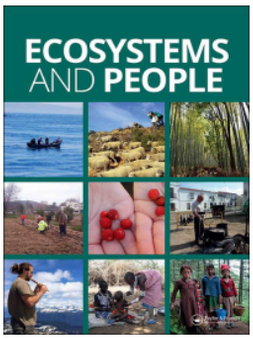

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Mainstreaming biodiversity and nature's contributions to people in Europe and Central Asia: insights from IPBES to inform the CBD post-2020 agenda

Camilla Sandström [a], Irene Ring [b], Roland Olschewski [c], Riccardo Simoncini [d], Christian Albert [e], Sevil Acar [f], Malkhaz Adeishvili[g], Christina Allard [h], Yakov Anker [i], Raphaël Arlettaz [j], Györgyi Bela[k], Luca Coscieme [l], Anke Fischer [m], Christine Fürst[n,u], Bella Galil [o], Stephen Hynes [p], Ulan Kasymov [b], Cristina Marta-Pedroso [q], Ana Mendes [r], Ulf Molau [s] and Jan Pergl [t]

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ABSTRACT

Recent global and regional assessments of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) show that Nature's Contributions to People (NCP) are under an alarming threat due to the continuing loss of biodiversity. These assessments call for increasing conservation efforts and a more sustainable use of biodiversity to enhance the chances of halting biodiversity loss and reversing current trends. One of the strategies to achieve change is to mainstream biodiversity into sectoral policies. Mainstreaming, a concept that can be traced back to the Brundtland report, promotes the integration of the environment into political, societal, and economic planning and decision-making. Based on the review of key studies undertaken during the regional assessment for Europe and Central Asia, we develop a stepwise approach to analyze the current status of mainstreaming of biodiversity and NCP. The approach can be used both for policy design purposes and diagnostic evaluations. It demonstrates that mainstreaming has the potential to improve the conservation and sustainable use of biodiversity as well as the sustained provision of NCP. However, based on the status of implementation across Europe and Central Asia, we conclude that mainstreaming needs to be pursued and implemented in a stronger and more systematic way. The results of our assessment provide important input to national strategies and policies but also to the ongoing process of the Conference of the Parties to the Convention on Biological Diversity while developing the post-2020 global biodiversity framework.

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1. Introduction

Nature's Contributions to People (NCP), which embody ecosystem services, are critically important for livelihoods, economies, and good quality of life, and are therefore vital to sustaining human life on earth (IPBES 2018a). Global and regional assessments of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) show that NCP are under an alarming threat due to the continuing loss of biodiversity (IPBES 2018a; IPBES 2019). For Europe and Central Asia, the focus of the current article, IPBES (2018a) identified a continuous decline of biodiversity in line with increasing uniformity of species compositions in land- and seascapes. Consequently, the delivery of many NCP from wetlands, semi-natural grasslands, peatlands, freshwater, and coastal marine habitats has decreased.

While ecosystem protection has progressed in Europe and Central Asia, the biodiversity status is low, and trends remain negative overall (IPBES 2018a). Both the regional and the global assessments (IPBES 2019) call for increasing conservation efforts and a more sustainable use of biodiversity to enhance

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the chances of meeting national and international biodiversity targets. The IPBES global assessment emphasizes the need for a transformative change, which can be defined as an environmental governance approach with the capacity to manage, trigger and respond to regime shifts at a system level (Chaffin et al. 2016; IPBES 2019; Díaz et al. 2019). The goal of transformative change is to actively shift degraded ecosystems to alternative, more desirable, or more functional ones by altering the structure and processes that define the governance regime.

One of the strategies to achieve transformative change put forth in recent assessments is the mainstreaming of biodiversity into sectoral policies (IPBES 2018a, 2018b, 2018c; IPBES 2019). Mainstreaming, a concept that can be traced back to the Brundtland report (WCED 1987), promotes the integration of the environment into political, societal, and economic planning and decision-making. The concept has been further developed under the Convention on Biological Diversity and is 'understood as ensuring that biodiversity, and the services it provides, are appropriately and adequately factored into policies and practices that rely and have an impact on it'. To facilitate further progress, a long-term strategic approach to mainstreaming (LTAM) was established at the fourteenth Conference of the Parties (COP 14) with the aim to integrate mainstreaming adequately into the post-2020 global biodiversity framework (CBD 2019) (https://www.cbd.int/mainstreaming/).

While many countries have at least partially integrated concerns for biodiversity and ecosystem services into key legal and policy documents, considerable room still exists for improvement to protect nature effectively in economic and policy sectors, and to actively support the mainstreaming of biodiversity and NCP in private and public decision-making (IPBES 2018a). More recently, the European Union (EU) emphasized the importance of biodiversity for human well-being and development in the European Green Deal (COM/2019/640 final) and the EU Biodiversity Strategy 2030 (COM/2020/380 final). However, this is rather an exception, since the overall uptake of biodiversity and ecosystem services by clear policy objectives, to be achieved through concrete policy instruments, is still rather weak in many countries in Europe and Central Asia (Ring et al. 2018). The richness of terminology found in the literature with regard to the concept of mainstreaming makes it difficult to derive empirical insights from different studies and to provide guidance for public and private decision-makers on how to advance the conservation, restoration and sustainable use of biodiversity and sustained provision of NCP (Visseren-Hamakers et al. 2015; Milner-Gulland et al. 2021).

This paper presents a novel approach to evaluate biodiversity mainstreaming, and the results of this approach. The aims of our paper are (i) to develop a scientific understanding of the mainstreaming concept, (ii) to propose a stepwise approach to analyze the mainstreaming of biodiversity and NCP, (iii) to evaluate the current status of implementation with respect to mainstreaming of biodiversity and NCP and (iv) to discuss promising options and opportunities for mainstreaming within seven key policy and economic sectors across Europe and Central Asia. Our paper is based on crucial insights from a systematic review of key studies undertaken as part of the IPBES regional assessment for Europe and Central Asia (Ring et al. 2018).

2. The mainstreaming concept

Governments traditionally react to policy problems by proposing and adopting specialized policy measures within specific economic sectors such as the forest and agriculture sector or policy sectors related to the environment and nature conservation. A sectoral approach can be effective as it fosters policy expertise and develops instruments and measures to effectively implement sector-related policies. However, due to the frequent lack of coordination across different policy sectors and the management of different ecosystems, governing through a sector-specific approach may lead to policy failures in terms of, for example, biodiversity loss and land degradation (IPBES 2018a, 2018b, 2018c, 2019; Willemen et al. 2020). Because of these failures, there is an intensified debate on how to enhance the relationships between global, national and local policies as well as on how to develop effective approaches to implement these policies (Visseren-Hamakers et al. 2015).

One such approach is based on the concept of mainstreaming, a political strategy with the objective to integrate the conservation and sustainable use of biodiversity in all steps of decision-making at all levels (Dalal-Clayton and Bass 2009). Principle 4 of the Rio Declaration already stated that environmental protection is 'an integral part of the development process and cannot be considered in isolation from it' (UN 1992; see also UNCED 1992 Agenda 21 ch. 8). Since then, mainstreaming is one of the major goals of the UN and can be found as a strategy to achieve objectives in, for example, the Aichi Biodiversity Targets and relevant Sustainable Development Goals (UN 2015). Partial progress has also been made towards mainstreaming biodiversity and NCP as well as identifying and managing the underlying drivers of biodiversity loss, by developing biodiversity strategies and action plans at multiple levels (IPBES 2018a). Initial environmental mainstreaming efforts were made to include the environment into national planning to 'ensure that economic decisions, policies, and plans took environmental priorities into account and addressed the impact of human activities on environmental services and assets' (Benson et al.

2014, p. 60). The concept has also been used to insert environmental issues into development plans such as poverty-reduction strategies (Bizikova et al. 2015). Conceptual guidance for environmental mainstreaming can be found in literature focusing on development (Grima et al. 2017), gender issues (Rönnblom 2005), and more lately on climate policy (e.g. Brouwer et al. 2013; Redford et al. 2015; Whitehorn et al. 2019) and the incorporation of ecosystem service values into accounting systems (Dasgupta 2021; Tinch et al. 2021).

Despite its widespread application, mainstreaming remains associated with some conceptual confusion. The European Environment Agency (2005, p. 12), for example, uses environmental mainstreaming more or less interchangeably with environmental policy integration. The Convention on Biological Diversity (CBD 2011a, p. 5) used to define mainstreaming as 'the integration of the conservation and sustainable use of biodiversity in both cross-sectoral plans [...] and in sector-specific plans [...]. It implies changes in development models, strategies and paradigms'.

Although the two processes of environmental mainstreaming and environmental policy integration may be interlinked, a qualitative difference exists between the two. The basic idea of mainstreaming is not to integrate across sectors but to move 'environmental issues from the periphery to the center of decision-making, whereby environmental issues are reflected in the very design and substance of sectoral policies' (Hauer 2017). Wamsler et al. (2014, p. 190) define mainstreaming as 'incorporating new aspects into existing core work', and that the incentive for mainstreaming stems 'from the need to change the dominant paradigm'. Benson et al. (2014, p. 606) state that environmental mainstreaming has developed as a strategy focusing on the 'greening' of non-environmental sectors. Environmental mainstreaming has been developed for the (systematic) incorporation of environmental issues into a specific sector (Nunan et al. 2012), while environmental policy integration focuses on cooperation of diverse actors in coordinating policies across traditional sectors or policy domains (Jordan and Lenschow 2010). Lately, integration has assumed a broader meaning, focusing on the need to adopt a holistic or overarching approach to the integration of policies. Examples of such approaches are resilience thinking, the robustness of socio-ecological systems, or reflexive governance (Folke et al. 2002). In relation to the Convention on Biological Diversity, the mainstreaming concept has been conceptually further developed to distinguish it more clearly from other concepts such as environmental policy integration.

A number of studies have analyzed how mainstreaming happens in practice. Nunan et al. (2012) argue that environmental mainstreaming can occur through two interlinked mechanisms or pathways: vertical and horizontal mainstreaming. Vertical mainstreaming refers to a top-down integration process of environmental concerns into a specific sector's policy, often guided by a governmental body (Nunan et al. 2012; Wamsler et al. 2014). Horizontal mainstreaming occurs via temporary arrangements, such as task forces and liaison groups, and depends on the expertise and technical knowledge available within sectors (Nunan et al. 2012, p. 266). Wamsler et al. (2014) further elaborate on the vertical and horizontal mainstreaming mechanisms by adding six different mainstreaming strategies (add-on, programmatic, inter- and intra-organizational, regulatory, managerial, and directed mainstreaming) to be able to analyze how various coordination-related activities may create synergies that increase the chance of successful environmental mainstreaming.

Karlsson-Vinkhuyzen et al. (2018) identify barriers to and levers for mainstreaming biodiversity into economic sectors that exert high levels of pressure on biodiversity. The findings highlight the importance of considering both the specific governance context of the sector, as well as external factors such as broader institutional capacity, public opinion, and socio-economic conditions. The former may in general be handled by the actors involved in the sector, while the latter may be out of reach for mainstreaming efforts. As indicated above, the empirical insights on how countries in Europe and Central Asia have mainstreamed the concerns underpinning the concept of biodiversity and NCP into key policy documents and strategies is still limited due to the rather scattered studies and results primarily based on individual cases instead of comparative studies. Furthermore, the mixing of mainstreaming and policy integration efforts makes it hard to assess any progress. With the clarification of the mainstreaming concept and our proposed stepwise approach to analyze the mainstreaming of biodiversity and NCP, i.e. the systematic incorporation of biodiversity and NCP into sector policies, we will improve the possibilities to evaluate the current implementation status of mainstreaming biodiversity and NCP into sector policies within countries as well as between countries.

3. Methods

The method presented here consists of an approach to assess mainstreaming that can be used both for policy design purposes and diagnostic evaluations (see Figure 1). The approach was developed as part of the IPBES assessment for Europe and Central Asia in the evaluation of governance options (for details, see Ring et al. 2018). The assessment started with the identification of the sectors to be analyzed. The

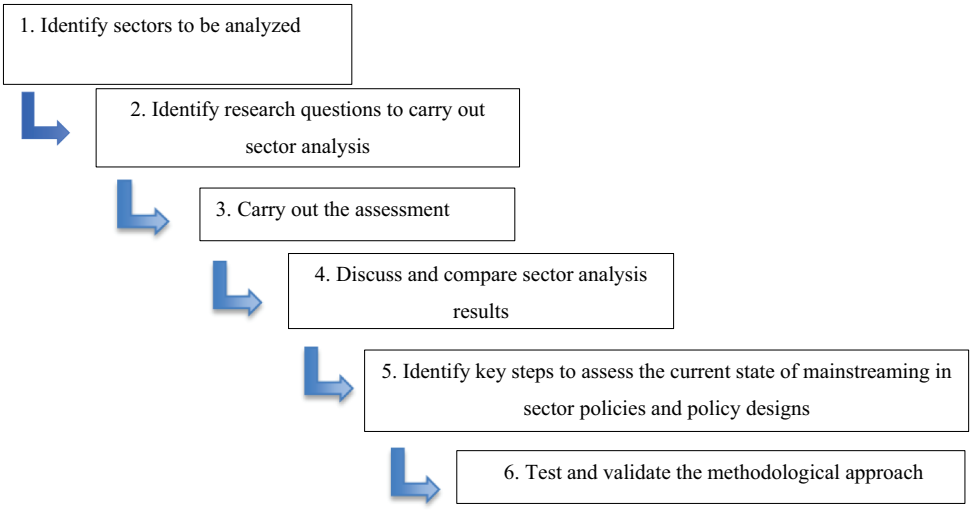

Figure 1. Flowchart of the six phases used to develop the methodological approach for assessing mainstreaming in sectors and designing policies.

policies considered related to conservation, environment, economic sectors (namely the primary sector, including agriculture and fisheries), the secondary sector (including resource extracting), manufacturing, and services (e.g. health). The assessment included scientific and grey literature up to 2017. Databases, such as the web of knowledge, were used to identify potentially relevant literature, complemented by information from websites of governmental and non-governmental organizations.

We performed a structured scoping review (Tricco et al. 2016), following an a priori developed protocol to collect and describe evidence. With a focus on each sector considered, the following questions guided the analysis:

- What are the main policy objectives?
- What policy instruments or combinations of policy instruments are used to govern the policy sector?
- What kind of governance mode is currently and predominantly governing the policy sector?
- What are the key constraints or opportunities related to these policies, governance modes, and instruments?
- Where can we see improvements, and how and where is mainstreaming within sectors and at different scales still needed?
- Where do instruments complement each other, where do they lead to synergies or to conflicts, which compromise policy goals?

The results were first synthesized in individual sector analyses and then compared. We developed the stepwise approach, motivated by Strategic Goal A of the Aichi Targets (CBD 2011b), which aims to 'address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society'. Based on these targets, and the results of the review, we identified three necessary key steps to be able to assess the current state of mainstreaming in sector policies as follows (see Table 1):

- Raising awareness of the human dependence on natural resources and NCP (incl. provisioning of information, enhancing capacity building and strengthening participation).
- Defining policy objectives related to the ecological, economic, and socio-cultural requirements for achieving a sustainable living.
- Designing instruments and policy mixes to support the implementation of mainstreaming of biodiversity and NCP in public and private decision-making able to achieve the satisfaction of human needs.

The results of the literature review are displayed for four subregions: Western Europe, Central Europe, Eastern Europe and Central Asia. The division into subregions was primarily made for communication and dissemination reasons. We complemented the assessment of the available – but sometimes limited – literature with in-depth knowledge provided by country and sector experts involved in the assessment.

The categories for assessing the current state of options and opportunities of actual governance were developed during the assessment process as a collaborative effort by the team of experts. Based on the outcome of the assessment we identified four categories that capture the current state of mainstreaming: i) effectively implemented; meaning, for example, that an option is applied in the relevant region, works well, and delivers the results intended, ii) implemented with scope for improvement; meaning, for example, that an option is applied in the relevant region, but does not yet deliver the results intended, iii) under development or started and iv) not yet initiated. In addition to the four categories, we also

indicate in Table 1 when an option is not applicable to a sector or not assessed. Despite of our efforts to integrate the best available knowledge and expertise, data limitations in terms of lack of literature and limited representation of experts need to be considered when interpreting the results, in particular relating to some countries in Eastern Europe and Central Asia.

4. Results

The results of the assessment of the current state of knowledge regarding mainstreaming biodiversity and NCP in seven policy and economic sectors in Europe and Central Asia are synthesized in Table 1. It demonstrates that many countries in Europe and Central Asia have, at least partially, integrated the concerns of biodiversity and NCP into key policy documents and strategies (Ring et al. 2018).

Table 1 also shows that there is ample room for improvement with respect to current practices and policy changes needed to achieve future goals. In other words, existing policies and strategies are underperforming in terms of achieving the Aichi Biodiversity Targets but also the Sustainable Development Goals (CBD 2014; IPBES 2018a). It also means that there are many opportunities to close the gap between current practice and changes needed by promoting more effective, efficient, and equitable policies, where mainstreaming can play a prominent role. The following subsections illustrate the potential to improve mainstreaming of biodiversity and NCP through various options and opportunities related to the three key steps: raising awareness, defining policy objectives, and designing instruments and policy mixes.

4.1. Step 1: raising awareness, providing information, and strengthening participation

Since the adoption of the Aichi Biodiversity Targets, large efforts have been made to raise awareness and to integrate stakeholders and the wider public into the governance of biodiversity and NCP, for example, through public debate, communication and knowledge sharing as well as public participation, organizational and individual learning, and capacity building (Schröter et al. 2014; Kareiva et al. 2015). Although these efforts have led to substantial progress, our assessment shows that there are significant opportunities to further raise awareness of the role of biodiversity and NCP across all the studied sectors, particular in Eastern Europe and Central Asia (Table 1).

Promising opportunities to raise awareness, strengthen participation, and transparency in decision-making processes achieve, among other things, (i) to make the diverse values of NCP visible through accounting and valuation of ecosystem services, (ii) to show trade-offs and tipping points, as well as (iii) to demonstrate the impact of changing production and consumption patterns. There is, for example, a long tradition in both the forestry and the fisheries sectors to closely monitor the use of forest land and fishing waters to assess or diagnose the current use of the respective resources. Although somewhat contested, these monitoring activities are closely linked to policy and planning both at a societal and individual level, and are further strengthened by the implementation of certification standards (Olschewski et al. 2018; see Box 1).

More general economic indicators, such as Gross Domestic Product (GDP), are currently not able to reflect all dimensions of NCP and a good quality of life (Schleyer et al. 2015; Dasgupta 2021). Therefore, further options are needed to measure national welfare and sustainable development. Moving towards 'measuring what we manage' will facilitate the comparison between sectors as well as interaction and coordination among them (TEEB 2009). A key point of attention is the interaction between environmental accounting and policy, and how accounting systems can provide guidance for 'real-world policy-making' (Jakob and Edenhofer 2015). Indeed the EU Biodiversity Strategy 2030 places a strong emphasis on the quantitative measurement of ecosystems and their services and values, and their incorporation into accounting and reporting systems used by business and the public sector.

4.2. Step 2: defining policy objectives

Although most countries in Europe and Central Asia have adopted a vast number of environmental policy objectives by applying multilateral environmental agreements (Widerberg and Pattberg 2015), a fragmented international treaty system, in combination with slow implementation (Susskind and Ali

Box 1. Awareness raising, monitoring and participation in the forestry sector.

Forests have contributed to human welfare throughout history. For centuries, the focus has been on extracting wood, which has often led to overexploitation and forest loss. Consequently, the question of how to sustainably manage forest resources gained importance, and monitoring systems were developed in many countries to provide the necessary information base (Gschwantner et al. 2022). While at the beginning, the volume of growing stock was the most important attribute to be measured, today other variables, related to wood supply, carbon storage and biological diversity, are often included in the monitoring activities (Vidal et al. 2016). However, first attempts to include social indicators, such as people's preferences or recreational behavior, have been made only recently (Hegetschweiler et al. 2022). A further endeavor is to harmonize and standardize monitoring approaches at the international level (Atkinson et al. 2020). These approaches can contribute, together with other options, to raising awareness and fostering participation, to informing better decision making, and to supporting the sustainable use of forest resources and their contributions to people. Table 1 (Step 1) shows that in Western and Central Europe several measures have already been implemented. However, measures are mainly only under development or have just recently started in Eastern Europe and Central Asia.

Table 1. Policy options and opportunities for mainstreaming biodiversity and Nature's Contributions to People (NCP) in Europe and Central Asia. Building on three key steps to assess the current status of mainstreaming, options and opportunities for mainstreaming are provided for seven policy and economic sectors in Central Asia and Europe's three subregions. The table synthesizes those policy options and opportunities from the sector analyses of the IPBES regional assessment report that are relevant to all sectors. The evidence shows (i) that biodiversity and nature conservation will benefit from being mainstreamed in environmental policies as well as all economic sectors and their respective policies and (ii) that NCP will benefit from being mainstreamed in all economic sectors, as well as the conservation sector. Source: Ring et al. 2018; IPBES 2018a; 2018b, p. 38-39.

	Sectors	CONSERVATION				ENVIRONMENT[1]				AGRICULTURE				FORESTRY				FISHERIES				EXTRACTIVE & MANUFACTURING[2]				SERVICES[3]			
STEPS	OPTIONS AND OPPORTUNITIES / Subregions	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA
STEP 1: Raising awareness	Encourage education, joint learning and common understanding																												
	Promote information sharing, transparency, knowledge management and training																												
	Make trade-offs and tipping points visible at the relevant spatial scales																												
	Encourage participation and dialogue among different actors																												
	Make diverse values visible through national and business accounting																												
	Mainstream recognition of need for profound societal transformation towards sustainability																												
STEP 2: Defining policy objectives	Adopt and translate international and regional targets and standards into national and local strategies and action plans																												
	Improve integration and coherence of legislation, sectoral policies and planning processes, to account for trade-offs and synergies																												
	Develop context appropriate targets and objectives to stimulate positive change																												
	Increase transparency and participation of a wide range of actors including indigenous peoples and local communities in decision making																												
STEP 3: Designing instruments and policy mixes	***Legal and regulatory instruments***																												
	Define and ensure property and access rights and responsibility																												
	Set up, adjust and enforce legal and regulatory standards to sustain biodiversity and nature's contributions to people																												
	Set up areas to protect biodiversity and nature's contributions to people																												
	Economic and financial instruments																												
	Phase out harmful subsidies	NA	NA	NA	NA																								
	Tax and charge negative environmental impacts	NA	NA	NA	NA																								
	Redistribute public revenues considering ecological objectives																												
	Reward socio-economic activities delivering public goods																												
	Secure conservation financing					NA	NA	NA	NA																				
	Foster sustainable technological and social innovation																												
	Social and information-based instruments																												
	Promote eco-labelling and certification schemes and improve their transparency and accountability																												
	Promote voluntary agreements and partnerships for responsible management, which include self-enforcement mechanisms																												
	Promote sense of agency and efficacy through the enhancement of public participation																												
	Support social norms that promote sustainable lifestyles and practices																												
	Rights-based approaches and customary norms																												
	Strengthen the use of indigenous and local knowledge and practices																												
	Strengthen the consideration of cultural properties and heritage in protecting sites and landscapes					NA	NA	NA	NA																				
	Strengthen the use of Social License to Operate or similar approaches to recognize the needs of indigenous peoples and local communities																												

1. Include the following policy areas: Marine and freshwater quality and quantity, flood management, air and wider environmental pollution (including eutrophication and acidification), waste management, mitigation of and adaptation to climate change, soil management and land degradation. Options and opportunities in rows left blank have been covered by the other sectors, also in relation to their environmental outcomes.
2. Include the following policy areas: Energy, mining, manufacturing.
3. Include the following policy areas: Health, education and research, transport, tourism, finance.

WE = WESTERN EUROPE **CE** = CENTRAL EUROPE **EE** = EASTERN EUROPE **CA** = CENTRAL ASIA

EFFECTIVELY IMPLEMENTED
IMPLEMENTED WITH SCOPE FOR IMPROVEMENT
UNDER DEVELOPMENT OR STARTED
NOT YET INITIATED
NOT ASSESSED
NA = NOT APPLICABLE

2015), impede the compliance with, and enforcement of the agreements in most of the analyzed sectors. Hence, there is an urgent need among public but also private decision makers to more clearly commit to the multilateral environmental agreements and to identify overarching policy objectives, balance competing demands and develop compliance incentives in combination with financing mechanisms to help improve the situation in all the analyzed sectors.

The ecosystem service concept and the further developed concept of NCP offer a useful framework to identify policy objectives and contribute to detecting limits for trading off one service for another, beyond which intended substitution can lead to catastrophic results (Bastian et al. 2007; Rockström et al. 2009; Simoncini 2009; Jax 2014; Mace et al. 2014). However, studies of the forestry and agricultural sectors, for example, show that the same ecosystem processes and components often provide diverse bundles of services simultaneously, which can make it difficult to set coherent sector policy objectives (Olschewski et al. 2018; Simoncini et al. 2019). Thus, there is a need to both vertically and horizontally mainstream biodiversity into sector policies as specified by Nunan et al. (2012).

To meet this demand, integrated governance arrangements to achieve transformational change have been developed for landscape, resource, water and coastal management, as well as at bioregional scales for energy management (IPBES 2019). Integrated spatial planning has also been identified as a strong instrument to explore spatial implications of combined policies on biodiversity and ecosystem services, and to design synergistic solution strategies (Albert et al. 2020; see Box 2).

Furthermore, integrated policies are to be taken into account, as well as consumption and production processes at local, regional, and national levels. Impacts displaced to foreign countries (e.g. telecoupling) also need to be considered. Some examples are (i) land-use policies to enforce and regulate transnational land acquisitions ('land-grabbing') (Rulli et al. 2013); (ii) regulation and monitoring of conflict-free mineral trade (Young et al. 2014); and (iii) the adoption of 'principles for responsible agro-investment' (Deininger and Byerlee 2011). There is also a number of policy-support tools specifically dedicated to checking for consistency between objectives, instruments, and potentially adverse impacts from one to another strategy, policy, program, or individual project (IPBES policy support gateway: IPBES 2021). Strategic environmental assessment (SEA) and environmental impact assessment (EIA) provide promising options to raise mainstreaming attention for biodiversity and NCP across a wider range of sectors, beyond environment and conservation (Geneletti 2013; Helming et al. 2013; Lamorgese and Geneletti 2013). Likewise, expanding interest in environmental-economic accounting, being led by the UN and its Ecosystem Accounting (SEEA EA) exercise, which seeks to consider ecosystem-related goods and services in a more transparent manner in national income accounts, should further improve mainstreaming and result in more sustainable development focused policy making (Chen et al. 2020).

Box 2. Integration through spatial planning.

Spatial planning can influence the conservation and sustainable use of biodiversity and NCP in diverse ways (Albert et al. 2020). When spatial planning disregards nature considerations, for example, by suggesting new road infrastructure in valuable habitat, it may impair biodiversity and ecosystem services through effects such as soil sealing and fragmentation. In contrast, planning has positive impacts when its plans and strategies carefully synthesize and consider best available knowledge on spatial dimensions of biodiversity and ecosystem services (Opdam et al. 2013; Longato et al. 2021). Spatial planning can be reactive, forming a keystone instrument to assess the spatial implications of combined policies on nature (Rozas-Vásquez et al. 2018). A pro-active, targeted approach to planning (Bateman et al. 2013) that is integrated across disciplines, sectors and scales can propose solution strategies that exploit synergies for people and nature (Albert et al. 2016). In concert with other legal and regulatory instruments, integrated spatial planning can form the backbone of policy mixes facilitating effective actions for safeguarding, enhancing or restoring biodiversity and NCP (see Table 1, Step 2). Planning in consideration of nature can also facilitate participation, foster stewardship, and provide the basis for targeted investments, for instance, to identify opportunities for nature-based solutions (Schmidt et al. 2022; Hynes et al. 2022) or areas for results-oriented agri-environmental payments (Galler et al. 2015). In sum, integrated spatial planning is being implemented although there remains scope for improvement (Table 1, Step 2) in Western and, partly, Central Europe, while there is still a long way to go in Eastern Europe and Central Asia.

4.3. Step 3: designing, implementing, and assessing instruments and policy mixes

Mainstreaming can contribute to overcoming various institutional failures causing biodiversity loss and ecosystem degradation by designing and implementing different policy instruments and tools (TEEB 2010; Muradian and Rival 2012; Parks and Gowdy 2013; Costanza et al. 2014; Kenter et al. 2015). In the third step, we assessed specific policy instruments belonging to the categories (i) legal and regulatory instruments; (ii) economic and financial instruments; (iii) social and information-based instruments; and (iv) rights-based instruments and customary norms (IPBES 2015a, 2015b) in the realm of biodiversity and NCP. Policy instruments are embedded in quite heterogeneous and complex systems involving multiple actors and governance levels (Buizer et al. 2011; Paloniemi et al. 2015), and different future pathways and scenarios (IPBES 2018a). This often calls for a policy mix embedded in specific institutional settings, which makes it difficult to assess these instruments in an isolated way. A policy mix aims to overcome the flaws of single instruments with respect to effectiveness, efficiency, and

equity, while highlighting the functional role of the relevant instrument in the mix (Schröter-Schlaack and Ring 2011). Such a policy mix could start top-down with the design of regulatory instruments based on socio-ecological indicators in the proximity of tipping points, to assure a minimum sustainable provision of NCP. Beyond this point, ecosystem service delivery could be further enhanced by applying economic, financial, and information-based instruments, including bottom-up approaches. Box 3 provides an example of the development of a policy mix in pasture management in Kyrgyzstan since 2009.

In principle, legal and regulatory instruments contribute to the implementation of all policies, including mainstreaming of biodiversity and NCP. Table 1 shows that they are widely applied in Europe and Central Asia. However, balancing practical flexibility and legal certainty in the design and implementation of these instruments is necessary to ensure their effectiveness and efficiency (Garmestani et al. 2013; IPBES 2015b). At the same time, direct regulations are seen to be less effective. Here, Santos et al. (2015) emphasize the limited ability to have an impact on broader land-use patterns and pressures undermining biodiversity and ecosystem services, while others doubt that regulations are flexible enough and able to appropriately deal with current environmental problems (Harring 2014). As an example, enhancing landscape diversity is sometimes hindered by regulations that forbid or strongly limit converting woodland to agricultural land (Agnoletti 2006). Although regulatory instruments are the backbone of policy mixes, one key factor constraining the effectiveness of existing environmental governance arrangements is limited enforcement, owing to a lack of institutional capacities, financial means, or corruption.

Economic and financial instruments complement existing regulatory and other policy instruments through approaches to balance conservation benefits and costs between actors and regions. Given that in existing markets NCP are often undervalued, these instruments incorporate the values of ecosystems into decision-making through corrected price signals. However, beside taxation, economic and financial instruments currently play a minor role in mainstreaming biodiversity and NCP in Europe and Central Asia (Table 1). Reforming environmentally harmful subsidies in sectors negatively affecting ecosystems is necessary for cost-effectively assigning public expenditures to reach conservation objectives. Innovative economic and financial instruments include payments for ecosystem services, biodiversity offsets and habitat banking, tax reliefs, ecological fiscal transfers, and integrated funding for biodiversity and climate change adaptation. Economic and financial instruments need to be customized to national and local conditions to provide cost-effective means for achieving conservation targets, while considering social impacts. They need to be implemented with caution as they can have (unintended) social consequences and can also be detrimental to efforts to maintain and restore biodiversity and NCP, for example, when promoting intensification of agricultural and forest land use (Ring et al. 2018).

Our assessment also shows that social and information-based instruments, which consider the interdependence of ecosystems and socio-cultural dynamics for successful environmental management at the local, national, or regional level, are widely underutilized in Europe and Central Asia (Table 1). The same holds for rights-based instruments, which despite being at the very center of the adopted UN SDGs, require further efforts to ensure that they are fully compliant with the fundamental principles of good governance. They also fall short in terms of their ability to deliver equalized power relations and in the facilitation of capacity

Box 3. Policy mix for pasture management in Kyrgyzstan.

In Central Asia, decentralization policies have been introduced with the objective of promoting the sustainable use of natural resources. For instance, Kyrgyzstan has decentralized the authority for pasture management to the newly created 'political local level', thereby strengthening self-governance through pasture user unions and pasture committees (Kasymov et al. 2016). An important feature of the latest pasture reform is that a mix of policy instruments was developed after the Pasture Law was approved by the Kyrgyzstan parliament in 2009 and tested while the reform was implemented (Table 2). One of the first tasks for each newly established pasture committee was the collection of pasture fees and the allocation of pasture tickets to pasture users (the financial policy instrument). The collected pasture fees finance the pasture committee's overhead costs and are invested in pasture infrastructures and improvement. The pasture fee is defined annually by the pasture committee for each type of livestock and pasture. It needs to be approved by the respective municipality.
A pasture ticket is allocated according to annual pasture use and a management plan (the regulatory policy instrument), which is developed and implemented under the coordination of the responsible pasture committee. The capacity and condition of pastures, their productivity, level of land degradation, and the size of livestock populations need to be monitored and assessed annually (regulatory and information-based policy instruments) by pasture committees as a basis for negotiations concerning the allocation of pastures for the following year's pasture use plan.

Table 2. Policy instruments in pasture management in Kyrgyzstan.

Legal and regulatory instruments	Economic and financial instruments	Social and information-based instruments	Rights-based instruments and customary norms
Pasture Law (2009)	Pasture fee and land tax	Information regarding pastures (e.g. distribution, state)	Pasture collective rights
Pasture use and management planning	Grants to pasture committees and pasture unions	Awareness building and trainings organized by NGOs and extension services	Customary norms and institutions
Pasture use monitoring			

Source: Ring et al. (2018).

building to ensure that conservation practice respects rights in all cases and supports their further realization where possible (Campese et al. 2009; IPBES 2018a). Our assessment shows that these types of instruments are rarely implemented and there are huge knowledge gaps in terms of their usage in several sectors. However, some of these policy instruments are partly considered within the conservation policy sector (Table 1).

5. Discussion

Current sustainability transitions, sector policies and potential future governance options for biodiversity and NCP mainstreaming demonstrate a clear gap between the identified state-of-the-art and desired pathways and policy objectives (IPBES 2018a; Simoncini et al. 2019; Whitehorn et al. 2019; Šumrada et al. 2020). The concept of sustainability transitions has emerged as an approach for both conceptualizing and fostering the radical change that is needed to achieve sustainable development (Kelly et al. 2021). Our assessment suggests that mainstreaming biodiversity and NCP is critical to achieve such transitions but remains a challenge across Europe and Central Asia. Nevertheless that progress in some countries can provide direction and momentum for other countries now and in the future. Hence, and as identified under the CBD post-2020 agenda (CBD 2019), mainstreaming can play a prominent role in closing the gap between policy ambitions and current practice. However, there are several reasons why biodiversity protection and the sustainable use of NCP are more of a side stream rather than the mainstream (Martens et al. 2003).

We have identified at least three main reasons broadly underlying the difficulties of biodiversity mainstreaming: (i) insufficient political commitment; (ii) a lack of enabling legal frameworks and policy mixes; and (iii) a need for governance arrangements for transformative change.

Although many countries are committed to international biodiversity policies, which explicitly recommend mainstreaming as an approach to protect biodiversity, there seems to be a lack of adequate political will and sustained leadership in the incorporation of biodiversity considerations and NCP into economic sectors (IPBES 2018a). Non-binding political commitments in combination with a lack of financial resources mean that the issue of mainstreaming tends to be low down on the political agenda. Mainstreaming is not only a technical exercise but involves severe goal conflicts. Thus, it is dependent on a strong political commitment to solve difficult key problems, including fulfilling the dimensions of sustainability as well as several SDGs simultaneously (Nunan et al. 2012). To help guide and accelerate mainstreaming in policy and economic sectors there is a need (i) to initiate social change and establish transformative capacity among stakeholders, and (ii) to mobilize political commitment as well as adequate funding – a role that needs to be taken up in tandem by public and private policy-makers at all levels.

While mainstreaming biodiversity and NCP in individual sectors is important, simultaneous implementation in several sectors increases the chances of achieving overall biodiversity and NCP objectives, thereby avoiding unintended consequences and spillover effects by activities performed in other sectors. Hence, it is important to develop a more coherent and enabling legal framework and policy mixes to respond effectively to biodiversity loss and broader sustainable development challenges. Policy needs to create incentives and recognize rights and responsibilities to engage local governments and communities, individuals, indigenous peoples, entrepreneurs, and others to take action for biodiversity. The challenge is to design governance arrangements that overcome the flaws and account for different ecosystems with diverse actors and multiple objectives involved within and across Europe and Central Asia. Furthermore, multiple drivers, sectors and governance levels have to be considered. In addition, existing policy regimes and sectoral policies already in place have a decisive impact on the effectiveness and efficiency of new instruments to be implemented. Thus, there is a need for more systematic comparative analyses and empirical evidence to specify the interaction between new and existing or traditional measures (Jordan et al. 2013), across different ecosystems and multiple governance levels.

Mainstreaming as a concept has been criticized for not being radical enough in terms of changing from business as usual to the transformation needed to halting biodiversity loss and reversing current trends (Wilson 2016). Yet mainstreaming has the potential to be an important cornerstone of societal transformation, but both are dependent on political commitment and enabling legal frameworks and policy mixes. Hence, governance itself also has to change as mainstreaming and societal transformation require new governance approaches, which provide an enhanced capacity to manage change. How we choose to organize our societies – both the public and the private spheres – is thus key for the realization of mainstreaming biodiversity and NCP. The literature on governance towards sustainability focuses in particular on finding promising governance modes (or mixes of modes) suitable to promote sustainable development (Lange et al. 2013). Our assessment shows that new modes of governance, such as decentralization, public-private partnerships, collaborative, or private forms of governance, increasingly emerge in parallel to traditional hierarchical governance. They allow a better involvement of different actors in policy and decision-making with the aim of

promoting shared responsibility for our common future. However, due to the intrinsic complexity of human societies, there is no single panacea for successful governance of biodiversity and NCP (Ostrom et al. 2007). Nevertheless, the various approaches to governance of complexity share important characteristics, since they all promote policy processes that stimulate adaptation and learning. Hence, to take up the challenge of successfully governing complexity and better adapting policies and instruments to specific contexts, approaches of biodiversity conservation and mainstreaming into sectoral policies, programs and strategies need to be seen as experiments that require governance and management for change, rather than against change, and systematic continuous monitoring and evaluation (Rist and Moen 2013). This can be achieved incrementally through adaptive governance and management and the systematic improvement of policy implementation (Hasselman 2017), or via transition or transformation governance and management, and the organization of evolutionary processes of societal change (Mårald et al. 2017; IPBES 2019, Díaz et al. 2019; Visseren-Hamakers and Kok 2022). Regardless of whether governments choose a more incremental or a more rapid transformative path to the future, mainstreaming biodiversity and NCP along the three key steps of raising awareness, defining policy objectives, and designing instruments and policy mixes (Table 1) is crucial to the success of this endeavor.

6. Conclusion

Our assessment of options for mainstreaming biodiversity and NCP into policy and economic sectors in Europe and Central Asia shows that mainstreaming has the potential to improve the conservation and sustainable use of biodiversity as well as the sustained provision of NCP. We argue that this is absolutely essential for reversing the current rapid rate of biodiversity loss. However, and as identified under the CBD post-2020 agenda, mainstreaming needs to be done and implemented in a stronger and more systematic way (see also Nunan et al. 2012; CBD 2019). The three steps of assessing the current status of mainstreaming, which include (i) raising awareness, (ii) defining clear and distinct policy objectives and, finally, (iii) designing instruments and policy mixes, provide not only guiding principles for policy design, but also a diagnostic assessment approach to support concrete advice on what measures work where, when, and how in all the assessed policy and economic sectors (Ring et al. 2018).

Our assessment emphasizes the need to identify barriers and opportunities for mainstreaming biodiversity into policy and economic sectors that exert high pressure on biodiversity. Key barriers include a lack of political will and inappropriate legal frameworks as well as policy mixes to respond effectively to biodiversity loss and broader sustainable development challenges. The key opportunities include developing strategies and policies based on integrative, inclusive, participatory, and adaptive governance principles to address policy incoherence, as well as the recognition of trade-offs and the creation of synergies (IPBES 2018a, 2019; Turney et al. 2020).

The insights from this assessment can inform the creation of national biodiversity mainstreaming strategies and policies. At the same time, the findings can be instructive for the ongoing international process of the Conference of the Parties to the Convention on Biological Diversity towards the post-2020 global biodiversity framework (Locke et al. 2019; Phang et al. 2020). Putting biodiversity mainstreaming center stage in those efforts provides promising opportunities to substantially advance more positive futures for people and nature.

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References

Agnoletti M. 2006. Traditional knowledge and the European common agricultural policy (PAC): the case of the Italian National Rural Development Plan 2007–2013. In: Parrotta J, Agnoletti M, and Johann E, editors. Cultural heritage and sustainable forest management: the role of traditional knowledge. Florence, Italy, p. 17–25. Ministerial Conference on the Protection of Forests in Europe. http://www.foresteurope.org/documentos/volume_1c.pdf.

Albert C, Fürst C, Ring I, Sandström C. 2020. Research note: spatial planning in Europe and Central Asia – Enhancing the consideration of biodiversity and ecosystem services. Landsc Urban Plan. 196:103741. doi:10.1016/j.landurbplan.2019.103741.

Albert C, Galler C, Hermes J, Neuendorf F, von Haaren C, Lovett A. 2016. Applying ecosystem services indicators in landscape planning and management: the ES-in-Planning framework. Ecol Ind. 61:100–113. doi:10.1016/j.ecolind.2015.03.029.

Atkinson MA, Edwards DM, Jensen FS, van der Jagt AP, Ditchburn BR, Sievänen T, Gasparini P. 2020. Harmonising, improving and using social and recreational data in National Forest Inventories across Europe. Ann For Sci. 77(3):1–10. doi:10.1007/s13595-020-00952-2. Europe.

Bastian O, Corti C, Lebboroni M. 2007. Determining environmental minimum requirements for functions provided by agro-ecosystems. Agron Sustain Dev. 27:279–291. doi:10.1051/agro:2007027.

Bateman IJ, Harwood AR, Mace GM, Watson RT, Abson DJ, Andrews B, Termansen M. 2013. Bringing ecosystem services into economic decision-making: land use in the United Kingdom. Science. 341(6141):45–50. doi:10.1126/science.1234379.

Benson E, Forbes A, Korkeakoski M, Latif R, Lha D. 2014. Environment and climate mainstreaming: challenges and successes. Dev Pract. 24:605–614. doi:10.1080/09614524.2014.911819.

Bizikova L, Metternicht G, Yarde T. 2015. Advancing environmental mainstreaming in the Caribbean region: the role of regional institutions for overcoming barriers and capacity gaps. Sustainability. 7:13836–13855. doi:10.3390/su71013836.

Brouwer S, Rayner T, Huitema D. 2013. Mainstreaming climate policy: the case of climate adaptation and the implementation of EU water Policy. Environ Plan C Gov policy. 31(1):134–153. doi:10.1068/c11134.

Buizer M, Arts B, Kok K. 2011. Governance, scale and the environment: the importance of recognizing knowledge claims in transdisciplinary arenas. Ecol Soc. 16:21. doi:10.5751/ES-03908-160121.

Campese J, Sunderland T, Greiber T, Oviedo G, editors. 2009. Rights-based approaches: exploring issues and opportunities for conservation. Bogor, Indonesia: CIFOR (Center for International Forestry Research) and IUCN.

CBD – Convention on Biological Diversity. 2011a. NBSAP training modules version 2.1 – Module 3. Mainstreaming biodiversity into national sectoral and cross-sectoral strategies, policies, plans and programs. Montreal: Secretariat of the Convention on Biological Diversity. http://www.cbd.int/nbsap/training/.

CBD – Convention on Biological Diversity. 2011b. Strategic Plan for Biodiversity 2011-2020, Including Aichi Biodiversity Targets. https://www.cbd.int/sp/.

CBD – Convention on Biological Diversity. 2014. Global biodiversity outlook 4. Montreal, Canada: Secretariat of the Convention on Biological Diversity. https://www.cbd.int/gbo4/.

CBD - Convention on Biological Diversity. 2019. Biodiversity Mainstreaming. Mainstreaming under the convention. https://www.cbd.int/mainstreaming/

Chaffin BC, Garmestani AS, Gunderson LH, Benson MH, Angeler DG, Arnold CA, Cosens B, Craig RK, Ruhl JB, Allen CR. 2016. Transformative environmental governance. Annu Rev Environ Resour. 41:399–423. doi:10.1146/annurev-environ-110615-085817.

Chen W, Van Assche K, Hynes S, Bekkby T, Christie H, Gundersen H. 2020. Ecosystem accounting's potential to support coastal and marine governance. Marine Policy. 112:103758. doi:10.1016/j.marpol.2019.103758.

Costanza R, de Groot R, Sutton P, van der Ploeg S, Anderson SJ, Kubiszewski I, Farber S, Turner RK. 2014. Changes in the global value of ecosystem services. Glob Environ Change. 26:152–158. doi:10.1016/j.gloenvcha.2014.04.002.

Dalal-Clayton DB, Bass S. 2009. The challenges of environmental mainstreaming: experience of integrating environment into development institutions and decisions (No. 1). London: International Institute for Environment and Development.

Dasgupta P. 2021. The Economics of Biodiversity: the Dasgupta Review. London: HM Treasury.

Deininger K, Byerlee D. 2011. Rising global interest in farmland. Can it yield sustainable and equitable benefits? Washington DC, USA: World Bank. doi:10.1596/978-0-8213-8591-3.

Díaz S, Settele J, Brondízio ES, Ngo HT, Agard J, Arneth A, Balvanera P, Brauman KA, Butchart SHM, Chan KMA, et al. 2019. Pervasive human-driven decline of life on Earth points to the need for transformative change. Science. 366(6471):eaax3100. doi:10.1126/science.aax3100.

European Commission. 2019. COM/2019/640 final. Communication from the Commission to the European Parliament, the European Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal: Brussels.

European Commission. 2020. COM/2020/380 final. Communication from the Commission to the European Parliament, the European Council, the European Economic and Social Committee and the Committee of the Regions. EU Biodiversity Strategy for 2030. Bringing nature back into our lives. Brussels.

European Environment Agency. 2005. Environmental policy integration in Europe: state of play and an evaluation framework. EEA Technical Report No 2. Copenhagen: European Environment Agency.

Folke C, Carpenter S, Elmqvist T, Gunderson L, Holling CS, Walker B. 2002. Resilience and sustainable development: building adaptive capacity in a world of transformations. AMBIO. 31:437–440. doi:10.1579/0044-7447-31.5.437.

Galler C, von Haaren C, Albert C. 2015. Optimizing environmental measures for landscape multifunctionality: effectiveness, efficiency and recommendations for agrienvironmental programs. J Environ Manage. 151:243–257. doi:10.1016/j.jenvman.2014.12.011.

Garmestani AS, Allen CR, Benson MH. 2013. Can law foster social-ecological resilience? Ecol Soc. 18:37. doi:10.5751/ES-05927-180237.

Geneletti D. 2013. Ecosystem services in environmental impact assessment and strategic environmental assessment. Environ Impact Assess Rev. 40:1–2. doi:10.1016/j.eiar.2013.02.005.

Grima N, Ringhofer L, Singh SJ, Smetschka B, Lauk C. 2017. Mainstreaming biodiversity in development practice: can the concept of PES deliver? Prog Dev Stud. 17(4):267–281. doi:10.1177/1464993417716356.

Gschwantner T, Alberdi I, Bauwens S, Bender S, Borota D, Bosela M, Tomter SM, Breidenbach J, Donis J, Fischer C, et al. 2022. Growing stock monitoring by European National Forest Inventories: historical origins, current methods and harmonisation. Forest Ecol Manag. 505:119868. doi:10.1016/j.foreco.2021.119868.

Harring N. 2014. Corruption, inequalities and the perceived effectiveness of economic pro-environmental policy instruments: a European cross-national study. Environ Sci Policy. 39:119–128. doi:10.1016/j.envsci.2013.08.011.

Hasselman L. 2017. Adaptive management; adaptive co-management; adaptive governance: what's the difference? Australas J Environ Manag. 24:31–46. doi:10.1080/14486563.2016.1251857.

Hauer N. 2017. The sidelined cross-cutting issue: mainstreaming environment into the water, sanitation, and hygiene (WASH) cluster. Thesis Lund University.

Hegetschweiler KT, Stride CB, Fischer C, Ginzler C, Hunziker M. 2022. Integrating recreation into National Forest Inventories – Results from a forest visitor survey in winter and summer. J Outdoor Recr Tour. 39:100489. 10.1016/j.jort.2022.100489

Helming K, Diehl K, Geneletti D, Wiggering H. 2013. Mainstreaming ecosystem services in European policy impact assessment. Environ Impact Assess Rev. 40:82–87. doi:10.1016/j.eiar.2013.01.004.

Hynes S, Burger R, Tudella J, Norton D, Chen W. 2022. Estimating the costs and benefits of protecting a coastal amenity from climate change-related hazards: nature based solutions via oyster reef restoration versus grey infrastructure. Ecol Econ. 194:107349. doi:10.1016/j.ecolecon.2022.107349.

IPBES. 2021. IPBES policy support gateway. https://www.ipbes.net/policy-support.

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2015a. IPBES/4/INF/13: Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services (deliverable 3 (d)).

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2015b. IPBES/4/INF/14: Information on work related to policy support tools and methodologies (deliverable 4 (c)). https://www.ipbes.net/events/ipbes-4-plenary.

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2018a. The IPBES regional assessment report on biodiversity and ecosystem services for Europe and Central Asia. Rounsevell M, Fischer M, Torre-Marin Rando A, Mader A, editors. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Bonn: Germany; 892 p. doi:10.5281/zenodo.3237429

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2018b. Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Europe and Central Asia of the intergovernmental science-policy platform on biodiversity and ecosystem services. Fischer M, Rounsevell M, Torre-Marin Rando A, Mader A, Church A, Elbakidze M, Elias V, Hahn T, Harrison PA, Hauck J, Martín-López B, Ring I, Sandström C, Sousa Pinto I, Visconti P, Zimmermann NE, Christie M, editors. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Bonn, Germany; 48 p. doi:10.5281/zenodo.3237428.

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2018c. The IPBES assessment report on land degradation and restoration. Montanarella L, Scholes R, Brainich A, editors. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Bonn, Germany; 744 p. doi:10.5281/zenodo.3237392.

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Brondízio ES, Settele J, Díaz S, Ngo HT, editors. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Bonn, Germany; 1144 p. doi:10.5281/zenodo.6417333.

Jakob M, Edenhofer O. 2015. Green growth, degrowth, and the commons. Oxford Rev Econ Policy. 30(3):447–468. doi:10.1093/oxrep/gru026.

Jax K. 2014. Thresholds, tipping points and limits. In: Potschin M, and Jax K, editors. OpenNESS ecosystem services reference book. EC FP7 Grant Agreement no. 308428. http://www.openness-project.eu/library/reference-book

Jordan A, Lenschow A. 2010. Environmental policy integration: a state of the art review. Environ Policy Gov. 20:147–158. doi:10.1002/eet.539.

Jordan A, Wurzel RKW, Zito AR. 2013. Still the century of "new" environmental policy instruments? Exploring patterns of innovation and continuity. Env Polit. 22:155–173. doi:10.1080/09644016.2013.755839.

Kareiva PM, McNally BW, McCormick S, Miller T, Ruckelshaus M. 2015. Improving global environmental management with standard corporate reporting. Proc Natl Acad Sci U S A. 112:7375–7382. doi:10.1073/pnas.1408120111.

Karlsson-Vinkhuyzen S, Boelee E, Cools J, Van Hoof L, Hospes O, Kok M, Peerlings J, van Tatenhove J, Termeer CJAM, Visseren-Hamakers IJ. 2018. Identifying barriers and levers of biodiversity mainstreaming in four cases of transnational governance of land and water. Environ Sci Policy. 85:132–140. doi:10.1016/j.envsci.2018.03.011.

Kasymov U, Undeland A, Dörre A, MacKinnon A. 2016. Central Asia – Kyrgyzstan and the learning experience in design of pastoral institutions. OIE Sci and Tech Rev. 35(2):511–521. doi:10.20506/rst.35.2.2538.

Kelly C, McAteer B, Fahy F, Carr L, Norton D, Farrell D, Corless R, Hynes S, Kyriazi Z, Marhadour A, et al. 2021. Blue Growth: a transitions approach to developing sustainable pathways. J Ocean Coastal Econ. 8(2):Art. 8. doi:10.15351/2373-8456.1143.

Kenter JO, O'Brien L, Hockley N, Ravenscroft N, Fazey I, Irvine KN, Reed MS, Christie M, Brady E, Bryce R, et al. 2015. What are shared and social values of ecosystems? Ecol Econ. 111:86–99. doi:10.1016/j.ecolecon.2015.01.006.

Lamorgese L, Geneletti D. 2013. Sustainability principles in strategic environmental assessment: a framework for

analysis and examples from Italian urban planning. Environ Impact Assess Rev. 42:116–126. doi:10.1016/j.eiar.2012.12.004.

Lange P, Driessen PPJ, Sauer A, Bornemann B, Burger P. 2013. Governing towards sustainability— Conceptualizing modes of governance. J Environ Policy Plan. 15:403–425. doi:10.1080/1523908X.2013.769414.

Locke H, Ellis E, Venter O, Schuster R, Ma K, Shen X, Woodley S, Kingston N, Bhola N, Strassburg B, et al. 2019. Three global conditions for biodiversity conservation and sustainable use: an implementation framework. Nat Sci Rev. 6(6):1080–1082. doi:10.1093/nsr/nwz136.

Longato D, Cortinovis C, Albert C, Geneletti D. 2021. Practical applications of ecosystem services in spatial planning: lessons learned from a systematic literature review. Environ Sci Policy. 119:72–84. doi:10.1016/j.envsci.2021.02.001.

Mace GM, Reyers B, Alkemade R, Biggs R, Chapin III FS, Cornell SE, Díaz S, Jennings S, Leadley P, Mumby PJ, et al. 2014. Approaches to defining a planetary boundary for biodiversity. Glob Environ Change. 28:289–297. doi:10.1016/j.gloenvcha.2014.07.009.

Mårald E, Sandström C, Nordin A. 2017. Forest governance and management across time: developing a New Forest Social Contract. London, UK: Routledge. https://www.routledge.com/Forest-Governance-and-Management-Across-Time-Developing-a-New-Forest-Social/Marald-Sandstrom-Nordin-Others/p/book/9781138904309.

Martens P, Rotmans J, de Groot RS. 2003. Biodiversity: luxury or necessity. Glob Environ Change. 13:75–81. doi:10.1016/S0959-3780(02)00089-4.

Milner-Gulland EJ, Addison P, Arlidge WN, Baker J, Booth H, Brooks T, Bull JW, Burgass MJ, Ekstrom J, zu Ermgassen SOSE, et al. 2021. Four steps for the Earth: mainstreaming the post-2020 global biodiversity framework. One Earth. 4(1):75–87. doi:10.1016/j.oneear.2020.12.011.

Muradian R, Rival L. 2012. Between markets and hierarchies: the challenge of governing ecosystem services. Ecosyst Serv. 1:93–100. doi:10.1016/j.ecoser.2012.07.009.

Nunan F, Campbell A, Foster E. 2012. Environmental mainstreaming: the organisational challenges of policy integration. Public Adm Dev. 32:262–277. doi:10.1002/pad.1624.

Olschewski R, Sandström C, Kasymov U, Johansson J, Fürst C, Ring I. 2018. Policy Forum: challenges and opportunities in developing new forest governance systems: insights from the IPBES assessment for Europe and Central Asia. For Policy Econ. 97:175–179. doi:10.1016/j.forpol.2018.10.007.

Opdam P, Nassauer JI, Wang Z, Albert C, Bentrup G, Castella J-C, McAlpine C, Liu J, Sheppard S, Swaffield S. 2013. Science for action at the local landscape scale. Landsc Ecol. 28(8):1439–1445. doi:10.1007/s10980-013-9925-6.

Ostrom E, Janssen MA, Anderies JM. 2007. Going beyond panaceas. Proc Natl Acad Sci U S A. 104:15176–15178. doi:10.1073/pnas.0701886104.

Paloniemi R, Apostolopoulou E, Cen J, Bormpoudakis D, Scott A, Grodzińska-Jurczak M, Tzanopoulos J, Koivulehto M, Pietrzyk-Kaszyńska A, Pantis JD. 2015. Public participation and environmental justice in biodiversity governance in Finland, Greece, Poland and the UK. Environ Policy Gov. 25:330–342. doi:10.1002/eet.1672.

Parks S, Gowdy J. 2013. What have economists learned about valuing nature? A review essay. Ecosyst Serv. 3:e1–10. doi:10.1016/j.ecoser.2012.12.002.

Phang SC, Failler P, Bridgewater P. 2020. Addressing the implementation challenge of the global biodiversity framework. Biodivers Conserv. 29:3061–3066. doi:10.1007/s10531-020-02009-2.

Redford KH, Huntley BJ, Roe D, Hammond T, Zimsky M, Lovejoy TE, da Fonseca G, Rodriguez CM, Cowling RM. 2015. Mainstreaming biodiversity: conservation for the twenty-first century. Front Ecol Evol. 3(137). doi:10.3389/fevo.2015.00137.

Ring I, Sandström C, Acar S, Adeishvili M, Albert C, Allard C, Anker Y, Arlettaz R, Bela G, ten Brink B, et al. 2018. Chapter 6: options for governance and decision-making across scales and sectors. In: Rounsevell M, Fischer M, Torre-Marin Rando A Mader A, editors. The IPBES regional assessment report on biodiversity and ecosystem services for Europe and Central Asia. Bonn, Germany: Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; p. 661–802. doi:10.5281/zenodo.3237429

Rist L, Moen J. 2013. Sustainability in forest management and a new role for resilience thinking. For Ecol Manag. 310:416–427. doi:10.1016/j.foreco.2013.08.033.

Rockström J, Steffen W, Noone K, Persson A, Chapin FS, Lambin EF, Lenton TM, Scheffer M, Folke C, Schellnhuber HJ, et al. 2009. A safe operating space for humanity. Nature. 461:472–475. doi:10.1038/461472a.

Rönnblom M. 2005. Letting women in? Gender mainstreaming in regional policies. Nord J Feminist Gender Res. 13:164–174. doi:10.1080/08038740600587711.

Rozas-Vásquez D, Fürst C, Geneletti D, Almendra O. 2018. Integration of ecosystem services in strategic environmental assessment across spatial planning scales. Land Use Policy. 71:303–310. doi:10.1016/j.landusepol.2017.12.015.

Rulli MC, Saviori A, D'Odorico P. 2013. Global land and water grabbing. Proc Natl Acad Sci U S A. 110:892–897. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3549107&tool=pmcentrez&rendertype=abstract

Santos R, Antunes P, Ring I, Clemente P. 2015. Engaging local private and public actors in biodiversity conservation: the role of agri-environmental schemes and ecological fiscal transfers. Environ Policy Gov. 25:83–96. doi:10.1002/eet.1661.

Schleyer C, Görg C, Hauck J, Winkler KJ. 2015. Opportunities and challenges for mainstreaming the ecosystem services concept in the multi-level policymaking within the EU. Ecosyst Serv. 16:174–181. doi:10.1016/j.ecoser.2015.10.014.

Schmidt S, Guerrero P, Albert C. 2022. Advancing sustainable development goals with localised nature-based solutions: opportunity spaces in the Lahn river landscape, Germany. J Environ Manag. 309:114696. doi:10.1016/j.jenvman.2022.114696.

Schröter-Schlaack C, Ring I. 2011. Towards a framework for assessing instruments in policy mixes for biodiversity and ecosystem governance. In: Ring I, and Schröter-Schlaack C, editors. Instrument mixes for biodiversity policies. POLICYMIX Report, Issue No. 2/2011. Leipzig, Germany: Helmholtz Centre for Environmental Research – UFZ; p. 175–208. http://policymix.nina.no.

Schröter M, van der Zanden EH, van Oudenhoven APE, Remme RP, Serna-Chavez HM, de Groot RS, Opdam P. 2014. Ecosystem services as a contested concept: a synthesis of critique and counter-arguments. Cons Letters. 7:514–523. doi:10.1111/conl.12091.

Simoncini R. 2009. Developing an integrated approach to enhance the delivering of environmental goods and services

by agro-ecosystems. Reg Environ Change. 9:153–167. doi:10.1007/s10113-008-0052-x.

Simoncini R, Ring I, Sandström C, Albert C, Kasymov U, Arlettaz R. 2019. Constraints and opportunities for mainstreaming biodiversity and ecosystem services in the EU's Common Agricultural Policy: insights from the IPBES assessment for Europe and Central Asia. Land Use Policy. 88:104099. doi:10.1016/j.landusepol.2019.104099.

Šumrada T, Lovec M, Juvančič L, Rac I, Erjavec E. 2020. Fit for the task? Integration of biodiversity policy into the post-2020 Common Agricultural Policy: illustration on the case of Slovenia. J Nat Conserv. 54:125804. doi:10.1016/j.jnc.2020.125804.

Susskind LE, Ali SH. 2015. Environmental diplomacy: negotiating more effective global agreements. 2nd ed. Oxford, UK: Oxford University Press. https://lawrencesusskind.mit.edu/environmental-diplomacy-negotiating more-effective-global-agreements-0.

TEEB. 2009. The economics of ecosystems and biodiversity for national and international policymakers – Summary: responding to the value of nature. http://www.teebweb.org.

TEEB. 2010. Mainstreaming the economics of nature: a synthesis of the approach, conclusions and recommendations of TEEB. http://www.teebweb.org/

Tinch R, Hynes S, Armstrong C, Chen W. 2021. Prospects for valuation in marine decision making in Europe. J Ocean Coastal Econ. 8(2):Art. 11. doi:10.15351/2373-8456.1150.

Tricco AC, Lillie E, Zarin W, O'Brien K, Colquhoun H, Kastner M, Levac D, Ng C, Sharpe JP, Wilson K, et al. 2016. A scoping review on the conduct and reporting of scoping reviews. BMC Med Res Methodol. 16(1):1–10. doi:10.1186/s12874-016-0116-4.

Turney C, Ausseil AG, Broadhurst L. 2020. Urgent need for an integrated policy framework for biodiversity loss and climate change. Nat Ecol Evol. 4:996. doi:10.1038/s41559-020-1242-2.

UN – United Nations. 1992. Report of the United Nations Conference on Environment and Development; [accessed 2022 March 10]. https://www.un.org/esa/dsd/agenda21/Agenda%2021.pdf

UN – United Nations. 2015. UN General Assembly, Transforming our world: the 2030 Agenda for Sustainable Development, 21 October 2015, A/RES/70/1. https://www.refworld.org/docid/57b6e3e44.html.

UNCED – United Nations Conference on Environment & Development. 1992. Agenda 21. Rio de Janeiro, Brazil, 3 to 14 June 1992; [accessed 2022 March 10]. https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

Vidal C, Alberdi I, Hernandez L, Redmond J. 2016. National Forest Inventories - Assessment of wood availability and use. Cham: Springer; p. 845. doi:10.1007/978-3-319

Visseren-Hamakers IJ, Brondízio ES, Leemans R, Solecki WD. 2015. Integrative environmental governance: enhancing governance in the era of synergies. Curr Opin Environ Sustain. 14:136–143. doi:10.1016/j.cosust.2015.05.008.

Visseren-Hamakers IJ, Kok MTJ, editors. 2022. Transforming biodiversity governance. Cambridge: Cambridge University Press.

Wamsler C, Luederitz C, Brink E. 2014. Local levers for change: mainstreaming ecosystem-based adaptation into municipal planning to foster sustainability transitions. Glob Environ Change. 29:189–201. doi:10.1016/j.gloenvcha.2014.09.008.

Whitehorn PR, Navarro LM, Schröter M, Fernandez M, Rotllan-Puig X, Marques A. 2019. Mainstreaming biodiversity: a review of national strategies. Biol Conserv. 235:157–163. doi:10.1016/j.biocon.2019.04.016.

Widerberg O, Pattberg P. 2015. International cooperative initiatives in global climate governance: raising the ambition level or delegitimizing the UNFCCC? Glob Policy. 6:45–56. doi:10.1111/1758-5899.12184.

Willemen L, Barger NN, Brink BT, Cantele M, Erasmus BFN, Fisher JL, Gardner T, Holland TG, Kohler F, Kotiaho JS, et al. 2020. How to halt the global decline of lands. Nat Sustain. 3:164–166. doi:10.1038/s41893-020-0477-x.

Wilson EO. 2016. Half-earth: our planet's fight for life. New York and London: Liveright.

WCED – World Commission on Environment and Development 1987. Our common future. Oxford, UK: Oxford University Press.

Young SB, Zhe Y, Dias G. 2014. Prospects for sustainability certification of metals. Metall Res Technol. 111:131–136. doi:10.1051/metal/2014008.