ecosystem assessments into national planning processes.

Conclusions and steps forward

This report provides a brief overview of current and potential uses of NCAs in national SDG policy processes. Based on a literature review, a number of interviews and the lessons learned from the *2nd Policy Forum on Natural Capital Accounting for Better Policy*, we investigated what has taken place in the design and implementation of evidence-based SDG policies and what role NCAs are playing or could play in these. Moreover, we examined which institutional hurdles prevent an environment in which NCAs can help to improve national policies directed at achieving SDGs. This report also provided a number of observations that are relevant for advancing the application of NCAs in the SDG processes.

From the review, we learnt that NCAs have the potential to measure several SDG indicators, and especially those related to natural capital (SDGs 6, 13, 14 and 15), but also some related to sustainable production and consumption (SDGs 2 and 12), energy (SDG 7), economic growth (SDG 8) and sustainable cities (SDG 11). The biophysical systems that underpin sustainable development are crucial for the economic and socially oriented SDGs, while human activities strongly influence the biophysical systems. So far, most attention has been paid to measuring status and trends towards achieving environmental targets. Less attention has been given to the role of NCAs in developing national implementation strategies for achieving the SDGs. This narrow focus has resulted in a more top-down process to monitor the progress of SDGs by using existing NCAs, and in less cross cutting and bottom up actions that use the accounts and indicators for developing or improving national policy processes.

We observe increasing attention on analysing interlinkages between SDGs, but this attention is focusing more on monitoring and awareness-raising than on linking or embedding existing policies in the SDG policy process or on creating new policies that focus more on the synergies between the SDGs. To date, the methods promoted for assessing the SDGs pay limited attention to the potential uses of NCAs. Due to its integrated approach, capable of showing interlinkages between the economy, the environment and society, NCAs may serve as useful input in a broad range of analytical tools. This potential seems underexploited, and especially the methods that most closely relate to the setup of NCAs – footprint analysis, input-output analysis and general equilibrium analysis. This potential is little known, not broadly advertised, but examples of use are emerging and should help to promote both NCAs and analytical methods. Given their coherent, structured and systems-based setup, NCAs can help the SDG process by promoting a systems-based approach and an institutional reform towards more integrated policy-making with multiple stakeholders and accountability bodies.

There exist several institutional hurdles that need to be addressed to increase the role of NCAs in SDG implementation, monitoring and review. These hurdles include a poor coordination and siloed implementation of activities related to natural capital accounting, scattered (or non-existent) data that are often of poor quality or not shared with others, and a lack of skills to use data to their full potential. It appears that these hurdles apply to many countries. Natural capital accounting is helpful for overcoming some of these hurdles as it brings methodological rigour to foundational data, strengthens statistical skills, and appeals to policymakers due to their direct link with the national accounts. Building NCAs that can pinpoint national progress towards achieving the SDGs and analysing the policies required to achieve the SDGs will demand investment in capacity and skills across the entire spectrum — from conceiving and collecting data to interpreting and communicating them clearly, and making them open and accessible to all.

From this, we conclude that there is an unrealised potential for using NCAs in SDG policy processes. Despite the need for further developments, indicators and analytical methods to support the SDG process already exist and are available to countries. This requires countries to develop their natural capital accounts, so that they can be used to analyse proposed, new or existing SDG policies. However, it is unlikely that this will happen overnight.

Increasing the use of NCAs for SDG policies requires a number of developments. First, it calls for national SDG policy processes that move beyond monitoring, look at synergies and trade-offs that cross the borders between ministries, cover various spatial scales and create conditions to foster a transition to a system of integrated policy-making. Here, the development processes for the SDGs and NCAs can go hand in hand. Both processes go beyond the mandate or competences of one single institution or ministry, and depend on skilled institutions to collect data, compile accounts, undertake analysis and develop policies. Moreover, both processes require strong political support and the political will to promote evidence-based policy-making and to cross institutional boundaries. In most WAVES and UNSD partner countries, the process to implement NCAs is set up in such a way.

Second, for using NCAs as well as for analysing SDG policies, it is essential that institutions capable of applying analytical methods to produce policy-ready and easily communicable messages participate in the development of the accounts. These institutions need not analyse all SDGs from the beginning, but countries can start from those that are most relevant for them.
For example, Costa Rica started with accounts for forests, water and energy to support their policies related to water use and water withdrawals (SDG 6), to monitor objectives related to renewable energy production and energy intensity (SDG 7) and monitor changes in forest assets (SDG 15). Furthermore, Botswana produced water accounts that support several policies related to poverty reduction (SDG 2), water and sanitation (SDG 6) and droughts (SDG 13). Such a prioritisation guides the accounts that have to be set up first, helps with the identification of the most relevant policy questions, steers the types of analysis that are needed and facilitates the establishment of the most appropriate governance arrangements. For this, countries do not have to reinvent the wheel over and over, but can use experiences from other countries. For this to occur, special emphasis should be put on countries communicating their results. Graphically presenting indicators is often easy, but it is more challenging to present analytical results in a way that enables policymakers to understand the relevance of the accounts and raise the right questions. This in turn enables analysists to do what is needed for policy review and design and guides statistical agencies to the compilation of the right type of accounts.

References

Banerjee O, Cicowiez M, Horridge M and Vargas R. (2016). A conceptual framework for integrated economic-environmental modelling. Journal of Environment & Development 25(3): 276–305.

Banerjee O, Cicowiez M, Vargas R and Horridge M. (2017). The integrated economic-environmental modelling platform: an application to Guatemala's fuelwood and forestry sector. In Vardon et al., (2017).

Bann C. (2016). Natural capital accounting and the sustainable development goals. WAVES Policy Brief, World Bank WAVES, Washington D.C.

Bass S, Ahlroth S, Ruijs A and Vardon M. (2017). The policy and institutional context for natural capital accounting. In: Vardon et al. (2017).

Collste D, Pedercini M and Cornell SE. (2017). Policy coherence to achieve the SDGs: using integrated simulation models to assess effective policies. Sustainability Science.

Costanza R, Daly L, Fioramonti L, Giovannini E, Kubiszewski I, Fogh Mortensen L, Pickett KE, Vala Ragnarsdottir K, De Vogli R and Wilkinson R. (2016). Modelling and measuring sustainable wellbeing in connection with the UN Sustainable Development Goals. Ecological Economics 130: 350–355.

Dobos I and Floriska A. (2007). The resource conservation effect of recycling in a dynamic Leontief model. International Journal of Production Economics, 108 (1–2), pp. 334–340.

Driver A, Nel JL, Smith J, Daniels F, Poole CJ, Jewitt D and Escott BJ. (2015). Land and ecosystem accounting in KwaZulu-Natal, South Africa. Discussion document for Advancing SEEA Experimental Ecosystem Accounting Project, October 2015. South African National Biodiversity Institute, Pretoria.

Edens B, Hoekstra R, Zult D, Lemmers O, Wilting H and Wu R. (2015). A method to create carbon footprint estimates consistent with national accounts. Economic Systems Research 27 (4).

Fitchett JR and Atun R. (2014). Sustainable development goals and country-specific targets. Lancet Global Health, 2014 September; 2(9): e503.

Gable S, Lofgren H and Rodarte IO. (2015). Trajectories for the sustainable development goals: framework and country applications. World Bank Group, Washington D.C.

Graveland C, Baas K, Faneca Sànchez M, Kroon T, Wonink S, Burgering L and Ball S. (2016). Sustainable Development Goals for water - SDG 6.4 - Three step approach for monitoring. Statistics Netherlands (CBS), The Hague.

Graveland C, Baas K and Opperdoes E. (2017). Physical water flow accounts with Supply and Use and water asset / water balance assessment NL. Statistics Netherlands (CBS), The Hague.

ICSU (2017). A guide to SDG interactions: from science to implementation (Griggs DJ, Nilsson M, Stevance A, McCollum D (eds)]. International Council for Science, Paris

Lucas P, Ludwig K, Kok M and Kruitwagen S. (2016). PBL Policy Studie 1966. PBL Netherlands Environmental Assessment Agency, The Hague.

Keith, H, Vardon M, Stein JA, Stein JL and Lindenmayer D (2017). Ecosystem accounts define explicit and spatial trade-offs for managing natural resources. Nature Ecology & Evolution, 1: 1683–1692.

Mandle L, Wolny S, Hamel P, Helsingen H, Bhagabati N and Dixon A. (2016). Natural Connections: how natural capital supports Myanmar's people and economy. WWF, Natural Capital Project, Myanmar.

Niestroy I. (2016). How are we getting ready? The 2030 agenda for sustainable development in the EU and its member states: analysis and action so far. Deutsches Institut für Entwicklungspolitik, Bonn.

Nilsson M, Griggs D and Visbeck M. (2016a). Map the interactions between sustainable development goals. Nature 534: 320–322.

Nilsson M, Griggs D, Visbeck M and Ringler C. (2016b). A draft framework for understanding SDG interactions. International Council for Science, Paris.

OECD (2016). Better policies for sustainable development 2016: a new framework for policy coherence. OECD, Paris.

OECD (2017). Development co-operation report 2017: data for development. OECD, Paris.

Oldekop JA, Fontana LB, Grugel J, Roughton N, Adu-Ampong EA, Bird GK, Dorgan A, Vera Espinoza MA, Wallin S, Hammett D, Agbarakwe E, Agrawal A, Asylbekova N, Azkoul C, Bardsley C, Bebbington AJ, Carvalho S, Chopra D, Christopoulos S, Crewe E, Dop MC, Fischer J, Gerretsen D, Glennie J, Gois W, Gondwe M, Harrison LA, Hujo K, Keen M, Laserna R, Miggiano L, Mistry S, Morgan RJ, Raftree LL, Rhind D, Rodrigues T, Roschnik S, Senkubuge F, Thornton I, Trace S, Ore T, Valdes RM, Vira B, Yeates N and Sutherland WJ. (2015).

100 key research questions for the post-2015 research agenda. Development Policy Review, 34(1): 55–82.
Pfeiffer A, Middeke F and Tambour M. (2016). 2030 Agenda for sustainable development – Implications for official statistics. Federal Statistical Office (Statistisches Bundesamt), Germany.
PBL (2017). People and the earth: international cooperation for the Sustainable Development Goals in 23 infographics. PBL Netherlands Environmental Assessment Agency, The Hague.
Reid AJ, Brooks JL, Dolgova L, Laurich B, Sullivan BG, Szekeresa P, Wood SLR, Bennetta JR and Cooke SJ. (2017). Post-2015 Sustainable Development Goals still neglecting their environmental roots in the Anthropocene. Environmental Science & Policy, 77: 179–184.
Reuter KE, Juhn D, Portela R and Venter J. (2016). Natural Capital Accounting across the Gaborone Declaration for Sustainability in Africa: A Desktop Scoping. Report Prepared for the Gaborone Declaration for Sustainability in Africa: Gaborone, Botswana. p.188.
SDSN (2014). Indicators and a monitoring framework for Sustainable Development Goals Launching a data revolution for the SDGs.
SDSN & TRENDS (2017). Counting on the world: building modern data systems for sustainable development. Sustainable Development Solutions Network, Thematic Research Network on Data and Statistics.
Statistics Netherlands (2016). Measuring the SDGs: an initial picture from the Netherlands. Statistics Netherlands (CBS), The Hague.
Statistics South Africa (2017). Sustainable Development Goals. Indicator baseline 2017. Statistics South Africa, Republic of South Africa.
Statistics Sweden (2016). Monitoring the shift to sustainable consumption and production patterns – in the context of the SDGs, Stockholm.
Termeer CJAM, Drimie S, Ingram J, Pereira L and Whittingham MJ. (2017). A diagnostic framework for food system governance arrangements: The case of South Africa. NJAS -Wageningen Journal of Life Sciences.
United Nations, European Commission, Food and Agricultural Organization of the United Nations, International Monetary Fund, Organisation for Economic Cooperation and Development and The World Bank (2014a). System of Environmental Economic Accounting 2012 – Central Framework, New York.
United Nations, European Commission, Food and Agricultural Organization of the United Nations, International Monetary Fund, Organisation for Economic Cooperation and Development and The World Bank (2014b). System of Environmental Economic Accounting 2012 – Experimental Ecosystem Accounting, New York.
UN ESCAP (2015). Integrating the three dimensions of sustainable development: a framework and tools. United Nations Economic and Social Commission for Asia and the Pacific, Bangkok.
United Nations (2015). Transforming our world: The 2030 agenda for sustainable development. United Nations, New York.
United Nations (2017). The Sustainable Development Goals Report 2017. New York.
UNSD (2015). SEEA and Transforming Global and National Statistical Systems for Monitoring SDG Indicators. Tenth Meeting of the UN Committee of Experts on Environmental-Economic Accounting, New York, 24–26 June 2015.
Vardon M, Bass S, Ahlroth S and Ruijs A. (eds.) (2017). Forum on natural capital accounting for better policy decisions: taking stock and moving forward. World Bank WAVES, Washington D.C.
Vaz PH. (2017). Discovery of natural resources: A class of general equilibrium models. Energy Economics, 61, pp. 174-178.Virto, L.C., J.L. Weber and M. Jeantil (2018). Natural capital accounts and public policy decisions: findings from a survey. Ecological Economics, 144: 244–259.
Waage J, Yap C, Bell S, Levy C, Mace G, Pegram T, Unterhalter E, Dasandi N, Hudson D, Kock R, Mayhew S, Marx C and Poole N. (2015). Governing Sustainable Development Goals: interactions, infrastructures, and institutions, in: Waage, J., C. Yap. (Eds.), Thinking Beyond Sectors for Sustainable Development. Ubiquity Press: London, pp. 79–88.
Willenbockel (2016). Climate policy and the energy-water-food nexus: a model linkage approach. Institute of Development Studies, University of Susses, Brighton, UK.
World Bank (2017). The 2017 atlas of sustainable development goals: a new visual guide to data and development. The World Bank, Washington D.C.
Zhou X and Moinuddin M. (2017). Sustainable Development Goals Interlinkages and Network Analysis: a practical tool for SDG integration and policy coherence. IGES, Japan.

Appendix: The SDGs

The 2030 Agenda for Sustainable Development, adopted by all UN Member States at the United Nations Sustainable Development Summit in September 2015, is a broad sustainability action plan for all countries, focusing on the poverty-development-environment nexus and with an overarching objective of leaving no one behind. It contains the following 17 Sustainable Development Goals (SDGs) – see https://sustainabledevelopment.un.org:

Goal 1. End poverty in all its forms everywhere
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3. Ensure healthy lives and promote well-being for all at all ages
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5. Achieve gender equality and empower all women and girls
Goal 6. Ensure availability and sustainable management of water and sanitation for all
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
Goal 10. Reduce inequality within and among countries
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12. Ensure sustainable consumption and production patterns
Goal 13. Take urgent action to combat climate change and its impacts*
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17. Strengthen the means of implementation and revitalise the global partnership for sustainable development

PBL Netherlands Environmental Assessment Agency

Mailing address
PO Box 30314
2500 GH The Hague
The Netherlands

www.pbl.nl/en

March 2018