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Using the System of Environmental-Economic Accounts—Ecosystem Accounting for policy: A case study on forest ecosystems

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Abstract

Robust, regular and integrated evidence on the environment and its relationship with the economy and human well-being is needed to deliver effective environmental policy. This paper highlights the role the United Nations statistical standard System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) can play in delivering this 'policy-ready' evidence. As part of an environmental-economic information system, the SEEA EA can organise, summarise and integrate multiple biophysical and socioeconomic data to support many policy applications. To achieve this, SEEA EA accounts need to be compiled in response to user needs for evidence across the policy cycle. This means delivering policy-ready evidence in the right format at the right time. We explore the role the SEEA EA can play in this regard, using forest ecosystems as a policy theme of high international concern for people, nature and climate. The paper presents a structured approach to evaluating the data and evidence needs across this policy framework, using the EU Green Deal and Liberia's forest policy frameworks as case studies. Starting from this policy user perspective is critical to establishing the evidence needs that SEEA EA can meet. This addresses long-standing concerns that the compilation of SEEA EA accounts have been driven by the availability of data, rather than demand driven in response to policy needs. We argue that addressing policy needs is essential for the SEEA EA to deliver on its potential to better mainstream the many benefits provided by natural, as well as intensively managed forests, and other ecosystems, into development planning.

Keywords: System of Environmental Economic Accounting Ecosystem Accounting (SEEA EA); Policy evidence, Sustainable Development; Forests

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Contents

1 Introduction

Robust scientific knowledge and data on the state and trends of the environment are imperative for effective policy-making (OECD, 2015; Rose et al., 2020). The Rio+20 Summit highlighted this in its outcome document 'The Future We Want'. Its section on institutional framework capacity for sustainable development aims to: "Promote the science-policy interface through inclusive, evidence-based and transparent scientific assessments, as well as access to reliable, relevant and timely data in areas related to the three dimensions of sustainable development – economic, social and environmental" (UN, 2012).

However, there are long-standing concerns that environmental policy has often been experience, rather than evidence, led (James et al., 2016), which is due to several factors. First, while there are many monitoring programmes tracking environmental trends, they tend to be biased spatially, temporally or towards easy-to-measure aspects of the environment, with limited assessment of implications of these trends over time, and their attribution to causes (Scarano et al., 2018). Second, relevant environmental evidence may not be readily accessible or stored locally, making it time-consuming and expensive to locate and understand (McKinnon et al., 2015). Third, decision-makers and the public may find it a cumbersome process to locate relevant evidence in the rapidly growing information flow (Bayliss et al., 2012; open data movement). Fourth, most environmental issues are complex and deeply interconnected to wider economic and social issues (Rose et al., 2018). Therefore, policy-makers also need relevant and scientifically grounded integrated evidence on how society and the economy both depend on and impact upon the environment (Berghöfer et al., 2016). Yet, monitoring programmes for ecosystem services and their contributions to the economy and well-being are often inadequate and not able to meet these evidence needs (Scarano et al., 2018). Furthermore, the operation in silos of environmental agencies often poses difficulties for generating integrated environmental evidence that can be captured by sectoral and strategic decision-making (Benson et al., 2014). Fifth, environmental data is often not processed into timely evidence that policy and decision makers can use (Scarano et al., 2018). Windows where good environmental-economic evidence can influence 'better' policy-making are often short, sometimes hard to anticipate, linked to changing governments or crises points (Rose et al., 2020). Consequently, when environmental evidence is readily and routinely available, it is more likely to be considered in policy (Rose et al., 2020).

These challenges present barriers for informing coherent policy and institutional responses, called for under the Sustainable Development Goal 17 (UNSD, 2022). The System of Environmental-Economic Accounting (SEEA) is an international statistical standard that has been developed to, *inter alia*, overcome these challenges. The SEEA aims to extend the System of National Accounts (SNA) used for producing statistics and measures of economic activity (UN et al., 2014) and comprises two parts. The first one is the SEEA Central Framework (SEEA CF 2012). This multipurpose statistical framework delivers consistent, regular, and harmonised data on environmental resources, inputs to the economy and returns to the environment (e.g., emissions to air and water). The second part is the SEEA Ecosystem Accounting (SEEA EA 2021) that organises evidence on the state of ecosystems and the services they deliver to the economy and society (UN et al., 2021; Edens et al., 2022) A key advantage of the SEEA EA is that it institutionalises the regular production of information on ecosystems and the benefits they provide with the production cycles of the SNA by National Statistical Offices (NSOs). This improves the availability of this information when decision-makers need it and supports the integration of economic, social (e.g., census data) and environmental information. It also improves the robustness of this evidence via the data quality assurance frameworks that underpin national statistics.

The core accounting model of the SEEA EA is presented in Figure 1 (UN et al., 2021), comprising ecosystem stocks and service flows in physical and monetary terms. The stocks of ecosystems are their

changes over time are measured via ecosystem extent and condition accounts. The ecosystem services accounts organise information on the supply of ecosystem services by different ecosystems and their use by different users (e.g., businesses, government or households) in physical and monetary terms, as flows within a period of time. The monetary value of expected future flows of ecosystem services from ecosystems informs the monetary ecosystem asset accounts. The accounts are compiled for a defined geographical area called an Ecosystem Accounting Area (EAA), such as a country, watershed or ecosystem type. The UN Statistical Commission has encouraged nations to implement the SEEA EA in their territory in the coming years (UN et al., 2021).

This paper examines the important roles that the SEEA EA can play in delivering 'policy-ready' evidence on the environment and its connections to the economy and people. Section 2 describes the role that SEEA EA can play in the policy cycle. Section 3 introduces forest ecosystems as a policy theme that SEEA EA can inform. Section 4 describes the evidence that SEEA accounts can deliver on this policy theme. Building on the observations of Vardon et al., (2016) that the development of environmental-economic accounts has not been 'user driven', in Section 5, we describe an approach for elaborating a policy framework to inform the accounts compilation process that may encourage greater focus on users' needs, using the EU Green Deal and forest policy framework in Liberia as case studies. In Section 6, we discuss the advantages of using the SEEA EA and the importance of starting from this policy perspective to deliver 'policy-ready' evidence. In Section 7, we conclude with recommendations for implementation of the SEEA EA.

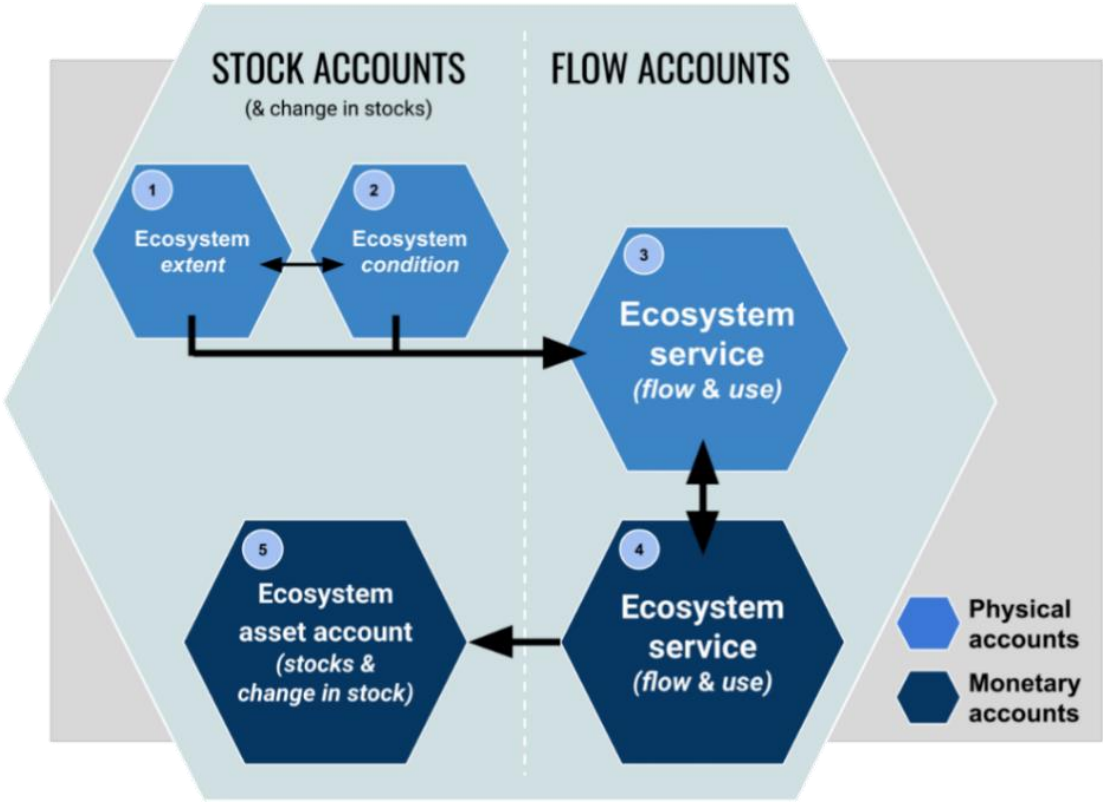

Figure 1: Core SEEA EA Accounts (UN et al., 2021).

2 Policy cycles and the SEEA EA

If evidence is to be influential for policy, it needs to be synthesised in a manner that best meets policy needs. Haynes (2006) suggests an evidence-base for policy should be structured as blocks that build on each other. For instance, using research studies and systematic reviews to integrate and synthesise a wide range of knowledge and evidence, and then densifying in synopses or summaries, which flow into decision-support systems. These types of decision-support systems or tools sum up the overall scientific evidence, integrate across various scales, disciplines and stakeholder interests and needs, and feed them into a specific decision point (Dicks et al., 2014). A common way of conceptualising these decision-making points is the policy cycle.

Vardon et al., (2016; 2018) highlight a central role for the SEEA in organising and summarising basic data in a systematic way to produce key indicators and aggregates that provide evidence across the policy cycle (Figure 2). However, for the SEEA EA to deliver 'policy-ready' evidence, the accounts need to meet key evidence needs in a format appropriate to the processes and procedures that drive the policy cycle. We explore this in the context of the policy cycle in the following sub-sections.

2.1 Agenda Setting

The SEEA EA can provide robust, regular evidence on the trends in the changing extent of ecosystems and their condition, as well as the ecosystem services they deliver. For example, showing the implications of deforestation on the ecosystem services downstream of water regulation and water security. Examining this type of trend data is an important first step in identifying emerging issues (UNEP, 2014). This evidence can inform exploratory, forward looking scenarios that reveal threats and opportunities associated with ecosystems (e.g., expansion of agricultural land in response to increasing population demand, or degradation in response to pollutants). Sutherland & Woodroof (2009) describe this systematic search for potential threats and opportunities that are currently poorly recognized as 'Horizon Scanning'. The aim being to establish a broad framing of policy issues that have been identified by consideration of trends in environmental data, pressures and their implications for economic and social welfare.

Links can be made between ecosystem extent and condition, and economic and social welfare via ecosystem service supply and use. Other links can be made between economic and social drivers of ecosystem degradation and ecosystem services loss. An example of using SEEA EA accounts to set the agenda for government policy is demonstrated for a forest region in Australia where competing uses of ecosystem services causes conflict in society. The accounts showed that the value of provisioning services for commercial use was lower than the value of regulating services used by the whole of society. This evidence has informed debate and resulted in a government review of forest information systems and their management (Keith et al. 2017; 2019).

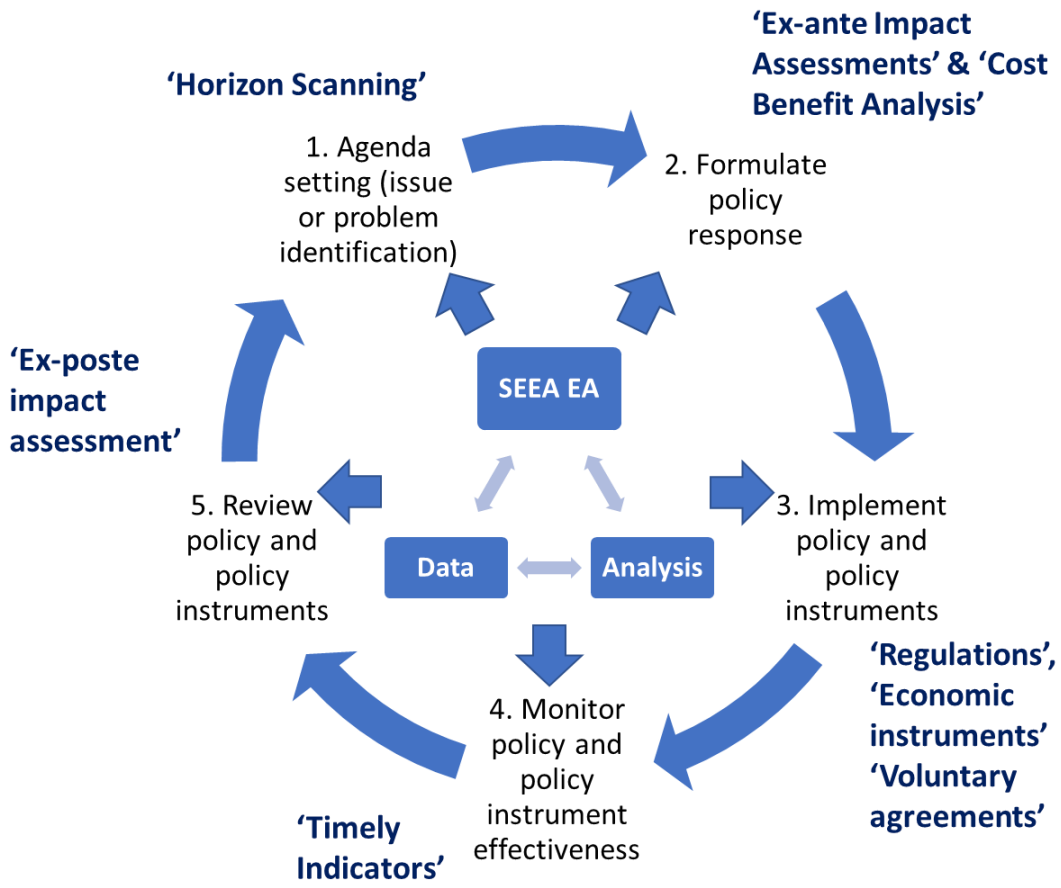

Figure 2: Role of SEEA EA in contributing evidence across the policy-cycle (adapted from Vardon et al., 2016; Bass et al., 2017)

A key advantage of SEEA EA is it allows for evidence on ecosystems to be linked with evidence on the economy and human well-being. This type of integrated information can help articulate 'Systems Thinking' approaches, which recognise these inter-connections and the need to pursue an integrative approach that addresses all development goals (Voulvoulis et al., 2022). Weitz et al., (2014) characterises this approach to cross-sectoral interactions as a nexus approach. Barber et al., (2020) provide an example for the water, energy and food nexus to illustrate the multiple benefits of nature-based solutions. Policymakers are now recognising the importance of these systems or nexus approaches in setting the agenda for a more integrated policy framework for sustainable development (Voulvoulis et al., 2022). The SEEA EA framework aligns well with evidence needs for such emerging integrative policy concepts (e.g., Environmental Policy Integration (EPI) and the WEL Nexus approach decribed by Venghaus et al., 2019).

2.2 Policy formulation

Policy targets are set and interventions and instruments to achieve them are proposed at the policy formulation stage. These targets set the policy objectives for interventions to address issues identified in the agenda setting stage. Ideally, they should be stated in a manner that is specific, measurable, achievable, relevant and time-bound (SMART) (UNEP, 2014). Policy instruments aim to change behaviours in a way that contributes to achieving policy objectives. They include legislative and regulatory, economic and voluntary instruments. For instance, formulating laws on nature protection, ecosystem management and restoration, and natural resources use.

The SEEA EA can also demonstrate to policy-makers the types of interventions that can deliver on these and wider policy targets. For instance, by delivering a more systematic set of information that covers stocks, flows, benefits and beneficiaries, the SEEA EA allows nature-based solutions targeted at a particular goal, such as climate change mitigation, to be designed in a more integrated way that delivers additional benefits. These benefits include climate change adaptation, biodiversity conservation and human well-being (Keith et al., 2021).

At this policy formulation stage, the SEEA EA can support ex-ante policy impact assessments, which evaluate potential instruments to achieve policy targets in terms of their economic, social and environmental impact and their coherence with other objectives and monitoring options. This can produce better designed interventions and instruments that deliver multiple benefits, evaluate cost effectiveness and avoid unintended consequences (e.g., environmentally extended cost benefit analysis often used in public policy appraisal, Johnston & Rosenberger, 2010). The European Commission have published 'better regulation' guidelines that highlight the important role that such 'Impact Assessments' should play as part of the public policy and programming cycle (EC, 2021a).

2.3 Policy implementation

The SEEA EA can help identify targeted deployment of policy instruments. For regulatory instruments, such as protection of ecosystems or zoning of land-use activities, the SEEA EA can identify trade-offs between economic, conservation and services outcomes associated with different land use activities (e.g., Keith et al., 2017). For financial policy instruments, the SEEA EA can support design of eco-compensation or payment for ecosystem services schemes (e.g., Ouyang et al., 2020). It can be envisaged that by providing a robust and transparent information framework, the SEEA EA could support the design of voluntary agreements with respect to ecosystem management and benefits access.

2.4 Policy monitoring

There are two distinct forms of monitoring; environmental monitoring to collect data that is compiled within SEEA EA accounts as part of the information system, and policy monitoring as part of the policy cycle that is used to assess policy effectiveness. Here we are discussing the latter, which involves the continuous and systematic generation of evidence to compare how well a policy is being implemented against expected results (EC, 2021a). Monitoring policy effectiveness focuses on policy outcomes (i.e., progress towards policy targets) rather than processes (i.e., policy formulation and implementation activities) (Schoenefeld et al., 2019). The SEEA EA can support policy monitoring by linking ecosystem restoration and conservation actions to a range of economic and well-being outcomes and monitoring progress towards goals and targets. For example, SEEA EA accounts of change in ecosystem extent and ecosystem services have been recommended within the monitoring framework of the Kunming-Montreal Global Biodiversity Framework (GBF) of the Convention on Biological Diversity, and several countries already implement and use accounts as a measure of biodiversity mainstreaming.[1]

2.5 Policy review

At this stage, ex-poste impact assessment of the effectiveness of policy instruments is undertaken to identify how they can be adapted to better achieve policy objectives and targets. This may be referred to as policy evaluation. For instance, in the context of European environmental and climate policy, the EEA (2016) propose policy review should consider relevance (i.e., of policy targets), effectiveness (e.g., to what extent

[1] https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-05-en.pdf

did the policy deliver on objectives), efficiency (e.g., returns on investment) and coherence (e.g., with other policy targets and instruments). Ruijs et al., (2019), highlight the SEEA EA can support these assessments with respect to unintended consequences of the policies (e.g., unintended impacts on biodiversity, carbon storage and ecosystem services) and revealing ecological, well-being and economic returns on policies to invest in ecosystems. This can help policy analysts determine if instruments need to be adjusted.

3 The Policy Framework for Forest Ecosystems

A policy framework represents a government's set of mechanisms to deliver improved outcomes for a given theme or sector and how these should be applied. It includes policy instruments, such as regulation, legislation, and economic instruments. Policy frameworks arise because no single policy, instrument or individual element will have the capacity to address, in a balanced, holistic, and mutually reinforcing way, all the issues relating to a particular theme or sector (UNSD, 2020). Here we elaborate the policy framework for forest ecosystems and identify potential evidence needs the SEEA EA can address.

3.1 International commitments to forests

The forests of the world support approximately 80% of terrestrial plant, animal and invertebrate species (FAO & UNEP, 2020) and supply societies with provisioning, regulating and cultural services, such as food, wood and fibres, climate and water flow regulation and opportunities for recreation (UNEP 2022; FAO 2022). Forests have great significance for countries' socioeconomic development at both local, regional, and national levels, with the forest sector ensuring 33 million jobs worldwide and at least USD 1.5 trillion to global Gross Domestic Product (GDP) (FAO 2022). In addition, forests provide cultural benefits and support the livelihoods of indigenous peoples (Dooley et al., 2022). Although all forest ecosystems provide multiple benefits, the magnitude and diversity of benefits tends to be higher for natural forests, compared with intensively managed forests (e.g., plantations and agroforests) (UNEP & IUCN, 2021).

Despite the importance and diverse values of forests, these ecosystems continue to be converted into other land uses and degraded (Song et al., 2018; Winkler et al., 2021). In thirty years (from 1990 to 2020), 420 million ha was deforested, representing 10% of the world's forest coverage (4,060 million ha) (FAO, 2020; 2022). Although more difficult to assess and monitor, addressing forest degradation is also important to determine the loss of ecosystem services (Baccini et al., 2017; Bullock et al., 2020), with a total of 20% of the Earth's surface being degraded (UN, 2019)). For these reasons, deforestation and forest degradation is a well-recognised threat to sustainable development.

In response, multiple global policies and international commitments have been made to halt forest loss and degradation and to promote conservation and restoration of forest ecosystems (Table 1). The most developed international policy mechanisms are those aiming at mitigating the role of deforestation in climate change and greenhouse gas emissions, led by the UNFCCC collaborative programme on *'Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries*' (REDD+; Nature editorial, 2009), which led to deforestation pledges in the Paris Agreement (UN, 2015). The Glasgow Leaders' Declaration on Forests and Land Use highlighted that policy-makers can see the importance of forests in climate change mitigation, and achieved clear 2030 and 2050 targets for halting deforestation pledged by the parties (Gasser et al., 2022). To enable monitoring, the global forest carbon monitoring framework provides a consistent means to compare progress at local scales, given the increasing capacity of national governments to collect and analyse forest data (Harris et al., 2021; Nabuurs et al., 2022).

There are also several international policy frameworks more focused on the preservation of forests with the aim to halt biodiversity loss and enable the sustainable development of communities that depend on forests. Pledges devoted to the conservation and restoration of forest habitats include the Bonn Challenge and all the activities related to the current UN Decade on Ecosystem Restoration. Recently, Adoption of the Kunming-Montreal GBF at the CBD COP15 is based on three main pillars: conservation, restoration and sustainable use. The GBF sets out targets related to each of these pillars and pathways to reaching them. The first pillar is focused on protection of important areas and the management of invasive species through transformative change: placing biodiversity at the centre of decision-making by transforming governance, economic and social systems. The second pillar includes reforestation and the reintroduction of threatened species through a pathway of enhancing the science-policy interface. The third pillar is capacity building to ensure sustainable management of natural resources and the engagement of local communities and indigenous peoples.

Table 1: Global policies and commitments for forests (not exhaustive, for a more detailed overview see Sotirov et al., 2020)

Year	Name	Description	Reference
2005	Reducing emissions from deforestation and forest degradation (REDD)	Development of mechanism to account for green-house gas emissions reductions from activities in developing countries reducing deforestation, forest degradation, and increasing the conservation, sustainable management and enhancement of forest carbon stocks.	UNFCCC REDD
2011	Bonn Challenge	Global commitment launched by the Government of Germany and International Union for Conservation of Nature (IUCN) to bring 150 million hectares of degraded and deforested landscapes into restoration by 2020 and 350 million hectares by 2030	Bonn Challenge
2014	New York Declaration on Forests (NYDF)	Global political declaration that brings together governments, companies and civil society actors including Indigenous Peoples' organizations with the common aim of halving the loss of natural forests by 2020, and striving to end it by 2030.	New York Declaration on Forests
2015	Paris Agreement	In its Article 5: "*Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1 (d), of the Convention, including forests*"	United Nations (2015). Paris Agreement. [English]
2015	2030 Agenda for Sustainable Development	Sustainable Development Goal (SDG) 15 aims to "*protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"*	Transforming our World: the 2030 Agenda for Sustainable Development. A/RES/70/1
2017	United Nations Strategic Plan	"*Provides a global framework for action at all levels to sustainably manage all types of forests and trees*	General Assembly Resolution 71/285: United Nations

	for Forests 2017–2030	*outside forests, and to halt deforestation and forest degradation*"	Strategic Plan for Forests 2017–2030 A/RES/71/285
2018	COP 14 CBD	recognised the *exceptional importance of primary forests for biodiversity conservation and the urgent necessity to avoid major fragmentation, damage to and loss of primary forests of the planet* (CBD 14/30).	https://www.cbd.int/doc/decisions/cop-14/cop-14-dec-30-en.pdf
2021	Glasgow Leaders' Declaration on Forests and Land Use	Reaffirms the commitment of leaders "*to work collectively to halt and reverse forest loss and land degradation by 2030 while delivering sustainable development and promoting an inclusive rural transformation*"	Glasgow Leaders' Declaration on Forests and Land Use [2th November 2021 (6pm)]
2021	Glasgow Climate Pact	Among other things, it "e*mphasizes the importance of protecting, conserving and restoring nature and ecosystems to achieve the Paris Agreement temperature goal, including through forests and other terrestrial and marine ecosystems acting as sinks and reservoirs of greenhouse gases and by protecting biodiversity, while ensuring social and environmental safeguards*"	UNFCCC/PA/CMA/2021/10/Add.1 Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on its third session, held in Glasgow from 31 October to 13 November 2021
2021	Joint Statement of the Collaborative Partnership on Forests	"*Presents sound scientific facts and figures around the current status of deforestation and the multidimensional services provided by forests. It also aims to support countries and other key stakeholders to address the issue*"	Joint Statement of the Collaborative Partnership on Forests "Challenges and Opportunities in Turning the Tide on Deforestation"
2021	UN Decade 2021-2030 on Ecosystem Restoration	Aims to prevent, halt and reverse the degradation of ecosystems worldwide, including forests	UN Decade 2021-2030 on Ecosystem Restoration Strategy
2022	COP27 UNFCCC	Among other things, it "*emphasizes the importance of protecting, conserving and restoring nature and ecosystems to achieve the Paris Agreement temperature goal, including through forests and other terrestrial and marine ecosystems acting as sinks and reservoirs of greenhouse gases and by protecting biodiversity, while ensuring social and environmental safeguards*"	Sharm el-Sheikh Implementation Plan (Decision -/CP.27)
2022	Kunming-Montreal Global Biodiversity Framework (GBF)	It has 23 action-oriented targets for urgent action over the decade to 2030, to reduce threats to biodiversity, secure the benefits people receive from biodiversity are sustained and mainstream biodiversity in public, private and financial decision-making, including forests, forest ecosystem services and biodiversity	COP15: Nations adopt four goals, 23 targets for 2030 in landmark UN biodiversity agreement

3.2 Regional and national policy frameworks for forests

Regions and countries have established policy frameworks to deliver on international targets (e.g., the GBF) and their own objectives for forests to secure the many benefits they provide. According to the latest global Forest Resources Assessment (FRA), most countries and territories assessed have specific national policies

for forests (164 out of 187) (FAO, 2020). National forest policies establish objectives, which may be elucidated via national plans or strategies. These are then implemented via policy instruments.

Table 2 provides an indicative and non-exhaustive list of potential policies and policy instruments that evidence about forests reported in SEEA EA accounts can inform. Forests' governance is also shared, across national (or federal), state (or provincial), and local levels. All these multilevel government bodies and their policies will impact the management of forests and the implementation of activities in forests. Using the SEEA EA as a common framework to organise information on forests can help bring coherence across these different scales of intervention.

Table 2: Elements of a national policy framework relevant to forests (indicative and non-exhaustive)

Potential policies and strategies	Potential policy instruments
Forest-specific • Forest Sector Policy • Forest ecosystems and other native vegetation policy • National/Sub-national Forest or Forestry Plan **Other (sector-specific)** • Tourism Sector Policy • Agriculture Sector Policy • Energy Sector Policy • Water Sector Policy • National Biodiversity Strategy and Action Plan • Climate Change Policy • Environmental Crimes' Policy **Cross cutting** • National Development Plan • Green Growth Development Strategy	**Legal and regulatory** • Public Forests Protected Areas • Environmental damage regulations • Forest Concessions • Forest Zoning • Regulations on the conversion of forest lands to non-forest lands (or Land Clearing Regulations) • National/Sub-national Forest Restoration Strategies, Policies and Plans • Timber Legality Regimes • Timber Industry Code of Practice (Mandatory) • Legislation on Threatened biodiversity including ecosystems • Forest Stewardship Plans **Economic and financial** • REDD+ National and Jurisdictional Strategies • Non-Timber Forest Products Exchange Programmes • Incentives to Sustainable Forest Value-Chains • Credit Lines for Sustainable Forestry and Agroforestry • Payment for Ecosystem Services (PES) • Forest Stewardship Plans (with payments to landowners) • Economic incentives to wildlife-friendly farming practices • Conservation easements • Sustainable finance instruments • Green and performance bonds **Voluntary (Social, cultural, educational / informational)** • Community based forest management (CBFM) • Forest Certification Schemes • Timber Industry Code of Practice (Voluntary) • Voluntary zero-deforestation agreements (e.g. Brazil's Soy Moratorium – SoyM) • Access and benefit-sharing policies • Voluntary Forest Stewardship Plans • Rights of Mother Earth • Community-based management (land, fisheries, water, hunting, etc) • Environmental certification

4 How the SEEA EA can support the evidence needs for forest policy

Whilst data from the SNA has been widely used for policy analysis, it fails to account for all the contributions from forests to the economy in a properly integrated manner (Castañeda et al. 2017). This means that it is of limited value for decision-makers in providing the evidence they need to implement the forest policy instruments for delivering on the multiple forest policy commitments described in Section 3. Here, we outline the progressive contributions of the SEEA to 'better' evidence for forest policy.

The SEEA CF extends the SNA to facilitate accounting for the stocks of biomass in forests for both plantation and natural forests (UN et al., 2014). This delivers evidence on the depletion of natural forest stocks and connects it to the economic activities they support (e.g., timber and wood fuel production). Following the FAO Global Forest Resources Assessment, the SEEA CF uses physical accounts for tracking the extent of Primary forest; Other naturally regenerated forest; Planted forest; Other wooded land (UN et al., 2014). The SEEA CF includes the broader contribution of forests in terms of non-wood forest products (e.g., mushrooms, honey, edible fruit and insects) (see SEEA AFF in FAO & UNSD, 2020).

The SEEA EA supports far more detailed and ecologically meaningful typologies than the CF, which are applied to tracking trends in forest ecosystems via ecosystem extent and condition accounts (UN et al., 2021). These ecosystem types are usually defined by detailed typologies at national or regional levels, which can then be aggregated and aligned with the IUCN Global Ecosystem Typology (GET) (Keith et al., 2022), the reference classification for implementing SEEA EA (UN et al., 2021), to enable consistent international reporting. The SEEA EA allows for the integration of a far wider set of variables on the condition (or quality) of forests beyond timber volumes via ecosystem condition accounts. For instance, information on biodiversity and carbon storage, which are key natural forest policy concerns.

The SEEA EA ecosystem services accounts include the wide range of contributions from forest ecosystems, for example related to water flow regulation, global climate regulation, soil and sediment retention and recreation-related and cultural ecosystems services (UN et al., 2021). Delivering evidence on these additional benefits from forests can inform more robust policy responses that promote protection and restoration of natural forests (FAO and UNEP, 2020). This can address the lack of recognition of forest ecosystem services (beyond timber provisioning) in policy (Hernández-Morcillo et al., 2022; Sorge et al., 2022). Furthermore, as the SEEA EA is a spatially explicit framework, it can better inform spatial planning for forest management, use and investment (UN et al., 2021).

Importantly, the focus of the SNA is on monetary values, whereas the SEEA includes accounts in both physical and monetary terms. This provides additional insight on a wider range of policy issues linked to forests, such as food, energy, water security, cultural and spiritual benefits. It also allows for trade-offs and synergies across different objectives for forests to be explored, such as between forest biodiversity conservation, climate change mitigation and timber revenues (e.g., Keith et al., 2017).

5 Case studies: Structured approach to establishing policy evidence needs

As highlighted by Vardon et al., (2016), the application of decision-centred design to environmental accounting will better enable evidence from the SEEA to be brought into the mainstream decision-making processes of government. A structured approach to assessing these policy evidence needs will directly support this design process, as elaborated in two case studies.

5.1 The EU Green Deal for nature and the role of forest ecosystem accounts

Forest policy in the EU is currently considered by many to be fragmented and dominated with a framing of forests as providers of wood and non-wood forest products (Elomina & Pülzl, 2021; Hernández-Morcillo et al., 2022; Sorge et al., 2022). The EU Green Deal (EC, 2019) is a key policy response to set the agenda for better, more integrated forest policy that addresses pressures on forest ecosystems and secures associated ecological, economic and climate mitigation benefits. This redirection is reflected in its EU Forest Strategy to 2030, which explicitly recognises the central and multi-functional role of forests and aims at unlocking "the potential of forests for our future, in full respect for the principle of subsidiarity, best available scientific evidence and Better Regulation requirements" (EC, 2021b).

However, information on the state of the EU's forests, their social and economic value, the pressures they face and the ecosystem services they supply is patchy (EC, 2021b). Evidence from the SEEA EA can help address this by contributing integrated information that links forests and their ecosystem services to the multiple development objectives of the EU Green Deal. An EU regulation has been proposed for Member States to regularly compile and transmit 'Forest accounts' and 'Ecosystem accounts' (as specifically described in EC, 2022). The scope of forest accounts proposed under this regulation broadly follows the SEEA CF. It includes accounts for the extent of wooded land that is available for wood supply and data on economic activity in the forestry and logging sector.

The proposed ecosystem accounts follow the MAES Ecosystem Typology (Maes et al., 2013), and will include accounts of all forest and woodland extent, condition (with indicators of deadwood per ha and tree cover density) and physical ecosystem services flows (wood provisioning, pollination, air filtration, global and local climate regulation, nature-based tourism) (EC, 2022). Ecosystem service users will be broken down by businesses (intermediate consumption), government, households, gross capital formation and exports. These build on the EU-level pilot ecosystem services accounts described by La Notte et al., (2022). These ecosystem accounts can help shift forest governance from models focused on timber and non-timber forest products to ones that recognise the additional benefits both managed and natural forests provide, which are often non-market in nature (Sorge et al., 2022).

To explore the potential for these proposed ecosystem accounts to support the EU Green Deal, the evidence needs across this policy framework were reviewed. All the policies, strategies and instruments in the EU Green Deal that were considered to have some relevance to forests were identified. Then the new EU Forest Strategy was similarly reviewed, following Elomina & Pülzl (2021), given this strategy aims to harmonise policy interventions with respect to forests under the EU Green Deal (EC, 2022). In total 17 policy documents were identified and reviewed, and 174 specific policy entry points identified (i.e., where evidence from SEEA EA forest ecosystem accounts could inform decision-making). These entry-points covered all stages of the policy cycle, including Formulation (41), Implementation (43), Monitoring (56) and Review (34). The agenda setting stage is not covered in the review given these documents already recognise emerging issues (full review in supplementary material).

Table 3 summarises the full review. It includes forest policy evidence demands that the SEEA EA can deliver (Column 2), at different stages of the policy cycle (Column 3) identified from different policy documents (Column 1), how SEEA EA supports delivery of this evidence (Column 4), and where the proposal under the EU regulation for introducing new environmental economic accounts has limited coverage (Column 5). This review assists in identifying options for implementing more detailed ecosystem accounts that could better meet the needs of the EU Green Deal for policy-ready evidence on forests. Table 3 provides the following insights:

- A more ecologically refined forest ecosystem typology than the single 'Forest and woodland' MAES ecosystem type would deliver evidence on the role of different types of natural and

managed forests in delivering the EU Green Deal (e.g., with respect to primary and old growth forests).

- Additional ecosystem condition indicators, including compositional indicators for biodiversity, structural indicators such as tree cover and size distribution and indicators for soil carbon would align the accounts with the evidence needs of the proposed Nature Restoration Law. This would help identify emerging issues and support policy impact assessment and instrument design.
- Evidence on carbon storage, as well as sequestration, by different forest types (including natural forest ecosystems) would support implementing the EU Climate Law and carbon accounting.
- Integrating information on protection status and governance is useful for policy demands, especially with respect to natural forests.
- Spatially explicit accounting data would help prioritise where policy instruments should be applied.
- Evidence on the supply of non-wood forest products, sediment and erosion control, water flow regulation and water purification would inform more integrated forest policy and impact assessment, as well as demonstrating the wider role of natural forests to delivering the EU Green Deal.
- Monetary ecosystem services accounts would help inform policy impact assessments and the design of financial policy instruments and support the case for better protection of natural forests.
- More resolved ecosystem service use accounts would help monitor the positive and negative impacts of different economic sectors and activities using forests.

Table 3: SEEA EA can meet the need for evidence at different stages in the policy framework for forests in the EU Green Deal (1,000 words)

Policy, strategy or instrument	Policy entry-points	Policy cycle stage	Aligning the SEEA EA to policy evidence needs	Comments on scope of proposed regulation on new environmental-economic accounts
EU Green Deal / EU Biodiversity Strategy	Protect, conserve and enhance the EU's natural capital and forest biodiversity	Monitoring	Regular indicators to track trends in forest extent, condition, ecosystem services and biodiversity at European scale	The MAES Ecosystem Typology for forests and woodland is very broad with poor ecological resolution (it really reflects a land cover, rather than ecosystem type, classification). Condition indicators proposed are limited to structural indicators with no carbon or composition indicators.
EU Green Deal / Climate Change Law / Regulation on LULUCF / CAP / EU Strategy on Adaptation to Climate Change / Farm to Fork Strategy 2020 / EU Renewable Energy Strategy 2018	Make Europe Climate Neutral by 2050, increase supply of global climate regulation services (e.g., via carbon farming, payments for ecosystem services, echo-schemes), implement robust carbon accounting and ensure carbon emissions do not exceed carbon removals for different land accounting categories	Formulation & Implementation	Informing targets on carbon storage, carbon emissions from forest conversion and global climate regulation services from forested lands	Measurement of global climate regulation services is covered but information on stocks of carbon and changes in stocks is not. No information on the monetary value of global climate regulation services is available to inform impact assessment or financial incentives to boost supplies of this ecosystem services.
		Monitoring	Thematic accounting for climate change as described in the SEEA EA can help with demonstrating compliance with the EU Regulation on LULUCF.	
EU Forest Strategy / Biodiversity Strategy / Proposed nature restoration law	Protect the EU's last remaining primary and old-growth forests	Monitoring	Indicators on the extent of primary and old growth forests protected and not protected	The MAES ecosystem typology does not include primary and old growth forests. The proposed accounts do not stratify forests according to protection status.
	Increase the extent of and quality of Europe's forests (including urban trees and agroforestry)	Implementation	Identify which areas should prioritised for afforestation or forest restoration based on ecosystem service and biodiversity benefits delivered	Limited information on non-structural condition indicators for forests is included and unclear where agroforestry and urban forests would be accounted for. The proposed accounts do not require them to be spatially explicit, limiting the potential to identify the best areas for afforestation / restoration

			Inform financial instruments to incentivise investment in afforestation and forest restoration based on ecosystem service and ecological returns	No monetary ecosystem services accounts, which will help design financial instruments based on the value of ecosystem services returns
	Identify and map the agricultural and forest areas in need of restoration	Implementation	Spatial data on forest extent, condition and services supply to prioritise restoration actions	No requirement for spatially explicit accounts. This limits their potential to inform policy interventions.
EU Forest Strategy / Proposed regulation on nature restoration	Ensure forest restoration and improve the condition of forests listed under Annex 1 of the Habitat Directive	Monitoring	Indicators should align with those under the proposed regulation on nature restoration: (a) standing deadwood; (b) lying deadwood; (c) share of forests with uneven-aged structure;(d) forest connectivity; (e) common forest bird index; (f) stock of organic carbon and associated reference levels to identify areas for restoration.	Only information on deadwood currently covered and no reference levels set out. Reference levels could be obtained in due course from the nature restoration law if adopted.
EU Green Deal / EU Forest Strategy / EU Strategy on Adaptation to Climate Change / Circular Economy Action Plan / EU Strategy for a Bioeconomy for Europe	Promote sustainable forest bioeconomy for long-lived wood products, wood-based resources for bioenergy and the non-wood forest bioeconomy (including ecotourism) Create financial incentives for forest owners and managers for improving the quantity and quality of EU forests, their resilience, forest biodiversity and the supply of regulating and cultural ecosystem services.	Formulation	Identifying the full range of forest ecosystem services and their value that can contribute to non-wood-based forest economic activities	Ecosystem services linked to non-wood forest products, sediment and erosion control, water flow regulation and water purification are not included. These represent potential economic opportunities, including in the context of nature-based solutions to climate change adaptation. Monetary ecosystem services supply and use accounts are not covered, these will be helpful to support policy appraisal (e.g., cost benefits analysis) and instrument design.
		Implementation	Inform financial instruments to incentivise investment economic activities linked to forest ecosystem services	Monetary ecosystem services accounts are not covered. These can help inform the design of financial incentives for private investment in forests

		Monitoring	Indicators to track wood and non-wood-based forest economic activity	Economic activity associated with wood production is accounted for in the forest accounts but extended supply and use accounts (discussed in the SEEA EA, Section 11) are needed to connect the supply and use of non-wood provisioning ecosystem services to economic activities.
		Review	Ex-poste impact assessment to understand if non-wood forest-based economic activities are impacting on other forest ecosystem services, climate change mitigation objectives and biodiversity	No information on forest ecosystem sub-types, composition condition indicators relevant to biodiversity, carbon storage and emission. Limited information on ecosystem services.
EU Taxonomy for Green Investments	Demonstrating which economic activities are contributing substantially to restoring biodiversity, enhancing ecosystem services and climate change mitigation	Monitoring / Review	Indicators to track trends in forest extent, condition, biodiversity, ecosystem services supply (including global climate regulation), carbon storage from forest areas operated for different economic activities	Limited information on non-structural condition indicators for forests and no breakdown of forest ecosystem service users by economic activity
EU Renewable Energy Strategy 2018	Ensure biofuels, bioliquids and biomass fuels are not made from raw material obtained from land with a high biodiversity value or high carbon stocks. This includes primary forest and other wooded land which is species-rich and not degraded. It also includes continuously forested areas of > 1 ha, with trees > 5m and > 10% canopy cover (subject to certain derogations)	Monitoring	Indicators of biomass provisioning ecosystem service and forest condition by forest sub-type (species-level composition, tree canopy cover, tree height)	The MAES forest and woodland ecosystem type does not distinguish primary forest and does not cover condition indicators for species-level composition, tree canopy cover, tree height.

5.2 Ecosystem accounting for forest policy in Liberia.

Liberia is one of the most forested countries on the west coast of Africa, with an estimated forest cover of 69 % or 6.69 million hectares (World Bank, 2020). A global biodiversity hotspot, Liberia hosts one of the largest populations of Western chimpanzees (Tweh et al., 2015), classified as "Critically Endangered" in IUCN Red List (Humle et al., 2016). Liberia's forests provide commercial timber products from which the government collects revenues (estimated forestry contribution to GDP of 8.8%; Central Bank of Liberia, 2021). Informal forest-economic activities (artisanal logging, charcoal production and non-timber forest product collection) also contribute significantly to employment and income, estimated at 3-4% of GDP (World Bank, 2020). The contribution of forests to food security cannot be ignored for a country where half of the population lives at or below poverty level. An estimated 35% of total household income is dependent on forests as a source of livelihoods and income (World Bank, 2020). Therefore, it is imperative that the formulation of forest policies, and the cross-sectoral policies that affect forests, are grounded on scientific evidence and data.

Liberia's 5-year national development plan, the Pro-Poor Agenda for Prosperity and Development (PAPD), serves as a core cross-sectoral development plan under the national Vision 2030 framework (Republic of Liberia, 2018a). It lays out the goal of raising per capita income levels and lifting Liberia's economic status to a middle-income country, while also setting ambitious goals for agriculture and fisheries, forestry, and service sectors. Liberia's forestry sector is governed by the Forestry Reform Law of 2006 (NFRL, 2006). The NFRL is currently going through implementation and monitoring stages of the policy cycle. Thus far, evidence from the monitoring stage is scarce for supporting the review of the policy and instruments. Notwithstanding, the Forestry Development Authority recently published its approach and vision to Sustainable Forest Management (SFM) in Liberia based on "4Cs" balancing principles: Commercialization, Conservation, Community, and Carbon (Agyeman et al., 2022). It again emphasizes the importance of evidence to appropriately balance the 4Cs outcomes.

As Liberia looks towards a period of continued economic and social development as envisaged in the PAPD, there is a clear incentive to harvest natural resources and modify the natural environment, for example, by converting forested land to high-value agriculture such as rubber, coffee, cocoa, and palm oil. While a natural resource extraction pathway is a well-trodden one, Liberia is in a position to evaluate the longer-term implications of this development path, both in terms of the sustainability of the management of natural resources, and in terms of the distribution of benefits and costs that would result from the increased extraction of natural resources. Considering the interlinked streams of benefits provided by Liberia's forest at the global, national and household level, it is conceivable that any decision to gain more of one benefit-stream may significantly affect others (Dade et al., 2019). For example, infrastructure development, mining concessions and expansion of high-value commodity products can significantly impact the extent, condition and delivery of ecosystem services provided by forest ecosystems.

In this context, the Liberia Environmental Protection Agency (EPA), in partnership with other governmental agencies, and with support from Conservation International (CI), began implementation of the Global Environment Facility funded "*Conservation and Sustainable Use of Liberia's Coastal Natural Capital*" project. A particular focus of the project is establishing the statistical infrastructure and capacity for the Liberian government to implement the SEEA EA as part of their national statistics program.

To ensure that the accounting recommendations delivered under the project respond to policy priorities and user needs there has been an ongoing process of engagement with officials from various agencies within the Government of Liberia. A review of Liberian policies, strategies and instruments identified 17 policies that have relatively direct connections to the management of forest ecosystems, with five considered of most significance in terms of connection to forestry and forest ecosystems. These include: 1) the PAPD; 2) National Forest Management Strategy; 3) Liberia's Nationally Determined

Contributions (NDCs) Implementation Plan; 4) National Biodiversity Strategy and Action Plan II; and 5) Liberia Forest Sector Project.

The findings of the review are summarised in relation to those five policies, strategies or instruments in Table 4, highlighting the policy entry points and the relevant forest ecosystem accounts. The focus on the specific evidence needs for the relevant policies at different stages of the policy cycle also informs the design of the accounts and the level of detail required. Key findings that emerge from Table 4 include:

- Information needs to be organised for different forest ecosystem types, land uses and condition status, including forests used for timber production, agroforests, coastal forests / mangroves and other natural forests. This is relevant across the forest policy framework for Liberia and supports implementation and reporting under the CBD GBF (this will be accommodated by adopting the IUCN GET for different forest types).
- Integrating information on ownership, management arrangements (especially community management) and protection status is useful across the forest policy framework.
- Evidence on carbon storage and associated global climate regulation ecosystem services is important for delivering on Liberia's NDC for climate change mitigation.
- Whilst indicators on timber stocks and provisioning services are needed, these should be complemented with information on a broader range of ecosystem services, in particular those contributing to the market and non-market benefits received by people living in forests or adjacent communities.
- Spatially explicit information will be helpful in targeting forest conservation and restoration interventions where they are needed most, improving community welfare via forest ecosystem services and livelihoods, protecting and conserving forests most important for biodiversity and climate change mitigation.
- As Liberia's forests are critical to supporting the economic livelihoods of many people and communities, integrated evidence to inform holistic policy design that recognises the connections between economic, social and environmental outcomes is needed.

Table 4: How the SEEA EA can meet the need for evidence at different stages in the policy framework for forests in Liberia

Policy, strategy, or instrument	Policy goals and entry points	Policy cycle stage	Aligning the SEEA EA to policy evidence needs	Comments on scope of proposed accounts
Pro-Poor Agenda for Prosperity and Development (PAPD)	Increasing the forest contribution to GDP from 9% to 12% Increasing forest cover from 44% to 100% in protected areas Reducing woody biomass use for energy from 95% to 80% of households Increase environmentally protected areas (both designated and proposed) to 30% of total forest area	Formulation Implementation Monitoring Review	Indicators of forest sector components of GDP (e.g., timber, firewood, charcoal, biomass, etc. and associated economic activity) not recorded in the SNA forestry sector Indicators of biomass provisioning ecosystem service (e.g., firewood, charcoal) and condition indicators on biomass and standing timber Identifying the full range of forest ecosystem services and their value that can contribute to non-timber-based forest economic activities Indicators on the extent of different forest ecosystem types that are protected and not protected	Initial focus should be placed on ensuring robust measures of the area of forest and associated timber resources, with additional data, such as protected areas, species and timber production incorporated over time. In the medium to longer term, information on other ecosystem services can be added
National Forest Management Strategy	Allocating up to approximately 2.0 million hectares of forest into timber sales contracts, forest management contracts, and private use contracts Managing existing protected areas (Nimba Nature Reserve and Sapo National Park) in accordance with the National Forest Reform Law and FDA regulations Defining new protected areas and allocating up to 950,000	Implementation Monitoring Review	Indicators to track timber provisioning ecosystem services, timber-based forest economic activity and ownership spatially Indicators on the extent of different forest ecosystem types that are protected and not protected, their condition (including connectivity), the species they support and the ecosystem services they supply to different users Indicators on environmental expenditure Ex-poste impact assessment on impact of timber exploitation on other forest ecosystem	The key focus here should be on ensuring the area of forests and the stock of timber are well accounted for. Focus is needed on spatial mapping given the need to allocated individual areas of forest to specific contracts and purposes

	hectares to the National Protected Area Network.		services, climate change mitigation objectives and biodiversity	
Liberia's Nationally Determined Contributions (NDCs) Implementation Plan (Prioritized Projects)	Reducing the national deforestation rate by 50% by 2030 Reducing GHG emissions from forest conversion by 40% below BAU levels by 2030 Reforesting an average of 12,285 ha per year to enhance forest carbon stocks Restoring 25% of priority degraded forests by 2030 Improving protection and conservation measures in 30% of mangrove ecosystems Enhancing coastal carbon stocks by restoring 35% of degraded coastal wetlands and mangrove ecosystems by 2030 Increasing the number of functional community forests	Implementation Monitoring	Indicators on the extent and condition of different forest ecosystem types (including coastal forests and mangroves) and the species they support that are protected, not protected or under community management Indicators on biomass, standing timber, carbon storage, carbon emissions from forest conversion and flows of global climate regulation services from forested lands Ex-ante impact assessment to identify priority areas for forest restoration-based biodiversity conservation, carbon mitigation, social welfare and poverty alleviation benefits realised	Beyond the robust measurement of forest area and timber stocks, the core focus for NDC related measurement is accurate assessment of carbon stocks and changes in stocks. A combination of on ground data collection (as conducted through the National Forest Inventory) and remote sensing is needed. The extension to incorporate data on mangroves is also needed. This has been a particular focus of one part of the GEF funded project in developing initial accounts for Liberia's coastal ecosystems
National Biodiversity Strategy and Action Plan II (will be reviewed and updated in light of the recent adoption of the	Ensuring at least 35% of mangrove forest of global importance is protected Increasing the number of PAs gazetted	Implementation Monitoring	Indicators on the extent of different forest ecosystem types that are protected and not protected, their condition and the ecosystem services they supply to different users. Indicators on forest species and biodiversity that are protected and not protected	Core to building these accounts will be the integration of data on ecosystem extent and the boundaries of protected areas. These data can be well supported by data on ecosystem condition, including on species, to provide performance

CBD's GBF in 2022).	Restoring forests through afforestation and reforestation Establishing areas of woodland Placing areas of forest under conservation through the REDD+ project		Indicators on biomass, carbon storage, and flows of global climate regulation services from forested lands that are protected and not protected Indicators to inform the CBD monitoring framework for the Kunming-Montreal global biodiversity framework for Goal A (integrity, connectivity and resilience of all ecosystems), Goal B (ecosystem services), Goal C (monetary and non-monetary benefits), D (funding of conservation and sustainable use of biodiversity and ecosystems)	measures of the effectiveness of the PA system in securing positive biodiversity outcomes.
Liberia Forest Sector Project	The Liberian Forest Sector Project operating within the World Bank's Country Partnership Framework focuses on the management of forests including: • Agroforestry • Natural resource management through Authorised Forest Communities • Protected areas • Benefits for people living in forests or adjacent communities	Formulation Implementation Monitoring	Indicators on the extent and condition of different forest ecosystem types (including agroforests) that are protected, not protected or under community management Indicators on the ecosystem services supplied by protected and not protected forests (particularly firewood, charcoal, fruits, nuts, firewood, honey, and medicinal products) and the location of associated users (especially nearby communities) and aggregate national use	The additional focus for this project concerns measuring a broader range of ecosystem services, in particular those contributing to the market and non-market benefits received by people living in forests or adjacent communities

6 Discussion

The SEEA EA has the potential to greatly improve the delivery of 'policy-ready' evidence. However, it cannot ensure that environmental-economic policy will be evidence led. The accounting system allows information on the environment to be organised at different scales and aggregates in response to users' needs. It supports the harmonisation of environmental, economic and social data, thereby better supporting integrated decision-making and coherent policy-responses. It helps identify where key information gaps lie, encourages data sharing and accessibility between institutions and investment in environmental monitoring. The regular production of SEEA EA accounts means a flow of 'policy-ready' evidence will be available when it is needed. The spatial component of the SEEA EA supports better integration of top-down policies with local level on-ground action, particularly at the ecosystem level such as forests.

If the SEEA EA is to deliver 'policy-ready' evidence, a structured approach to engaging with potential users in the policy community is necessary to establish appropriate formats, including accounting structures, aggregates, classifications / cross-walks and accounts production cycles. Essential to this is understanding the policy processes and analyses to which this evidence will contribute. We explored this using a structured approach to evaluating the policy framework for forest ecosystems, a theme high on the international policy agenda (Table 1), using the EU (Table 3) and Liberia (Table 4) as case studies.

The review of the policy framework for forests under the EU Green Deal identified 17 different policies where improved forest management can contribute to their success (Table 3 and supplementary material). including the EU forest strategy, biodiversity strategy, law on climate change, and circular economy action plan. Starting from this policy perspective allows a broad range of evidence needs to be established, for which SEEA EA accounts can be developed to provide the relevant information.

The case study for Liberia focused on five policies, strategies or instruments of particular relevance to national forest management and policy (Table 4). Forests are important across a range of policies, showcasing how the governance of forest resources is a complex endeavour because of interdependence with cross-sectoral policies such as biodiversity, climate change, agriculture, and national development plans. Starting from this policy perspective highlighted that whilst there is a need for reliable indicators on timber stocks, production and economic activity, evidence on a broader range of forest ecosystem services and their contributions to well-being and local community livelihoods is also necessary.

Application of SEEA EA at national levels can generate the economic arguments needed to channel funds to nature-based solutions. A specific example is the UNFCCC Paris Agreement, where carbon markets (as a regulated and voluntary economic policy instrument), can contribute substantially to meet targets for Nationally Determined Contributions and the funds needed for forest-based mitigation (UNEP, 2022; UNEP & IUCN, 2021). At the same time, carbon finance supporting conservation, restoration or sustainable management of forests helps countries to fulfil socioeconomic needs, such as job creation through ecotourism or the sustainable exploitation of non-timber forest products and the conservation of forest-dependent species and ecosystems. Through the SEEA EA, countries have the appropriate tool to monitor if the investments supported by climate finance are leading to the expected environmental and socioeconomic benefits (Vardon et al., 2022).

Given the range of policy entry points for SEEA EA accounts, achieving successful outcomes will require substantive levels of co-ordination and balancing of interventions in different locations across a range of institutions, donors and initiatives to support policy design and implementation. To achieve appropriate levels of co-ordination, stakeholders have a significant advantage by working from a commonly agreed set of baseline information and a common language for describing the state, changes in state and services

provided by forest ecosystems. This rationale for the use of SEEA EA is supported by the reality that inconsistencies in information and language among different agencies can lead to significant confusion and increased costs in implementation. Therefore, the policy review process itself is a steppingstone for engaging with stakeholders to raise awareness of the relevance of coherent and consistent evidence for 'better' decision-making.

As a statistical standard, the SEEA EA sets the boundaries, classifications, definitions, and comprehensiveness for reporting. If the SEEA EA is to deliver 'policy-ready' evidence over the long-term, it is critical that there is alignment between policy documents and these standards and classifications, or concordances between them are established, so that the data in the accounts can directly inform the policies. Considerable flexibility and adjustments to develop concordances will be needed to achieve this alignment, especially when applying data from old systems.

SEEA EA holds promise for supporting many policy needs for forests and other ecosystems. However, it sits within a larger landscape of policy instruments and internationally agreed frameworks for structured data collation and synthesis. Biodiversity-focussed examples include the IUCN Red List of Ecosystems, the global standard for ecosystem risk assessment, which is applied by environmental agencies in many governments, research and NGO communities and has been proposed as one of the metrics to monitor progress against one of the goals agreed under the GBF (CBD/COP/15/2).[2] The FAO regularly collect, analyse and disseminate information on the status of and trends in the world's forests through the Global Forest Resources Assessments (FAO 2020). As part of countries commitments towards meeting the Paris Agreement (UNFCCC 2015), Parties to the Convention provide data on their national greenhouse gas emissions from all sources, including land use, land-use change and forestry (LULUCF) to a Global Stocktake. Further research and investigation are needed about the complementarities and potential alignment between these existing frameworks and the SEEA EA statistical standard, especially for capturing opportunities to improve the data bases serving the SEEA EA.

Co-design of environmental monitoring and reporting systems with SEEA EA will clearly enhance alignment. For instance, the new EU framework for forest monitoring and strategic plans can deliver detailed, accurate, regular and timely information on the condition and management of EU forests, and on the products and ecosystem services that forests provide. As a critical part of the information system that could support forest ecosystem accounting in Europe, developing this framework with the classifications and structures in mind will greatly enhance the potential for mainstreaming information on forests across environmental, economic and social planning processes and policies.

7 Conclusion

This paper highlights the role the SEEA EA can play as a structured framework for organising information on the environment and its relationship with the economy and well-being. Hence, the SEEA EA contributes to evidence-led, integrated policy action by delivering robust 'policy-ready' evidence when it is needed across the policy cycle.

To deliver on this potential, proper engagement with policy researchers, academics and policy-makers and assessors is needed to understand what evidence they need, in what format and how it can be delivered to support their processes. The structured approach presented in this paper establishes policy evidence needs

[2] https://www.cbd.int/doc/c/179e/aecb/592f67904bf07dca7d0971da/cop-15-l-26-en.pdf

for which SEEA EA accounts can provide the relevant information, using forest policy frameworks as case studies. The examples of the EU Green Deal and Liberia highlighted the importance of considering the full range of relevant policies and objectives for forests at the outset when embarking on the compilation of SEEA EA accounts. Showing the alignment of the SEEA EA with each stage of the policy cycle brings to the attention of the policy community the importance of natural as well as intensively manged forests. These structured reviews provide a foundation for active engagement with the policy community, so their evidence needs, and their policy evaluation processes are understood more fully.

Ensuring SEEA EA accounts are compiled in response to user needs is crucial to build understanding, foster ownership and the end-use of the accounts, as well as building demand for future production of accounts. Institutionalising the SEEA EA into the policy-making processes in this way will greatly enhance the ability of governments and the private sector to deliver better, more coherent policy responses. In the context of forests specifically, this can encourage transition from sector-by-sector policy responses to coherent responses that recognise the trade-offs between intensive management of forests for provisioning services and more sustainable management of all forests to achieve a range of environmental, economic and social objectives. This is essential if we are to transition to a sustainable development pathway that is socially inclusive and in balance with nature.

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