

Increasing the use and usefulness of natural capital accounting for decision making

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Abstract

The growing number of countries and organizations producing natural capital accounts is an indication that many people are convinced of their usefulness. While the application of natural capital accounting in analysis and decisions remains relatively limited, we have identified an increasing number of actual and potential uses. This paper summarizes the types of uses identified, by country and by reference to stages of the policy cycle: (1) issue identification; (2) policy design; (3) policy implementation; and (4) monitoring and review. Drawing on the material presented to the Natural Capital Accounting Policy Forum in 2016, 2017 and 2018, we also identify examples covering a range of policy areas, such as climate change, biodiversity conservation, forest management and sustainable development. A fourth Policy Forum is scheduled for later in 2019 and will focus on land management. The Policy Forum has provided an annual platform for sharing experiences and is continuing to highlight the need for the users and producers of accounts to work together on the design, production and institutionalization of accounts so that they can be used in the analytical and policy tools commonly used in government and business.

Drawing upon these results and experience from WAVES partner countries, we discuss possible ways forward to make natural capital accounting even more policy relevant and more widely used to inform policy.

Objective

The objective of this paper is to provide information and stimulate discussion. Feedback on the paper from the London Group is welcomed.

Questions for the London Group to consider are:

- Does the paper reflect your knowledge of the use of environmental accounting by countries and others?
- What other examples are there of the use or proposed use of environmental accounting?
- Are the suggestions made for encouraging understanding and use of environmental accounting beyond the information provider community useful? Do you have other suggestions?
- How can quality assurance processes, and in particular international review of accounts and accounting applications, be managed?

1. Introduction

Work on environmental-economic accounts ('accounts' for short) has tended to be supply driven. In part this is attributable to the fact that the original mandate in the 1992 Earth Summit Action Plan, *Agenda 21*, concerned the development an accounting framework, now adopted as a full international accounting standard in the form of the SEEA. It may also be due to the fact that the main strength of the SEEA is to be cross-sectoral, using a framework that does not always align to the classifications of sectoral statistics that experts and policy makers are used to.

There has however been increasing recognition that it is not enough to produce accounts and that it is equally important to actively promote their use in policy. When the World Bank's Wealth Accounting and Valuation of Ecosystem Services (WAVES) global partnership was formed in 2012, promoting mainstreaming of the accounts into policy was a key feature of the program, recognizing two decades of experience from both developed and developing countries. Since then, policy uses of accounts have come more and more into focus. Accounts-related work of the OECD, UN Environment, Conservation International, UN Statistical Division and UN regional offices have all included aspects of policy use (sources). In addition, donor organizations have increasingly insisted on seeing policy impact from WAVES projects and programs.

When the WAVES Partnership initiated the Policy Forum of Natural Capital Accounting for Better Decisions (the 'NCA Policy Forum', for short) together with the Netherlands Ministry of Foreign Affairs in 2016, there was already a growing body of examples for policy uses of NCA, as evidenced in the rich materials submitted to the Forum and the publications that resulted from each of the Forums (See Vardon et al 2017, Ruijs and Vardon 2018, Vardon et al 2019). The intention of the NCA Policy Forum, which is about to be held for the fourth time, is to bring together accounts producers with policy makers from different fields to discuss and showcase how NCA can inform various topics. After the inaugural forum in 2016, each Policy Forum has focused on a specific theme. The themes chosen are always quite broad and cross-sectoral, such as SDGs, climate change, biodiversity and integrated land management, as this is really the strength of NCA.

2. Some preliminary points on policy application of accounts

Before discussing the application to date of accounts in policy analysis and decision-making, it may assist to make some preliminary points.

Quality assurance

The accounts produced to date have all undergone quality assurance procedures. This has involved within-country checks on the accuracy and interpretation of data as well as international review by accounting experts. Quality assurance reviews, both within country and international, have relied on voluntary contributions by international experts, usually from countries with much experience with natural capital accounting (e.g. Australia, Canada, Netherlands, Sweden, UK and USA). The reliance on relatively few reviewers is an issue that will need to be addressed if, as is expected, the number of countries producing and using accounts increases. That being said, questions about the data quality have generally been a second order issue in policy application, as policy agencies tend to focus more on key trends than on specific data points.

Application of accounts at different scales

Accounts can be applied at several levels of aggregation. At the most aggregated level, wealth accounts, estimate the value of the natural capital assets in a country. Initiatives like *The Changing Wealth of Nations* (World Bank 2018) and *Inclusive Wealth Report* (UNEP 2019) attempt to measure total wealth, ie. not only adding natural resources to the produced capital included in SNA, but also by quantifying human and social capital. These estimates are typically at the macro level, ie. not disaggregated by industry. Their role is primarily to serve as a signal, to raise awareness about the actual wealth of a country, and the sustainability of current economic policies, both in environmental and economic terms. They can be used with economic models at the aggregate national level to make future projections of potential growth paths.

The SEEA Central Framework (CF) accounts are typically done at the meso level, ie disaggregated to the industrial sectors as defined in SNA. They are well suited for integration into meso-level economic models, such as CGE models and Integrated Assessment models, and in fact data from accounts has already been used in modelling climate policy scenarios (Garrido 2019). Accounts have made it easier to regularly feed data into models and to update the structure of the models; accounts also assist modelling through their use of standardized definitions common classifications and clear protocols for model running and interpretation.

Cost-benefit analyses at the national policy level, e.g. concerning taxes and regulation of pollution and resource use, are often done in these types of models. This however typically requires data on the cost of available measures, which is not included in the accounts and often has to be estimated on an ad hoc basis. As the SEEA CF accounts include both flows and stocks, more specific indicators can be derived from them, e.g. sector-specific indicators on resource productivity and efficiency, which also lend themselves perfectly to estimate some of the SDG indicators. If computed for subnational levels, they of course lend themselves to addressing issues on the province and municipality government levels.

Land and ecosystem accounts, being geographically disaggregated, can be derived not only for various administrative boundaries but also aligned to ecosystem boundaries, such as catchments and primary forests. The challenge here is to actually link the ecosystem accounts to industries and households, so that the application of information in analysis and decisions does not stay within the environmental sector only. As some country examples show, local data can sometimes speak more readily to decision makers, influencing policy instruments in a more direct manner (Castillo 2017). Cost-benefit analyses for land uses such as for infrastructure and settlements also need to be site-specific and thus requires these types of data.

Emergence of new applications as accounting has developed

Consistent with the original intent of Agenda 21, accounts enhance decision-making through complementarity or integration of environmental data with the System of Nation Accounts (SNA). However, as SEEA has developed and SEEA-based accounts have been produced and are now being used, it has become increasingly apparent that accounts also enhance decision-making in other ways: by prompting collection of new information including to address data gaps; by organizing information in a way that enhances its relevance to broader analysis and decision-making (eg. because accounts link impacts with transactions and transactors); or simply by increasing the consistency and authority of information through standardization and the use of standard classifications, particularly ISIC. This latter point should not be underestimated, as the credibility that statistical agencies or central banks have is particularly important for the economists, data analysts and policy makers that do not usually work on environmental or sustainability issues.

Institutional arrangements

One of the challenges in account application has been to ensure that accounts are produced independently while also establishing enduring links between producer and user communities. Many countries address this by assigning account production independent statistical agencies and encouraging the statistical agency to engage with users from that position of independence, but there is a range of approaches, as seen in the following examples:

- Botswana has institutionalized the production of water accounts within the Department of Water Affairs, which also advises on their interpretation and application;
- Costa Rica's independent central bank produces its accounts yet has established collaborative mechanisms between the bank and users for water, energy and forests;
- the Netherlands has established a clear separation between its statistical agency as producer and its environmental assessment agency as policy analyst;
- Sweden has a long tradition of the statistical office producing the accounts yet actively promoting their use by academia as well as government. An economic analysis institute (National Institute of Economic Research) under the Ministry of Finance regularly use the accounts data in economic analysis and modelling, in particular emission and waste accounts;

- In the United Kingdom, the national statistical office prepares the accounts but an independent expert Natural Capital Committee analyses the data and advises government on the protection and improvement of natural capital (Bass et al 2017; Ruijs and van der Esch 2017; Barter 2017).

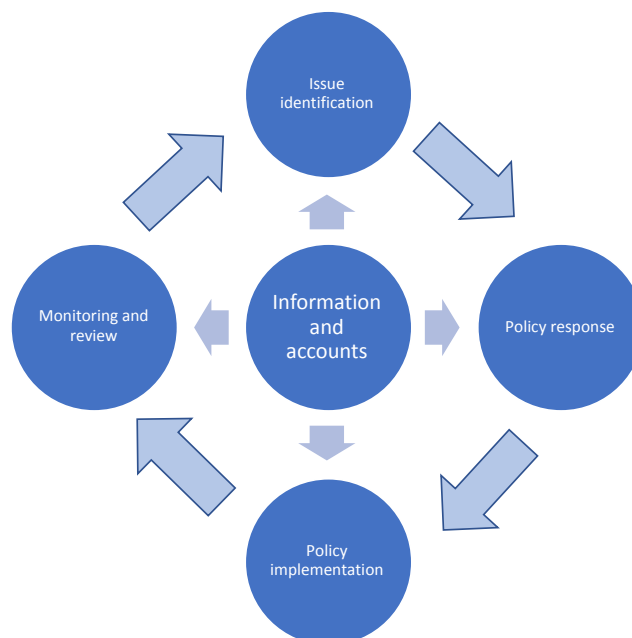
Even when appropriate institutional arrangements are established, it can take a long time for these to become a firm part of a country’s decision-making culture or ‘policy style’ (Ruijs and van der Esch 2017). As a result, no government is yet applying NCA comprehensively and routinely in its decision-making. Moreover, even for countries such as Netherlands and Sweden that make relatively extensive use of NCA in policy analysis, there is little information available on the level of influence accounts have had on actual decisions (Ruijs and Graveland 2018), although the UK reports that NCA has changed perceptions and language of stakeholders (Ruijs and Vardon 2018).

3. Information Concerning Application of Accounts in Policy

The instances of policy application of accounts catalogued in this paper have been drawn from the published proceedings of the three NCA Policy Forums held to date, supplemented by information provided by experts contacted by the authors. This approach was used because, as yet, the academic literature on the application of NCA in decision-making consists mostly of theoretical explorations rather than of case studies of actual application by governments (eg Keith et al 2017; Liu et al 2018). (One recent article that does review application by governments draws largely on the same NCA Policy Forum publications that are the sources for this paper (Ruijs et al 2019, while another recent paper that discusses application by governments is based on a 2014 survey of countries and so for present purposes is dated (Recuero Virto, Weber and Jeantil 2019)).

For convenience, instances of accounting applications gathered from NCA Policy Forum publications are presented in two ways in the attached tables. Table 1 arranges instances by country, with WAVES countries marked with an asterisk. Table 2 arranges these instances by reference to the standard public policy cycle, modified as shown in figure 1 to place the production of environmental information and accounts at the heart of the cycle, after Vardon et al (2016).

Figure 1. The policy cycle and the information system



In other words, Table 2 arranges instances of policy application according to whether their primary function is to enhance:

- (1) issue identification, eg to identify trends in environmental resource consumption;
- (2) policy design, eg to identify policy goals in response to observed trends and impacts;
- (3) policy implementation, eg to provide a systematised supply of standardized data and indicators for a regulatory scheme such as fisheries management; and
- (4) monitoring and review, eg to monitor the extent and condition of a forest estate against policy objectives for the estate.

Note that the policy cycle moves from the general to the specific and back to the general, from broad themes of scanning data for problems and conceptualizing responses, through the specifics of measuring and management of programs, and back towards the general in evaluating the success of policy responses.

Case Study One: Indonesia Low Carbon Development

A member of the G-20, Indonesia is a diverse archipelago nation of more than 300 ethnic groups and has the largest economy in Southeast Asia, the world's fourth largest population, is the 10th largest economy in terms of purchasing power parity, and the 14th largest in area. From 2000 to 2010, Indonesia sustained an average economic growth rate of about 6% owing it to a large extent to its rich natural asset base. Continuous growth has allowed the country to become a middle-income country reducing the poverty rate from 70% in 1984 to less than 10% today.ⁱ These gains, however, have been accompanied by significant pressure on natural capital, which is likely to threaten prospects for sustaining future growth.

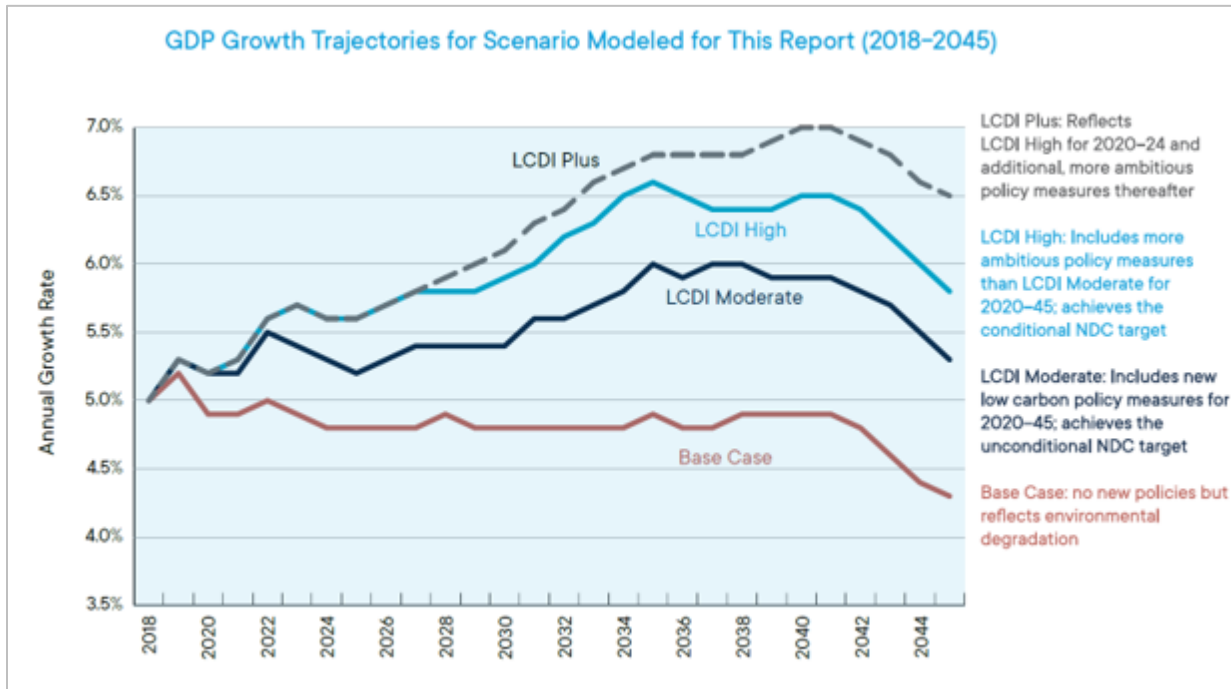
Indonesia's high economic growth relies largely on natural resources, with agriculture, forestry and fishing contributing 11.4% to GDP. Agriculture has mainly relied on expansion into new lands, particularly for oil palm, causing many environmental problems, including loss of forests (22 million ha between 1990 and 2014), reduced biodiversity and high carbon emissions (1,454 MtCO₂-eq. in 2016). The resulting air pollution from these emissions have caused serious health effects in Indonesia's population and recent estimates indicate that the total annual cost of premature deaths from air pollution is about 3.5% of Indonesia's GDP (2015).ⁱⁱ

The Government of Indonesia has become increasingly aware of the overall importance of natural capital and is proactively addressing the challenges of managing it. More recently, comprehensive analysis of prospects of a low carbon economy allowed Indonesia's Government to understand ways to grow sustainably and reduce pressure to natural capital. Bappenas, in cooperation with several development partners, including the World Bank, introduced the Low Carbon Development Initiative for Indonesia (LCDI) to explicitly incorporate Green House Gases (GHG) emissions reduction targets into the country's Mid-Term Development Plan (RPJMN 2020-2025), along with other interventions for preserving and restoring natural resources.ⁱⁱⁱ

The research carried out under the LCDI built on previous work and expanded the analysis to develop forecasts using a systems approach.^{iv} Technical assistance under WAVES contributed to this approach and overall modelling exercise through development of natural capital methodologies, protocols, models and SEEA compliant data that were particularly useful to introduce and analyze carrying capacity, which is a concept that helps understand how growth could be constrained by the limits of natural capital stocks to provide ecosystem services (i.e. provisioning, regulating and cultural services). Arguably this represents one of the main contributions in terms of policy uptake by an NCA framework in the country, as this work underpins decisions that will be made in the next five-year policy cycle.

Case Study One: Indonesia Low Carbon Development, continued

One of the key findings of the LCDI report is that a low carbon growth path can deliver an average GDP growth rate of 6% annually until 2045. Through the sustainable utilization of its natural resources, and by reducing its carbon and energy intensity, Indonesia’s total GHG emissions can fall by nearly 43% by 2030. This surpasses Indonesia’s target in its national climate action plan, or Nationally Determined Contribution (NDC), presently set at 41% below baseline. In these scenarios, forested land is also predicted to expand, while fish stocks should remain stable, and peat degradation largely avoided. Investments totaling between US\$ 14.6 billion to US\$ 22.0 billion per year for the period 2020-2024, are required to realize such improvements. This is equivalent to between 1 and 1.7% of GDP: it compares well to Gross Fixed Capital Formation, which has been in the order of 30% of GDP over the last ten years.



Source: LCDI Report

Case Study Two: Natural Capital Accounts for the Public Forest Estate England, UK (after Harris et al 2019)

Background

In order to manage the Public Forest Estate in England for a range of benefits other than just timber provisioning, Forestry England has established an on-going set of natural capital accounts for the land they manage. These accounts cover extent, the condition of different types of habitat, both physical and monetary flow accounts and a monetary asset account. The experience gained in developing national level accounts along the lines of the SEEA EEA has informed the development of these corporate accounts.

Key findings

The latest accounts show that there has been a substantial increase in the net asset value of the Public Forest Estate. This is partly attributed to an increase in the net asset value of timber, reflecting both a strengthened timber price and increased volume predictions for the next few years. The value put on recreational visits to the estate remains the largest single contributor to the balance sheet, with visitor numbers increasing by 25% against baseline year of 2013/14. There was also increased value attributed to carbon sequestration, reflecting increased non-traded carbon values (using UK Government published values) as well as an increase in projected sequestration.

Policy relevance and stakeholders

Forest Enterprise is finding natural capital accounting a very useful additional tool in understanding the benefits that our forests deliver for society. The process of identifying assets and physical flows of benefits through the development of the natural capital accounts has also proven to be beneficial in highlighting what we do and don't understand about the services that the estate delivers, and how they might be improved.

At a strategic level the information in the accounts is a key means for the organisation to have a regular check on whether the value of the natural capital services the estate provides is improving, as well as an overview of the state of play of and trends in the condition of different assets. However, the accounts are also used to inform decision making at all levels by clearly linking management activities with the value of the natural capital services and assets.

Source: Forestry England 2019. Natural Capital Account 2018-19.

https://www.forestryengland.uk/sites/default/files/documents/FE_NCA_18-19_FINALSEPT.PDF

4. Discussion on current uses and ways to expand policy applications

On the basis of the examples discussed at the three NCA Policy Forums to date, a wide range of developed, developing and least developed countries have produced and applied accounts to at least some degree. Applications are fairly well divided between general and specific policy uses. The subject-matter of applications is also diverse, ranging from broad themes such as the SDGs and natural capital, through major topics such as climate change, biodiversity and water, to specifics such as fuelwood and honey production.

When considered by reference to the policy cycle (figure 1), the most popular applications have been associated with issue identification and policy analysis, followed by indicator production and monitoring. As many of the countries that participated in the NCA Policy Forums had just begun developing accounts, not many had started using them for monitoring as yet, although this would seem to be the most evident application. A survey of countries who have been publishing accounts for a long time might yield a different result. Instances of the use of accounts as a tool of policy implementation, including direct use as a management tool, are rare. This may be because there is rarely a direct link from data/analysis to actual policy decisions. It might also to some extent be because there is a disconnect between producers and users; accounts may have been used but the producers are unaware of this, and the users are unaware of that they are using accounts data or derivatives thereof. Also rare to

date are examples of accounts being used across the various stages of the cycle: the Netherlands does so in relation to energy policy and Australia has an accounts strategy that foreshadows future policy application across the stages of the policy cycle.

There seems to be no particular pattern as to which accounts that has been most useful. The examples from the Forum shows an eclectic mix of accounts. It is also noteworthy that the last two NCA Policy Forums were geared towards SDGs and Climate Change/Biodiversity respectively, which causes a bias to the contributions. On SDG indicators, SDG 6 on water is the most commonly addressed. A clearer guidance on the links of specific SDG indicators to NC accounts might increase the use of NCA in that regard.

While not evidenced in the material, the above-mentioned convening aspect of developing NCA should not be underestimated in terms of policy impacts. Sharing and agreeing on data is a powerful way to bring issues to the attention of other stakeholders than the sectoral ministry in charge, getting to a common view of what is happening on the ground and facilitating collaboration. This is particularly noticeable when pertaining to assets like land and water.

It would be useful to collect additional information on uses of accounts from London Group members to get a fuller picture. One purpose of this paper is to elicit such information and discuss ways to enrich the so far quite meager literature on policy uses of NCA.

5. Concluding remarks: possible ways to increase policy use of NCA

While the application of accounts is gaining momentum, the potential of accounts to improve decision-making remains largely unrealized. There is still much to be learned and a significant need for international programs such as WAVES Partnership is to promote the exchange of ideas and experience. Suggestions for further learning and exchange include:

- Building the evidence base on policy uses of NCA through contributions by the London Group
- Building on the success of the NCA Policy Forum by
 - undertaking a review to ensure that it continues to achieve its full potential for the sharing of ideas and experience
 - continuing to disseminate learning from the Policy Forum to a broader audience through official and academic publications
 - encouraging participants to engage in bilateral and plurilateral collaboration and exchange on accounting application
- Encouraging higher education institutions to offer programs in both account production and policy application
- London Group members promoting connections between producers and users within their own countries while maintaining appropriate independence in account production

6. Acknowledgements

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Table 1: Policy Uses of Accounts by Country

Country or International Organization	Cross-sectoral Policy Uses (eg economic policy)	Sectoral/local Policy Uses (eg forest management)	Policy Uses Under Consideration
Australia	State of the Environment Reporting (Australian Capital Territory 2016, 2017, 2019)	Water allocation analysis (2018)	National Environmental-Economic Accounting Strategy (2018)
Botswana*	Fiscal policy & macroeconomic indicators of sustainability (2017); SDG 6 indicators	National water strategy and planning (2016, 2017, 2018)	Catchment management (2016)
Brazil	Green GDP (NC depreciation; costs of inaction) (2017)	Water resource management; Green Domestic Product (2017; 2018)	
Canada		Clean growth & climate policy analysis; trade agreement analysis; forest carbon budget (2018)	
Chile			Monitoring for sustainable development plans (2018)
China	Gross Ecosystem Product Accounting (2018)		Eco-compensation and 'ecological civilization' (2018)
Columbia*	Natural capital indicators (2018) Monitoring green employment (2018)	Water price modelling (2016); Monitoring forests and water, (2016, 2018)	
Costa Rica*		Policy analysis: energy, water, forests (2016, 2018); indicators	SDGs, Climate change, Aichi targets (2016); Monitoring policy progress (2018)
European Union	EU Growth Strategy; SDG indicator development; product air emission footprints (E2018)		General and sectoral environmental policy analysis and indicator development (2016)

Country or International Organization	Cross-sectoral Policy Uses (eg economic policy)	Sectoral/local Policy Uses (eg forest management)	Policy Uses Under Consideration
France	Wealth and climate indicators (2018); Indicator design (France 2018)		Artificialized land ratio indicator (2018)
Germany	Indicator production (2018)		
Guatemala*	Sustainable Development/SDG policy; Modelling of climate impact and responses (2016; 2018)	Forest & fuelwood strategy; water use; modelling for forestry & SDGs (2016, 2018)	
Indonesia*	Climate: Paris NDC (2016) National Development Plan; Low Carbon Development Plan; climate impact modelling (2017, 2018)		
Inter-American Development Bank	Integrated Environmental Economic Modelling (2017)		
Italy		Climate impacts on water; Emission permit monitoring (2018)	
Madagascar*		Water monitoring	
Malaysia			Monitor and review biodiversity policy implementation (2018)
Mexico	Policy analysis; Net Domestic Product; Natural capital indicator (2018)	Biodiversity mainstreaming (2018)	Ecological monitoring; Test modelling for species abundance accounts(2018)
New Zealand	Carbon Tax Working Papers (2017, 2018)		
Netherlands	Green Growth measurement framework (2016); Policy analysis and modelling including climate, energy, scenarios (2018)	Energy policy (2016); Monitoring Water Policy Implementation; monitoring carbon sequestration (2016, 2018);	

Country or International Organization	Cross-sectoral Policy Uses (eg economic policy)	Sectoral/local Policy Uses (eg forest management)	Policy Uses Under Consideration
Norway		Air emission analysis by industry (2018)	
Peru	Economy-wide effects of ecosystem degradation (2018)	Assess ecosystem status	
Philippines*		Water management and pricing including valuation and biophysical monitoring; Local landscape management; Assessing mangroves & coastal protection; fisheries (2016, 2018)	
Russia	Natural resource stocks and use (Russia 2018)		
Rwanda*	National Strategy for Transformation; Green Growth Strategy (2017, 2018)	Land use planning; Review of Water Master Plan; biophysical monitoring & indicators (2016)	
South Africa		Water security; Protected Area expansion (2017); Biodiversity mainstreaming (2018); Spatial Planning; Ecosystem restoration (2017)	Monitoring (2018); Biodiversity trend analysis (2018)
Sweden	Analysis and modelling across various sectors, eg air, energy, product footprints (Sweden 2016, 2018)	Policies for GHG reduction (2014); Greenhouse gas monitoring; GHG consumption footprint (2016, 2018)	SDGs and air emissions (2016); Identify actors and actor-responsibility for biodiversity management; biodiversity expenditure analysis (2018)
Uganda*		Species protection, GHG analysis (2018)	Ecosystem and biodiversity trends (2018)
United Kingdom	Natural Capital analysis, protection and improvement (2016, 2018)	Forest management (2017)	Inter-city comparison, including green areas; Monitor changes in ecosystem services; implementation of 25 Year Environment Plan (2018)

Country or International Organization	Cross-sectoral Policy Uses (eg economic policy)	Sectoral/local Policy Uses (eg forest management)	Policy Uses Under Consideration
United States of America		Cattle GHG emissions and climate impact analysis (2018)	
Zambia*		Climate risks to water supply and biodiversity; forest production modelling incl honey (2018)	Water accounts used in Integrated Environmental Economic Modelling (2018)

Notes:

1. * Denotes a WAVES Core Implementing Country
2. Years refer to one of three forums on Natural Capital Accounting for Better Decisions held in 2016-2018 (see Vardon et al (eds) 2017 on the 2016 workshop; Ruijs and Vardon (eds) 2018 on the 2017 workshop; and Vardon et al (eds) 2019 on the 2018 workshop).

Table 2: Policy Uses of Natural Capital Accounts by Stage of Policy Cycle and Type of Use

Stage of Policy Cycle	Cross-sectoral Policy Uses (eg economic policy)	Sectoral/local Policy Uses (eg forest management)	Policy Uses Under Consideration
<p>Issue Identification (includes general policy analysis, advice and goal-setting)</p>	<p>State of the Environment Reporting (Australian Capital Territory 2016, 2017)</p> <p>Fiscal policy & macroeconomic indicators of sustainability (Botswana 2017)</p> <p>Green GDP (NC depreciation; costs of inaction) (Brazil 2017)</p> <p>Gross Ecosystem Product Accounting (China, 2018)</p> <p>Sustainable Development/SDG policy; Modelling of climate impact and responses (Guatemala 2016; 2018)</p> <p>EU Growth Strategy; SDG indicator development; product air emission footprints (EU 2018)</p> <p>National Development Plan; Low Carbon Development Plan; climate impact modelling (Indonesia 2017, 2018)</p> <p>Policy analysis and modelling including climate, energy, scenarios (Netherlands 2018)</p> <p>Policy analysis; Net Domestic Product (Mexico 2018)</p> <p>Carbon Tax Working Papers (NZ 2017, 2018)</p> <p>Assess ecosystem status; economy-wide effects of ecosystem degradation (Peru 2018)</p>	<p>Water allocation analysis (Australia 2018)</p> <p>National water strategy and planning (Botswana 2016, 2017, 2018)</p> <p>Water resource management; Green Domestic Product (Brazil 2017; 2018)</p> <p>Clean growth & climate policy analysis; trade agreement analysis; forest carbon budget (Canada 2018)</p> <p>Policy analysis: energy, water & forests (Costa Rica 2016, 2018)</p> <p>Forest & fuelwood strategy; water use; modelling for forestry & SDGs (Guatemala 2016, 2018)</p> <p>Climate: Paris NDC (Indonesia 2016)</p> <p>Climate impacts on water (Italy 2018)</p> <p>Biodiversity mainstreaming (Mexico 2018)</p> <p>Air emission analysis by industry (Norway 2018)</p> <p>Mining & Environment; assess mangroves & coastal protection; fisheries (Philippines 2016, 2018)</p>	<p>SDGs, Climate change, Aichi targets (Costa Rica 2016)</p> <p>General and sectoral environmental policy analysis and indicator development (EU 2016)</p> <p>Test modelling for species abundance accounts (Mexico 2018)</p> <p>Biodiversity trend analysis (South Africa 2018)</p> <p>Identify actors and actor-responsibility for biodiversity management; biodiversity expenditure analysis (Sweden 2018)</p> <p>Ecosystem and biodiversity trends (Uganda 2018)</p> <p>Inter-city comparison, including green areas (UK 2018)</p>

Stage of Policy Cycle	Cross-sectoral Policy Uses (eg economic policy)	Sectoral/Local Policy Uses (eg forest management)	Policy Uses Under Consideration
	<p>National Strategy for Transformation; Green Growth Strategy (Rwanda 2017, 2018)</p> <p>Analysis and modelling across various sectors, eg air, energy, product footprints (Sweden 2016, 2018)</p> <p>Natural Capital analysis, protection and improvement (UK 2016, 2018)</p> <p>Integrated Environmental Economic Modelling (Inter-American Development Bank 2017)</p>	<p>Land, Water & Minerals (Rwanda 2016)</p> <p>Biodiversity mainstreaming (South Africa 2018)</p> <p>Species protection, GHG analysis (Uganda 2018)</p> <p>Cattle GHG emissions and climate impact analysis (USA 2018)</p> <p>Climate risks to water supply and biodiversity; forest production modelling incl honey (Zambia 2018)</p>	
Policy Design	<p>Indicator design (France 2018)</p> <p>Natural capital indicator (Mexico 2018)</p> <p>Green Growth measurement framework (Netherlands 2016)</p> <p>Spatial Planning; Ecosystem restoration (South Africa 2017)</p>	<p>National water strategy and planning (Botswana 2016)</p> <p>Water price modelling (Columbia 2016)</p> <p>Mining & Environment (Philippines 2016)</p> <p>Water security; Protected Area expansion (South Africa 2017)</p> <p>Policies for GHG reduction (Sweden 2014, xxxx)</p>	Eco-compensation and 'ecological civilisation' (China 2018)
Policy Implementation (includes management)		Forest management (UK 2017)	Catchment management (Botswana 2016)
Monitoring and Review	State of the Environment Reporting (Australian Capital Territory 2016)	Monitoring forests, water, green employment (Columbia 2016, 2018)	Monitoring for sustainable development plans (Chile 2018)

Stage of Policy Cycle	Cross-sectoral Policy Uses (eg economic policy)	Sectoral/Local Policy Uses (eg forest management)	Policy Uses Under Consideration
	Natural capital indicators (Columbia 2018) Wealth and climate indicators (France 2018) Indicator production (Germany 2018) Natural resource stocks and use (Russia 2018) SDG 6 indicators (Botswana)	Emission permit monitoring (Italy 2018) Monitoring Water Policy Implementation; monitoring carbon sequestration (Netherlands 2016, 2018) Greenhouse gas monitoring; GHG consumption footprint (Sweden 2016, 2018)	Monitoring policy progress (Costa Rica 2018) Artificialised land ratio indicator (France 2018) Monitor and review biodiversity policy implementation (Malaysia 2018) Ecological monitoring (Mexico 2018) SDGs and air emissions (Sweden 2016) Monitoring (South Africa 2018) Monitor changes in ecosystem services; implementation of 25 Year Environment Plan (UK 2018)
Use at Multiple Stages (including institutionalization)		Energy policy (Netherlands 2016)	National Environmental-Economic Accounting Strategy (Australia 2018)

Notes:

1. Some initiatives perform several functions and are thus shown in more than one cell.
2. Years refer to one of three forums on Natural Capital Accounting for Better Decisions held in 2016-2018 (see Vardon et al 2017 on the 2016 workshop; Ruijs and Vardon 2018 on the 2017 workshop; and Vardon et al 2019 on the 2018 workshop)

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Endnotes

ⁱ Indonesia Systematic Country Diagnostic (World Bank, 2015); World Bank Data (World Bank: PovcalNet, n.d.); WB staff calculations World Bank Data (World Bank, 2018); Indonesia Country Partnership Framework (World Bank, 2015)

ⁱⁱ Closing the Development Gap: Development Policy Review 2019 (World Bank, 2019) These estimates do not include the burden of air pollution on Indonesia's neighbor countries. Measuring them will add accuracy and transparency to the estimations.

ⁱⁱⁱ Indonesia's nationally determined contributions (NDC) includes a unilateral reduction target of 29% (~2,869 MtCO_{2-eq}) below Business as Usual (BAU) emissions of Greenhouse gases (GHGs) by 2030, plus a conditional target of up to 41% reductions below BAU with sufficient international support. (Bappenas, 2019) It targets 2030 emissions of 2,037 MtCO_{2-eq} under the unconditional target and emissions as low as 1,693 MtCO_{2e} under the conditional target. (WRI, 2017)

^{iv} World Bank Low Carbon Development: A paradigm Shift Towards a Green Economy in Indonesia (Bappenas, 2019)