

Towards a *National Ecosystem Assessment* in Germany

A Plea for a Comprehensive Approach

We present options for a National Ecosystem Assessment in Germany (NEA-DE) that could inform decision-makers on the state and trends of ecosystems and ecosystem services.

Characterizing a NEA-DE, we argue that its cross-sectoral, integrative approach would have the advantages of increased scientific understanding, addressing specific policy questions and creating science-policy dialogues. Challenges include objections against a utilitarian perspective, reservations concerning power relations, and responsibilities concerning the funding.

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In the search for strategies to conserve and enhance ecosystems and biodiversity given increasing anthropogenic pressures, there is a rising interest in the concept of ecosystem services (ES). ES have been defined as the contributions that ecosystems provide to human well-being (TEEB 2005) and are derived from a range of ecosystems. These include strictly protected areas, semi-natural and cultural landscapes as well as production landscapes, such as agricultural fields or forests. However, the degree to which these areas deliver provisioning ES such as timber and food, regulating ES such as flood protection or climate regulation through carbon sequestration, and cultural ES including opportunities for recreation differs substantially.

In highlighting the contributions that ecosystems provide to human well-being the concept makes the often neglected societal benefits of conservation visible, going beyond classic arguments for nature protection based on intrinsic values of biodiversity only (Schröter et al. 2014). In addition, the concept goes beyond nature protection, operationalizing the Brundtland Commission's (WCED 1987) demand to sustain the capacity of the environment to support the needs of present and future generations.

*National Ecosystem Assessments (NEAs)*¹ help to inform decision-makers on the state and trends of ecosystems and the services they provide as well as synergies and trade-offs between them across

the diversity of ecosystems, forms of land use, and degrees of protection. In doing so they offer ways of mainstreaming biodiversity and ES across administrative levels and land use sectors, with a potential to enhance their consideration and uptake beyond the environmental and nature conservation policy fields and communities of actors.

Prominent examples of international assessments are the *Millennium Ecosystem Assessment* (MA 2005) and the study on *The Economics of Ecosystems and Biodiversity* (TEEB 2010). These assessments illustrated the significance of biodiversity and ES for human well-being, enhanced awareness and interest from policy and science, and effectively led to the establishment of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (Görg et al. 2010). Within IPBES, various assessments have been commissioned, aiming at assessing the state and trends of biodiversity, ecosystems and their services, but also to provide insights on policy and governance options. Apart from IPBES, the revised *EU Biodiversity Strategy to 2020* (EC 2011), in its Action 5, requests Member States to “map and assess the state of ecosystems and their services in their national territory by 2014” (a process abbreviated as MAES²).

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¹ An assessment can be understood as the “analysis and review of information for the purpose of helping someone in a position of responsibility to evaluate possible actions or think about a problem” (Maes et al. 2013, p. 48).

² <http://biodiversity.europa.eu/maes>

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In Germany, the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (Environment Ministry) and the Federal Agency for Nature Conservation commissioned several research projects to address the requests made in the MAES context, focusing on indicator development, ES in urban areas, and cultural services (Marzelli et al. 2014, Albert et al. 2016, Grunewald et al. 2016). This ongoing implementation of MAES in Germany (*MAES-DE*), while not a *German National Ecosystem Assessment (NEA-DE)*, can be a potential starting point for such a comprehensive assessment.³ *MAES-DE* is providing relevant information on ecosystems, biodiversity and ES for the environmental and nature conservation communities. However, the smaller research projects commissioned in Germany to implement the *MAES-DE* are hardly harmonized, generating a risk that the research outputs do not fit a common conceptual framework, and thus will not lead to a coherent national dataset. The information generated in *MAES-DE* tends to stay in the environmental policy sector and the ES concept's potential strength of mainstreaming environmental issues remains underexplored (Schleyer et al. 2015).

While a *NEA-DE* is missing for Germany (Marquard et al. 2013), several European countries have recently implemented elaborated *NEAs* (Schröter et al. 2016), demonstrating how a comprehensive *NEA* assumes an integrated perspective that includes various policy and economic sectors, diverse stakeholder interests and considers a much broader selection of relevant ES, their mutual interactions, and relations to human well-being. The objective of this article is to present and discuss outcomes of a recently conducted scoping study (Albert et al. 2014) investigating how a comprehensive *NEA-DE* could be best designed and implemented in order to provide evidence-based decision support across policy sectors, and to facilitate mainstreaming of biodiversity and ES in policy and natural resource management.

The scoping study followed an inter- and transdisciplinary approach inspired by similar work in the United Kingdom (Haines-Young et al. 2008). The methods included document and data

reviews, interdisciplinary workshops, as well as interviews and focus groups with potential interest groups and user groups. Several German Federal Ministries were consulted: Environment, Education and Research, Food and Agriculture, Economic Affairs and Energy, and Economic Cooperation and Development.

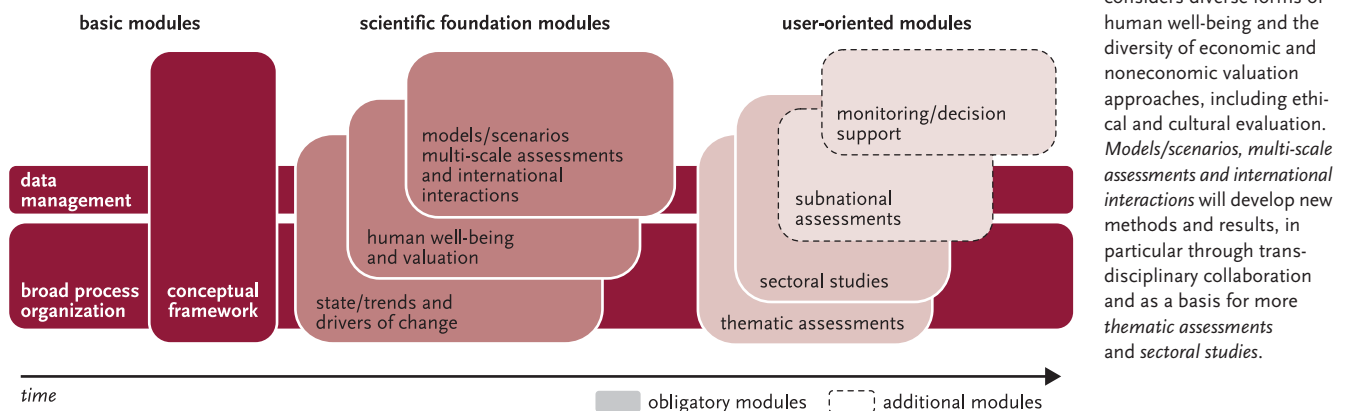
In this paper, we present the findings of the scoping study, characterizing a comprehensive *NEA-DE* and highlighting several advantages of this cross-sectoral, integrative approach. We address important challenges, and suggest ways forward given the current state of implementation in Germany. We thereby adopt an expert perspective on the needs, options and conditions for a comprehensive *NEA-DE* that seeks to inform decision-makers, the scientific community, and stakeholders for whom such a *NEA-DE* could be relevant.

A Comprehensive National Ecosystem Assessment in Germany

The scoping study suggested that the key objective of a comprehensive *NEA-DE* would be to provide evidence-based information on how national level policy and management decisions can affect biodiversity, ecosystems and ES, trade-offs between services, and impacts on human well-being. Furthermore, a number of more specific questions from different policy sectors were identified, for instance, referring to the role of ES in the German energy transition. To achieve independence and to emphasize its cross-sectoral policy relevance, the assessment should be funded jointly

³ A *NEA-DE* would be a joint and continuous activity of the research community, policy-makers, and civil society actors, ideally across all relevant levels of decision-making from the community up to the national. Based on existing knowledge and data, a *NEA-DE* would comprise the assessment and valuation of the state and trends of ecosystems, biodiversity, and ES, an analysis of the implications for human well-being, and the development and exploration of decision options for future developments.

FIGURE 1: Modules of a comprehensive *National Ecosystem Assessment in Germany (NEA-DE)* (adapted from Albert et al. 2014). *Conceptual framework* represents the analytical backbone of the assessment ensuring knowledge integration and comparability of results. *Process organization* facilitates the necessary coordination between clients, users, stakeholders and participating scientists and other experts. *Data management* establishes a uniform data structure and central data storage. *State/trends and drivers of change* is a biophysical assessment of the state of ecosystems, their services and development trends. *Human well-being and valuation* considers diverse forms of human well-being and the diversity of economic and noneconomic valuation approaches, including ethical and cultural evaluation. *Models/scenarios, multi-scale assessments and international interactions* will develop new methods and results, in particular through transdisciplinary collaboration and as a basis for more *thematic assessments* and *sectoral studies*.



by several Federal Ministries and be supported by a broad and high-ranking, cross-sectoral political mandate. As such, it would go way beyond the currently implemented *MAES-DE*.

The scoping study proposed implementing a modular approach in the form of several thematically disaggregated work packages. This would allow temporal flexibility, stepwise progress, and separate funding sources. The following three types of models were identified (see figure 1):

- **Basic modules** to develop a conceptual framework, organize the ongoing process of collaboration, and manage the various data. The conceptual framework should build upon existing concepts, but be specifically adapted to German context in order to be best addressing relevant issues and enhance joint understanding among participants.
- **Scientific foundation modules** to study the state, trend, and drivers of change for biodiversity, ecosystems and ES and their interaction with human well-being, as well as scenarios and international transboundary effects.
- **User-oriented modules** to include thematic assessments of specific policy issues, sectoral studies, and subnational assessments at lower administrative levels.

Taken together, a comprehensive *NEA-DE* would have several commonalities with the ongoing implementation of *MAES-DE*, but differ with respect to the focus and depth of analysis that would be applied in the different modules (see table 1). Further, the comprehensive *NEA-DE* should not be conceptualized as a one-time exercise but rather as a continuous monitoring effort in order to track changes in ecosystems and their services and to craft adequate response options.

Opportunities for a Science-policy Dialogue

Three key opportunities would arise from the implementation of a comprehensive *NEA-DE*: First, it would strongly enhance scientific understanding and could provide – for the first time – a nationwide dataset of the state and trends of ecosystems, biodiversity and ES in Germany. A comprehensive *NEA-DE* could draw on a broad spectrum of environmental data, also from the ongoing implementation of *MAES-DE*. While existing data is, however, often not collated in one database and not harmonized with other datasets and between the German federal states, a comprehensive *NEA-DE* could make a useful contribution by harmonizing and integrating available data to enable analyses of states and trends of biodiversity, ecosystems and ES.

Second, a comprehensive *NEA-DE* could address a broad set of policy-relevant questions, and inform a wide range of policy fields as well as public and private decision-makers at multiple levels. This could include, among others, providing information for extended accounting systems such as the *System for Environmental-Economic Accounting (SEEA⁴)* at national levels and the EU ecosystem accounting processes within *MAES/EU Biodiversity Strategy⁵*, which would allow for a better consideration of ES changes next to the conventional information on the state of the economy (EC et al. 2013, UN et al. 2014). Based on the enhanced scientific understanding and the common datasets created in the scientific modules, a comprehensive *NEA-DE* would derive specifically targeted information to assess impacts of ongoing land-use changes or to estimate potential implications of alternative policy options. In particular, such a *NEA-DE* goes beyond the environmental and nature conservation perspectives to provide information and decision support more likely to be regarded as independent and fair by diverse audiences. In consequence, the insights generated by a comprehensive *NEA-DE* would have a greater chance to contribute to mainstreaming biodiversity and ES in various policy sectors

4 http://unstats.un.org/unsd/envaccounting/eea_white_cover.pdf
 5 <http://biodiversity.europa.eu/maes>

TABLE 1: Comparison of a comprehensive *National Ecosystem Assessment in Germany (NEA-DE)* and of *Mapping and Assessment of Ecosystems and Their Services in Germany (MAES-DE)*.

	proposal of a comprehensive <i>NEA-DE</i>	ongoing implementation of <i>MAES-DE</i>
specific objective	<ul style="list-style-type: none"> ■ broad, comprehensive assessment of biodiversity, ecosystems and their services, explicitly addressing policy questions across sectors to provide informed evidence base 	<ul style="list-style-type: none"> ■ analysis of state and trends of selected ecosystem services in separately funded projects ■ priorities, definitions and methods implemented in close cooperation with Environment Ministry for best fit to conservation policies
mandate	<ul style="list-style-type: none"> ■ broadest possible mandate sought 	<ul style="list-style-type: none"> ■ mandate taken by the Environment Ministry to support national implementation of Action 5 of the <i>EU Biodiversity Strategy to 2020</i>
relation to conceptual framework	<ul style="list-style-type: none"> ■ joint development of a conceptual framework accepted by various sectors 	<ul style="list-style-type: none"> ■ building on the existing conceptual framework proposed by the <i>MAES</i> working group with a focus on conservation policies
type of knowledge generation	<ul style="list-style-type: none"> ■ comprehensive synthesis of existing knowledge and co-generation of new, empirical findings 	<ul style="list-style-type: none"> ■ selective and incremental compilation of existing knowledge ■ developing new insights concerning specific ecosystem services
participation	<ul style="list-style-type: none"> ■ broad participation by inclusion of stakeholders 	<ul style="list-style-type: none"> ■ small, focused consultation of relevant scientists and practitioners
coordination and data management	<ul style="list-style-type: none"> ■ strongly coordinated process ■ coherent data management 	<ul style="list-style-type: none"> ■ comparatively little coordination effort
funding	<ul style="list-style-type: none"> ■ substantial funding needs for coordination as well as for the scientific and user modules 	<ul style="list-style-type: none"> ■ less funding needs for coordination and incremental compilation of existing knowledge

and levels of public and private decision-making, crucial also to the recently published *Integrated Environmental Programme 2030* of the Environment Ministry (BMUB 2016, SRU 2016).

A third major benefit would result from the function of the comprehensive *NEA-DE* as a social process at the science-policy-society interface. Full-scale *NEAs* are not purely scientific efforts, but include deliberation and negotiation, within science and between science, policy and the broader stakeholder community (Jahn et al. 2012). In such a *NEA-DE* the diverging values and interests that various actors and stakeholder groups hold for biodiversity and ES are taken into consideration. Within this context, the success of *NEAs* to influence policy- and decision-making depends on the degree to which the *NEA's* process and its results are perceived by clients and stakeholders as simultaneously scientifically credible, politically relevant, and socially legitimate (Cash et al. 2003). To enhance the likelihood of fulfilling these requirements in situations of uncertain facts and high political stakes, the questions to be addressed in an assessment cannot be defined top-down but must be developed in a deliberation process if the results are to be broadly accepted and have transformative impacts (Funtowicz and Ravetz 1993). Along these lines a *NEA-DE* could serve as a boundary management process, which may ease different actor groups to communicate effectively and to come to consensus as to what to consider as reliable evidence, convincing arguments, a legitimate process and an appropriate addressing of uncertainty (Cash et al. 2003).

Challenges Identified and Concerns Regarding Implementation

Despite some reservations, the scoping study received considerable support from the scientific community, with a significant group of researchers interested in contributing to a more harmonized and comprehensive *NEA-DE* and in providing decision-relevant information for Germany. First initiatives to establish a community of practice open to scientists, policy-makers, practitioners and other stakeholders have emerged.

However, actors from both science and policy had divergent ideas whether and, if so, to what extent and how a *NEA-DE* should be implemented. Thus the scoping study was more critically discussed and reflected across different Federal Ministries that had been involved in the scoping process. As a consequence, to date, no decision to conduct a *NEA-DE* has been taken by the Ministry of Education and Research, the Environment Ministry, or any other German ministry.

Parts of the scientific community and some nongovernmental organizations raised concerns that an assessment focusing on ES could favor utilitarian viewpoints over intrinsically motivated conservation objectives. It was assumed that the results of a comprehensive *NEA-DE* could be used to neglect existing national conservation or restoration targets, potentially resulting in an inadequate consideration of biodiversity protection issues. These concerns have been voiced with regards to ES research repeatedly

(Schröter et al. 2014) and should be addressed up-front in the scoping of the assessment framework and in the communication strategy. It is well known that management for some specific ES, like intensive agriculture, may imply trade-offs with other ES and biodiversity, while management for some other ES shows synergies with various policy goals such as carbon fixation and climate change adaptation (Kabisch et al. 2016, Wüstemann et al. forthcoming). Conservation priority setting should be a matter of societal choice, supported but not replaced by a *NEA-DE*. The information gained in the assessment provides an evidence base, which can be used, for instance, to foster participatory scenario building to explore future options for better and more sustainable decision-making.

More reluctance towards a comprehensive *NEA-DE* was shown from the policy side.⁶ The key implementation challenge recognized was that the outcomes of such a broad and open assessment process could not be fully controlled by any single actor. Diverging interests and unequal power relations seemed to exist between the Environment Ministry on the one side, and the Ministries of Food and Agriculture and of Economic Affairs and Energy, as well as the related business sectors, on the other side. A comprehensive *NEA-DE* was expected to interfere with the ongoing sensitive discussion and negotiation processes between the ministries. More specifically, representatives from the Environment Ministry feared that the conclusions drawn from a comprehensive *NEA-DE*, funded and mandated jointly by several ministries, could at least partly contradict the Ministry's own political priorities and strategies (BMUB 2016). It was feared that if the ES concept was framed in an interministerial context, its power as an argument for nature conservation might be weakened. For example, if agricultural products would be regarded as provisioning ES, the ecological impacts, disservices resulting from intensive agriculture, might be considered less severe once traded off against the benefits. To handle this issue, it was suggested that final ES, such as yield, could be partitioned into components describing contributions from ecosystems (e. g., regulating ES as natural inputs) and human inputs (e. g., agricultural management) (Bengtsson 2015).

In such a context, defining a joint mandate and obtaining the cross-ministerial funding necessary for a comprehensive *NEA-DE*, would be another great challenge. Without a clear mandate and joint funding from the government at an interministerial level, the whole process and also its outcomes could be criticized as being biased towards a nature conservation perspective and as underemphasizing other legitimate interests. The restrictions re-

⁶ The specific German legislative, cultural and governance context generally provides a challenge to establish national assessments of the state of the environment that necessarily must cut across different federal states and different sectors. Exceptions are assessments that have been set up in specific agreements such as monitoring progress towards the targets of the *Water Framework Directive*. An open and participatory assessment process such as the one proposed for *NEA-DE* thus raises diverse concerns. In addition, policy advice in Germany is usually provided by small scientific councils and the national scientific community has generally little experience in participating in such broad assessment activities.

sulting from a narrow focus are illustrated by the current implementation of *MAES-DE* which is of limited relevance for several policy processes outside the environmental sector (e. g., reform of agricultural subsidies, infrastructure development) as it has neither integrated the full range of ES categories (provisioning, regulating and cultural services) nor the related societal processes contributing to human well-being (e. g., food, climate protection and recreation). Thus it restricts the relevance of the ES approach as a whole, a weakness to be overcome in the context of a comprehensive *NEA-DE*.

Recommendations for Moving Forward

The scoping study revealed that there are several good reasons to develop a comprehensive *NEA-DE*. In order to address the implementation challenges identified, the authors recommend a stepwise approach.

The first step, which is currently already implemented, is the *MAES-DE* process having a distinct and straightforward objective (implementing *MAES*). The ongoing *MAES-DE* implementation process has also already provided some new methodologies, data and maps which help demonstrate the added value of the ES approach for policy and science, for example, concerning spatial differences in wood provision (Grunewald et al. 2016). Besides creating the knowledge base for further assessments, this process also identified important data gaps and priority research needs that can guide the further adaptive stepwise approach suggested.

The next step is initiating a “small *NEA-DE*” process, including raising more awareness on the ES concept in German policy-making but also in business and the wider public. Further, the process should continuously provide new insights and reports on ecosystems and their services and familiarize the media and other societal institutions (including education and teaching) with this approach. This small *NEA-DE* would still be flexible in its structure and would not require a major funding investment nor for a cross-ministerial mandate upfront, although the latter might be desirable.

Building on the initiatives to establish a community of practice open to interested scientists, policy-makers, interested practitioners and other stakeholders, the small *NEA-DE* could be a science-policy-society-platform integrating insights and jointly supporting the *NEA-DE* process together with partners such as the recently founded *Ecosystem Services Partnership-DE* (*Innovationsnetzwerk Ökosystemleistungen Deutschland*⁷). In addition to existing institutions and networks, the establishment of a national forum on the necessity of a comprehensive *NEA-DE* could be part of the small *NEA-DE* and help to identify and moderate between expectations and provide and disseminate information about other, more advanced national assessments in Europe and beyond. In order to enhance compatibility and comparability of the ongoing research

efforts with a small *NEA-DE*, the actors involved and interested in a more comprehensive *NEA-DE* should remain in continuous exchange and coordination within the emerging community of practice.

Another step towards the comprehensive *NEA-DE* could be an open Horizon Scanning approach that invites all relevant actors to formulate potential questions that the *NEA-DE* should answer. This would allow different actors to get further acquainted to the approach and would help further understanding the different sectoral perspectives to it without turning such a scoping into an official part of a *NEA-DE* right away. This Horizon Scanning approach would be followed by a step to break up the silo or sectoral approach described in the challenges section. Such measures should improve the cross-sectoral nature of integrated ecosystem management linking biodiversity with abiotic soil, water and air quality related planning arenas and, what is most important, with human health and recreation planning (Kabisch et al. 2016).

A further important step towards a comprehensive *NEA-DE* would be to address the key challenge identified in the scoping process, the definition of a joint and multi-sectoral mandate. Given the reservations discussed in the challenges section, the ongoing *MAES-DE* phase should be used as a stepping stone, gradually involving diverse stakeholders and institutions and familiarizing them with the process. The importance of building bridges in mandate and funding of an ecosystem assessment has been highlighted in many other assessments in Europe but also the ongoing activities in IPBES. IPBES has taken important steps to bridge different sectors, scales of analysis and to integrate various forms of knowledge and worldviews within its assessment structure. It has made significant progress in integrating different forms of valuing ES (going beyond monetary values) by using alternative terms for the components of nature in its conceptual framework (Diaz et al. 2015). Although IPBES is still perceived as an effort from the environmental policy side, it has already attracted other stakeholders to ES thinking and research and the chance is that it will contribute to a broader public understanding of their relevance in future policy-making. However, the assessments cover large regions and the insight for the national level will likely be limited. A comprehensive *NEA-DE* could complement the IPBES assessments with many relevant insights at national level. It could also serve as strong interface between national decision-making, similar activities in other countries, and on higher levels.

In Germany, however, we currently perceive a major lack in that respect especially in the knowledge, understanding and acceptance of the ES concept using different arguments for, and against, the concept (Schröter et al. 2014). For example, some actors perceive the concept as little different from existing ones such as “sustainability”, “multifunctionality” or “landscape services” and therefore question its added value. There are fears that the ES concept too strongly emphasizes economic values, potentially resulting in a disregard of other important ecosystem values (Morelli and Moeller 2015), while others highlight the potentials of ES to support planning and policy decisions (Fürst 2015) and improve policy decisions, albeit only under specific conditions

⁷ www.esp-de.de

(Spangenberg and Settele 2016). Concerning the sociopolitical process of a comprehensive NEA-DE, we hence suggest that coordinators of assessments need to address science-policy-society issues as well as potentials and limitations of the ES concept for a Germany context with different stakeholders consciously and openly.

The scoping study was not commissioned by a ministry or state agency, but initiated and conducted by the Helmholtz Centre for Environmental Research – UFZ in collaboration with external experts, motivated by an interest to enhance the uptake of environmental research results in policy.

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