



Joint Workshop

Indication, Integration and Application of Ecosystem Services

in Decision Making

Kiel University (Germany)

May 6th to May 8th, 2013

organized by

Working Group “Ökosystemleistungen/Ecosystem Services”
of the International Association for Landscape Ecology, German section (IALE – D),

Thematic Working Groups “Ecosystem Service Indicators”
and “Application of Ecosystem Services in Planning and Management”
of the Ecosystem Service Partnership (ESP) and
the ESP Task Force Group “Ecosystem Service Cascade”

Abstracts and List of Participants

PLENARY I

May 6, 2013 2 pm-6 pm

Keynote 1:

Olaf Bastian, Karsten Grunewald, and Ralf-Uwe Syrbe: “Landscape services - a new and promising concept?”

In addition to the popular and successful concept of ecosystem services (ES) the term landscape services (LS) has been appeared recently. For its meaningfulness several arguments are propounded, e.g. spatial aspects, the more contextual view, the greater role of human influenced areas, practical applicability, and relevance for planning. It is worth addressing the question of whether the concept of Landscape is suitable to enhance the ES methodology, particularly to overcome some of its weaknesses.

The presentation shall contribute to the discussions of the term Landscape Services. We seek answers to questions like:

- What are the differences between LS and ES – in terms of contents, classifications, indicators, methods, reference units, fields of practical application?
- Are there common intersections that can be defined equally as LS or ES?
- Are there meaningful LS definitions?
- Does it really make sense to introduce the LS term?

We will illustrate our arguments with selected practical examples, particularly on a case study about the impacts of the enhanced cultivation of energy crops. We analyzed landscape processes and potentials (in the sense of the “supply” part) with an indicator-based approach in the district of Görlitz (2106 km², Saxony, Germany), e.g. biotic productivity of the site, soil erosion (water, wind), nitrate leaching, groundwater recharge, carbon sequestration, biodiversity, landscape aesthetics). Then, we interpreted the results regarding an ecological risk assessment of the intensified agriculture in general and especially the enhanced cultivation of energy crops. By the use of landscape-related reference units (biophysical units, so-called micro-geochores) it was possible to regionalize the results and to reveal spatial differences in terms of the carrying capacity or sensibility concerning an intensified cultivation. The demand side was considered by semi-structural interviews and standardized questionnaires among stakeholders and residents.

Keynote 2:

Tobias Plieninger: **“Assessing, mapping and quantifying cultural ecosystem services at landscape level”**

Numerous studies underline the importance of immaterial benefits provided by ecosystems and especially by cultural landscapes, which are shaped by intimate human–nature interactions. However, due to methodological challenges, cultural ecosystem services are rarely fully considered in ecosystem services assessments. This study performs a spatially explicit participatory mapping of the complete range of cultural ecosystem services and several disservices perceived by people living in a cultural landscape in Eastern Germany. The results stem from a combination of mapping exercises and structured interviews with 93 persons that were analyzed with statistical and GIS-based techniques. The results show that respondents relate diverse cultural services and multiple local-level sites to their individual well-being. Most importantly, aesthetic values, social relations and educational values were reported. Underlining the holistic nature of cultural ecosystem services, the results reveal bundles of services as well as particular patterns in the perception of these bundles for respondent groups with different socio-demographic backgrounds. Cultural services are not scattered randomly across a landscape, but rather follow specific patterns in terms of the intensity, richness and diversity of their provision. Resulting hotspots and coldspots of ecosystem services provision are related to landscape features and land cover forms. We conclude that, despite remaining methodological challenges, cultural services mapping assessments should be pushed ahead as indispensable elements in the management and protection of cultural landscapes. Spatially explicit information on cultural ecosystem services that incorporates the differentiated perceptions of local populations provides a rich basis for the development of sustainable land management strategies. These could realign the agendas of biodiversity conservation and cultural heritage preservation, thereby fostering multifunctionality.

Keynote 3:

Christian Albert, Jennifer Hauck, Christine Fürst, James Aronson and Christina von Haaren: **“Application of Ecosystem Services in Planning and Management: Towards an Updated Research Agenda”**

Ecosystem and landscape services have become a topical issue in science and policy. Despite the growing knowledge base, and heightened awareness of political and socio-economic relevance of ecosystem services, actual mainstreaming and implementation of ecosystem services in practical planning and decision-making is still in its infancy.

A review of current research needs for improved decision making on ecosystem services, e.g. provided by Daily et al. 2009, de Groot et al. 2012, Braat 2012, or Burkhard et al. 2012 shows that a huge research agenda lies ahead of us. This research agenda covers many different topics such as quantification and valuation of ecosystem services, trade-off analysis and stakeholder involvement to name just a few. Yet, our contribution proposes some additional key themes of research needed to enhance scientific understanding of the conditions that support or impede the application of ecosystem services in practice. In order to identify important research themes, we adopt a perspective of use-inspired scientific research, asking in which decision-contexts ecosystem services information could be applied and which requirements the information would need to fulfill. We then explore how relevant ecosystem services knowledge could be generated and which criteria are needed to assess its usefulness for decision support. Our list of research issues on the application of ecosystem services in practice is derived from a synthesis of existing, more general, research agendas on ecosystem services and amended with topics from recent research on the science-policy/practice interface.

Keynote 4:

Roy Haines-Young & Marion Potschin: “The Ecosystem Service Cascade- Who Needs a Conceptual Framework?”

The creation of a conceptual framework has been a key initial step in many recent ES initiatives. Such efforts have been stimulated in part by the success of the iconic MA diagram linking services to components of human well-being, but also by the need to communicate and flag up the particular perspective being taken. Although they differ in detail and complexity, most attempt to illustrate in some way the trans-disciplinary nature of the ES paradigm, by using the service concept to link representations of biophysical structures and processes to human values, benefits and ultimately people’s well being. There is also, often an explicit attempt to show how decision making processes operate within the frameworks.

This paper will review some of the key ecosystem service conceptual frameworks currently to be found in the literature. With their proliferation it is now appropriate to ask about the role that they play in contemporary debates. Are they, in fact, mainly communications tools, a logo, or do they capture some important methodological or theoretical insights? As we move towards operationalising the ES concept should we be more demanding of them, and suggest that they should be richer in a theoretical sense? If so, what novel features do we need to include? Given the trans-disciplinary nature of the ecosystem service paradigm, can these conceptual frameworks represent anything that is fundamentally testable?

Keynote 5:

Adrienne Grêt-Regamey, Ken Bagstad, Ariane Walz, Hermann Klug, Sandra Lavorel, Ulrike Tappeiner, Davide Geneletti & Stoyan Nedkov: **“Exploring the effects of scale for ecosystem services assessment”**

The essential ingredients of long-term sustainable development include accurate knowledge about its resources and wise policies to use them. This knowledge of resources includes a systematic place-based description of ecosystems and their interdependencies. The policy aspect requires adequate information on the potential and actual use of the goods and services provided by the ecosystems. Overly fine-grained ecosystem services analysis may cause users to lose focus on broader-scale patterns. However, information loss typically occurs with coarser-scale analysis, and this is particularly relevant in highly heterogeneous environments, such as mountain regions.

Using case studies of five ecosystem services in mountain regions of Europe, South America, and the United States, we quantify information gains and losses to identify appropriate spatial resolution and extents for ecosystem services assessment. We map five ecosystem services - carbon sequestration, flood regulation, agricultural production, timber harvest, and scenic viewsheds - at a common global resolution (270 m x 270 m) and comparable fine resolution (30x30 m) across eight case study regions. Results show changes in trade-offs at different scales. Since high-resolution analysis comes with a cost - non-uniform data availability, greater modeling requirements, and potential for users to focus excessively on small-scale patterns - we illustrate where high-resolution ecosystem services analysis is most valuable in informing decision making.

WORKING GROUP SESSIONS

May 7-8, 2013

ESP Task Force “Ecosystem Service Cascade”

The Cascade Model and Ecosystem Service Framework Concepts

The “Cascade Task Force” was formed at the Ecosystem Service Partnership (ESP) conference in Portland, August 2012. The Cascade Model was seen as a catalyst to stimulate discussions on Ecosystem Service Concepts. The Task Force is part of the ESP Working Group #1 on “Ecosystem

Service Assessment Frameworks & Typologies". The Cascade Task Force takes the opportunity of the IALE-D ecosystem service working group meeting in May 2013 in Kiel to discuss newly developed ecosystem service concepts and applications as a preparation for the 6th ESP conference in Bali.

A conclusion from the Portland meeting was that while the cascade model was a good communication device we need to think more deeply about how to represent the way values feed back to the biophysical components, and so develop a richer picture of a socio-ecological system. Thus in this the proposed workshop we are inviting presentations on ecosystem service concepts and will explore different frameworks that support or provide alternative approaches and perspectives to the cascade model. The key questions carried over from the Portland meeting are:

- What are the relations between:
 - Environmental pressures and ecosystem states?
 - Biophysical structures / processes and ecosystem functions?
 - Ecosystem functions and ecosystem services?
 - Ecosystem services and human benefits?
 - Human benefits and values?
 - Ecosystem service based values and management decisions?
 - Ecosystem services and policy actions?
- What are the relations between different ecosystem services? How are these relations operating throughout ecosystem service tradeoffs?
- Do we find different results if we change the (conventional) directions of the arrows and look at the system more intensively from the demand side?
- Which are the spatio-temporal relations between the cascade's components and are there different scales involved?
- Which is the specific role of biodiversity for the provision and valuation of services?
- Do the different relationships have different significance? Can we determine focal elements and processes?

At the meeting we will explore them further, and exchange information on case studies that help us to explore the advantages and limitations of the overall approach. The discussions will feed into the on-going discussions of the ESP Task Force.

Session organizers:

Marion Potschin <Marion.Potschin@nottingham.ac.uk>

Presentation abstracts within the session “Ecosystem Service Cascade”

Karsten Grunewald, Olaf Bastian, Ralf-Uwe Syrbe: “The Five Pillar EPPS Framework for Quantifying, Mapping and Managing Ecosystem Services”

The assessment of ecosystem services in a structured way needs suitable, flexible frameworks including robust procedures or guidelines for each of the working steps, e.g. indicator selection, valuation rules, the consideration of space, scale and time aspects, stakeholder involvement, as well as a consistent, logical terminological system. Based on traditional ecosystem and landscape assessment discourses and referring to existing ecosystem function and services approaches, we previously presented the so-called EPPS framework with three pillars: (1) properties, (2) potentials and (3) services of ecosystems. That framework particularly highlights the differentiation between the bio-physical conditions of ecosystems (including functioning), their potential (capacity) and the real use of ecosystem services. We do not perform a pillar "ecosystem functions" (because of misunderstandings) and we renounce "supporting services" (because of the double counting problem). For demand-related evaluation and management purposes, we extend the EPPS framework by two additional pillars: (4) benefits/values and (5) beneficiaries. The extended scheme enables the main application needs of the conception to highlight the values for beneficiaries, to maintain the ecosystem properties and to support the service providers. The concerned actors, both the service providers and the beneficiaries, impact upon the ecosystems through their management or use activities. The implementation of ecosystem service management actions cannot be done without the knowledge of the beneficiaries or the stakeholders involved. Thus, the framework especially focuses on the feedback of people to ecosystems through decisions, utilization and management, and it particularly addresses space and time issues. We present an exemplary application of the framework for selected ecosystem services.

Lasse Loft, Alexandra Lux, Katja Heubach, Uwe Zajonz, Claudia Grunewald and Marion Mehring: “Operationalising the ESS-Framework for the assessment of climate induced changes in ecosystem services provision”

Efforts to apply the concept of ecosystem services (ESS) to current land use planning have increased strongly (e.g. Daily and Matson, 2008; Tallis et al., 2008). In order to support decision-makers with the optimal allocation and management of different land use options, scholars such as de Groot et al. (2002, 2006, 2010) and Haines-Young and Potschin (2010, 2011) have developed integrated ESS approaches. Building on these theoretical approaches for assessing future changes in ESS provision

we investigated climate induced changes of biodiversity and ecosystem services provision in three case studies:

- A tropical marine ecosystem with distinct coral reefs (Socotra Archipelago), with local and regional population being especially dependent upon fish biomass for food security.
- A savannah ecosystem in West Africa with a local population being especially dependent upon non-timber forest product provision by baobab trees for household income.
- South African savannah ecosystems with a unique diversity of large mammals, which are the basis for wildlife tourism, an important source of income in eastern and southern Africa.

Based on these case study experiences we adapted a stepwise research framework to support prediction of climate-induced changes in ESS provision, and their social relevance. Special emphasis was put on studying and standardising the transdisciplinary process of implementing the ESS approach, i.e. necessary consultation steps in the interfaces between natural and social sciences, and optimisation of the stakeholder involvement. The case studies showed that a complete implementation of the framework turned out as way to complex and time consuming. Depending on the research emphasis and questions not all but only a selection of steps were taken. In addition the order of the applied research steps varied between the different case studies. As a result the research framework was refined and is now perceived as a set of modular building blocks, which can be combined in different ways, depending on research and decision-makers needs.

Joachim Spangenberg: "From Cascade to stairways: human intervention in ESS generation"

The 'cascade model' of ecosystem service ESS generation and valuation was developed in particular for the case of marginal change valuation. This paper intends to strengthen the model's applicability to both non-incremental changes, and to landscape planning.

For this behalf, a more detailed process analysis is undertaken, with a focus on the use value attribution turning biophysical ecosystem functions ESF into ecosystem service potentials ESP. We furthermore distinguish the service potential ESP and the ESS finally provided by mobilising the potential, and both from the benefits accruing to agents after appropriation and commercialisation of the ESS they mobilised.

The relevance of use value attribution is illustrated by discussing different ESP attributed to the same ESF, biomass provision, and the resulting different ESS. The example demonstrates the importance of the use value attribution step for the final (e)valuation of policies, plans and their expected outcome. For the reverse use of the 'cascade' as 'stairways' for planning processes, the prevailing uncertainty requires legal and participative foundations for decision making, and an awareness of the potentially

conflicting private and public interests involved. This reverse application combines with the 'cascade' to form a full cycle of ecosystem services generation and management.

Matthias Schröter: "Two ideas to reform the ES cascade model"

In this presentation I would like to contribute to the workshop of the ESP task force "ES cascade" with conceptual thoughts to reform the cascade, supported by examples from my work on spatial modelling of multiple ecosystem services in Telemark province, Norway.

The ecosystem services cascade model has been a remarkably successful way to structure, visualise and conceptualise research and debate in ecosystem services. While the field develops, the cascade needs to be reconsidered. In this presentation I would like to present two ways to reframe the cascade idea.

Recently, the distinction between supply and demand or functions and services has drawn increased attention. 'Functions' (or capacity) and 'supply' have been used interchangeably. Furthermore, ecosystem functions are often already influenced by human interference to a degree that makes it difficult to consider them on the 'ecosystem' side of the cascade. One way to solve this problem would be to open an own ecosystem service box which is divided into capacity to provide services and actual flow of services, measured with comparable indicators. By comparing these two, we manage to include a parsimonious notion of sustainability in the cascade.

Another urgent issue is the representation of social and ethical values in the cascade, especially in the case of cultural services. Here, different forms of economic values have dominated the debate so far, which neglects underlying ethical persuasions. While the cascade suggests a certain 'read-from-left-to-right' logic, it can be shown that cultural, immaterial services this rationality is hard to follow as the values which are derived are unclear. My second proposal is thus to include a representation of values that determine the factual existence of a service and are as such a (philosophical) starting point for a reformed cascade model.

Johannes Förster: "Proposal of a framework for assessing the role of ecosystem services in land management"

Over the past decades, the concept of ecosystem services evolved from being used for highlighting the link between biodiversity, ecosystems and human wellbeing (MA 2005), to a concept that is suggested as a tool for decision making (e.g. TEEB 2010, UK NEA 2011). In particular the ecosystem service cascade has proven to be useful for capturing the variables that link the biophysical

properties of ecosystems with the benefits they provide to human well-being (Haines Young and Potschin 2010, de Groot et al. 2010, TEEB 2010, UK NEA 2011).

There exist numerous case studies, where ecosystem services were assessed in biophysical and monetary terms (e.g. see TEEB Database). In some instances, the concept has been applied also in informing decision-making on land management (e.g. see TEEB cases). However, often ecosystem service assessments neglect the integration of the information into decision-making on land management. Therefore, van Oudenhoven et al. 2012 extended the ecosystem service cascade by components that relate the ecosystem-service cascade to land management.

Based on the concepts outlined above, this presentation will provide an introduction to a conceptual framework for assessing the role of ecosystem services in land management. The framework aims at representing both, the ecosystem service cascade linking ecosystems with human wellbeing (supply of ecosystem services), and the socio-economic context, which determines the demand for ecosystem services and influences land-use decisions. By linking the ecosystem service cascade with land management, feedbacks of land-use decisions on ecosystems and the provisioning of ecosystem services can be analysed, allowing the assessment of trade-offs and synergies between different land-use options. For the application of the conceptual framework, an analytical framework will be presented, which allows the qualitative and quantitative assessment of the role of ecosystem services in land management.

Markus Meyer: "The ecosystem service cascade as an approach to evaluate biofuel sustainability certification schemes"

In practice, indicators for certification schemes to determine the environmental and partly social impacts are selected by experts or through stakeholder consultation, which does not necessarily ensure a balanced and representative indicator set. Therefore, our question is whether the ecosystem service cascade as a system analytical approach is suitable to evaluate sets indicators in biofuel certification schemes. We focus on local/regional environmental impacts such as water availability, i.e. sustainable water use without groundwater depletion in the respective watershed, or biodiversity, i.e. habitat heterogeneity. Requiring a site-specific and flexible assessment, certification schemes elaborate less on local/regional than on global impacts. Global impacts are mostly determined with standardized methods such as life-cycle assessments.

The ecosystem service cascade has already been successfully used as a framework for indicator selection for the environmental assessment of biomass production. In this study, sets of indicators from applied certification schemes are compared with an "ideal" indicator system to reveal system analytical limitations. An "ideal" indicator system derived from existing knowledge considers major

environmental impacts and their feedbacks and provides a balanced selection of indicators for the different steps of the ecosystem service cascade. We are especially focusing on the question whether major environmental impacts and indicator interactions are adequately considered and to which extent further consideration of indicator interaction is necessary and feasible for biofuel certification. Preliminary results show that most of the indicators of biofuel certification schemes describe land management practices and implicitly consider biomass provision and other affected ecosystem services such as water supply, while indicators for biophysical properties and functions such as the minimum population size are neglected. The interactions between indicators of the different steps of the ecosystem service cascade and the underlying human activities are either not at all or only weakly considered, e.g. by naming links between the different ecosystem properties.

Siegmar Thomas: “Ecosystem services, human benefits and policy actions”

Landform diversity and spatial bio-diversity of ecosystem services

Schemes will be shown interrelationships of landform- and spatial bio-diversity. Plant-physiological sites and plant communities increase in general by increasing of the true surface area with increasing altitude difference and complementary elevation / depression frequency of an area, e.g. a catchment or watershed area. Comparisons of the orthogonal projection of the real true surface cannot result in a real valuation of the spatial bio-diversity of different landscape areas.

Man-made decrease of landform diversity

Man-made decrease of landform diversity will be shown from a negative example: filling-up an erosion valley with soil, rubble to gain some m² plain area.

The removing of an old grove of oak trees in the former depression has the result of a strong loss of biodiversity and also negative effects on bio-climate and human benefit for the neighboring inhabitants. Also the strong use of pesticides with spaciouly spraying machines in very small hobby-vineyards as mini-plots inside cities is quite the opposite of protecting clean air.

Conservation of landform diversity and policy actions

We have to avoid negative tendencies if possible: leveling out and filling-up natural (and semi-natural) depressions / small erosion valleys for new flat agricultural areas; so-called "relief amelioration" mainly inside cities. Otherwise this would contribute immensely to reduce spatial biodiversity.

There are a lot of good recommendations, e.g. the so-called “Good practice in agriculture”, “Good practice in pesticide use” and so on. But these are not justifiable. So, sometimes users of

agricultural mini-plots inside cities – living far from their mini plots (officially nominated as entrepreneurs of agricultural firms), e.g. mini-hobby-winegrowers (of e.g. less than 100 m² mini plot) can do what they want, also immediately adjacent to other inhabitants and living houses, residential areas. Also there is sometimes a lack of check of legal requirements.

Marion Kandziora, Benjamin Burkhard and Felix Müller.: “Systems interrelations within the ecosystem service cascade?”

The ecosystem service cascade is an important tool to highlight all the components which are needed to analyse ecosystem services spatially and temporally. Many studies focus on either the function, the ecosystem services, the benefits or the many different valuation methods. The influence of biodiversity on ecosystem services has been the focal point in many studies as well.

Here an attempt has been made to investigate and visualize the interrelations between ecosystem functions (indicated by ecosystem integrity), ecosystem services and components of human well-being in the framework of a theoretical matrix exercise in an agriculturally dominated case study area in Northern Germany. The tradeoffs among the three categories of regulating, provisioning and cultural ecosystem services and individual services (e.g. timber, crops and livestock) have been found to exclude and/or compete in varying intensities. Biodiversity plays an important role for supporting regulating and cultural services.

This analysis gives the opportunity to investigate land use changes and trigger trade-off discussions as an adaptive management cycle for decision-making and management.

Alexander van Oudenhoven: “Ecosystem services database: quantifying and structuring indicators based on the Cascade Model”

We are building a database in which quantification studies of ecosystem services provision are integrated. The database enables a quantitative overview of multiple ecosystem services on the one side (through multiple indicators, for properties, capacity and flow), and a range of management intensities on the other side. Management intensities have been classified into (semi)natural, low intensity use, high intensity use, converted and abandoned, with over a dozen subcategories. Per ecosystem service, we have compiled the most prevalent indicators and data for ecosystem properties, functions and services that are relevant for the ecosystem services provision. The database therefore offers an overview of a) suitable indicators per ecosystem service; b) a land use and management intensity typology which can be applied for multiple ecosystems and regions, and which is closely linked to the IMAGE, FAO and WWF typology; and c) quantified information of

ecosystem service provision per land use management type for grassland, mangrove, forest, dry-land ecosystems, among others.

The above mentioned could contribute to the both workshops on “The Cascade Model and Ecosystem Service Framework Concepts” (Potschin) as well as “Challenges of Interrelation and Aggregation of Ecosystem Services for Indicator Construction” (Müller), the main reasons being that the database is being constructed based on the Cascade Model and that indicators needed to be selected that were suitable for interrelation and aggregation, but that at the same time needed to provide information on the links between pressures (management) and state, ecosystem properties and functions and services. Our database does not contain information on economic value or human wellbeing (benefit), but we are looking towards linking the database up with the ESP’s Ecosystem Services Valuation Database. We stress that this is work in process, but experiences are there to be shared and discussed.

Jörg Priess: “The ES-cascade - a systematic integration of ‘boxes & arrows’ as components of socio-environmental systems”

Since the first version of the ecosystem service (=ES) cascade and similar conceptual approaches, many authors have been building on the concept, and to date multiple versions of the ES cascade are in use. Other authors have linked or embedded the concept in larger thematic contexts such as land-use science, integrated analysis of social-ecological systems or (participatory) environmental decision making. Many of the published ES concepts are using a socio-environmental context, mostly comprising an environmental (or ecological) and a socio-economic (or social) subsystem.

Using systems science terminology, the representation of ecosystem services (ES) within these approaches appears either more as a system component (box) or as a feedback (arrow), reflecting the different perceptions of authors and the different pools and fluxes of matter, energy or information covered by the term ES.

Building on these conceptual models, this paper proposes a systematic representation of the elements of the ES-cascade as components of socio-environmental systems. We demonstrate the feasibility of the concept using different examples from the latest CICES classification (v4, 2012). The approach can be applied at different spatial scales. Furthermore, the concept enables a clear distinction between ES-provisioning and ES-receiving units, as well as an identification and classification of feedback mechanisms relevant for different groups or classes of ES.

Verina Ingram, Jolanda van den Berg, Mark van Oorschot and Marcel Kok: “Innovations in integrating ecosystem services into tropical timber value chains with Dutch links”

Current Dutch government trade and development policy focuses on increasing the sustainability value chains for key commodities. However the role of ecosystem services (ES) in sustainability is not clearly defined. This paper presents an analysis of tropical timber value chains. Content analysis was used to examine how diverse policies address ecosystem services and biodiversity. ES were not defined, but couched in terms of economic value and strongly linked to markets, whilst biodiversity was frequently mentioned in association with conservation. Four organisational and institutional innovations (sustainable public procurement, public-private partnerships for sustainable chains, certification, and reduced emissions for deforestation and degradation schemes) were analysed investigating the extent to which ecosystem services were addressed and/or integrated. Interviews and literature were combined with an innovations systems and value chain analysis approach. The cases highlight that ES have been largely not figured in the innovations with ES not made explicit. The exception is Forest Stewardship Council certification – a major driver to integrate ES in three cases. Framework conditions have predominantly triggered the innovations and equally presented barriers. The involvement of multiple stakeholders along the chain is seen in all cases as critical to the success, although the way this has occurred- through mandating, facilitating, partnering and endorsing varies widely by case. Notable is the differing extent to which civil society and consumers (private, corporate or public) were included and how power and control of the chain, especially access to information and institutional building, is an important to how the innovation was introduced and its impact. Lessons learnt include addressing the complex terminology; evidence of the impact of certification on ecosystem services; making ES conserved through certification more explicit; the development of internationally accepted impact indicators and ES assessment methodologies and “seeing through the trees” of multiple certification schemes and sustainable forest management initiatives.

ESP Thematic Working Group on “Application of ES in Planning and Management”

Applying Ecosystem Services in Assessments: Lessons Learned and Ways Forward

The last decade has seen the emergence of an increasing number of ecosystem services assessments at local to global scales that explicitly aim to inform policy, economy and civil society and support decision-making. This workshop aims at bringing together scientists that are interested or have been involved in ecosystem service assessments to discuss two key questions:

- What type of information was considered helpful by policy- and other decision makers?
- What can be learned from this experience for future applications?

The symposium format will be short presentations, followed by a moderated round-table discussion. Scientists interested in participating are asked to submit an abstract (max. 300 words) that either summarizes their potential paper contribution or explains their particular interest in the workshop discussion.

Session Organizers:

Christian Albert & Jennifer Hauck

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Presentation abstracts within the session ESP Practice

André Mascarenhas; Tomás B. Ramos; Dagmar Haase; Rui Santos: “Integration of ecosystem services in spatial planning: a survey on Portuguese regional planners’ views”

Despite the increasing attention that ecosystem services (ES) have attracted in recent years, many issues remain unresolved to fully integrate the concept of ES into everyday planning, management and decision-making. Awareness, knowledge, organizational and institutional capacity are essential prerequisites for mainstreaming ES in planning processes. However, current ES approaches do not take existing administrative and governance structures and practices as a starting point. Moreover, only few SEA cases are available with a clear recognition of ES. Previous research by the authors,

analysing the Portuguese planning context, has revealed a low level of ES integration in spatial plans and discrepant levels of integration between regional spatial plans and strategic environmental assessment (SEA) reports. The main goal of this research is to improve the knowledge on the main factors that influence the integration of ES in regional spatial planning in Portugal. A survey questionnaire was designed and administered to draw the Portuguese profile, aiming at practitioners and decision-makers from Portuguese regional spatial planning authorities. We identify important factors that ES-inclusive SEA needs to consider. For a better integration of ES in Portuguese regional planning practices, a higher level of awareness and knowledge of the concept by practitioners and decision-makers is needed. Related to this, planning guidelines at national and regional levels with a stronger emphasis on ES are needed, since currently they are considered to be poor or inexistent. SEA results and recommendations covering ES also need to be better included in the planning process and consequently reflected by the spatial plans.

Jennifer Hauck, Nina Buhr and Christian Albert: “What ecosystem services information do users want? A study among German regional planners”

The last decade has seen the emergence of an increasing number of assessments of ecosystems and their services at local to global scales. However, actual implementation of ecosystem services information in planning and decision-making practice so far remains limited.

The objective of this contribution is to develop and test a method for investigating what information and knowledge landscape managers on the regional level need to integrate and address ecosystem services in their day-to-day decision-making. The regional level has been chosen as the focus for analysis because is most appropriate for investigating and addressing human-environment interactions. Landscape managers are understood as political decision-makers and land planning administrators.

In order to investigate which information and knowledge resources landscape managers need to adequately consider ecosystem services in their decision-making, the analysis will address four themes: (1) What are key decision-making challenges for landscape managers with impacts on ecosystems? (2) Which information on potential impacts on ecosystems do they (already) use as decision-support, and what are information constraints? (3) In which planning and management decisions making processes would landscape managers like to integrate information on ecosystem services, and what is the expected added value? (4) Which kind of ecosystem services information would be useful for different types of decision processes, and how can it be effectively communicated?

The results provide valuable new knowledge of the interests and requirements of land managers at the regional level concerning a greater integration of ecosystem services in their work. These results are expected to be an important input for further studies, and a potentially very useful contribution for developing assessment designs and processes most likely to yield useful and usable information for decision-making.

Leena Kopperoinen and Pekka Itkonen: “Planning for green infrastructure sustaining ecosystem services“

In the Green Infra research project (Finnish Environment Institute SYKE 2012–2013) work package 2, we (1) examine how green infrastructure and ecosystem services relate to each other, and (2) study how green infrastructure can be defined and located spatially on the basis of ecosystem services in land use planning, in a way that fosters the flow of services for the health and well-being of people. The goal of the whole research project is, in addition to identifying the development needs of actual physical green infrastructure, to analyze relevant regulatory regime related to green infrastructure and its development needs.

Using our GIS-based method, the prerequisites for the provision of various ecosystem services will be assessed on the basis of more than 20 spatial datasets. Based on expert evaluation, the datasets are scored according to how important the areas represented by them (e.g. high nature value farmlands) are in potentially providing each type of ecosystem services or how harmful the phenomenon represented by them (e.g. sites of algae bloom observations) are for the provision of different ecosystem services. The ultimate purpose of the method is to help local and regional land use planners in outlining green infrastructure and incorporating ecosystem services and green infrastructure in sustainable land use planning.

Our work has brought up many interesting questions and viewpoints, such as: How well do the prerequisites of ecosystem service provision potential represent the actual ecosystem service provision? What issues does the use of expert evaluation bring along? What kinds of datasets are needed to comprehensively cover different ecosystem services / service categories? Is the methodology framework spatially transferable? What criteria should the ecosystem service –based delineation of green infrastructure base on? How to communicate the results in such a way that their applicability, impact and benefit are maximal?

Veronika Fontana: “Keep it traditional? Comparing ecosystem services of three land-use alternatives using a multi-criteria analysis”

Larch (*Larix decidua*) meadows are an ancient land use system in the central Alps. Currently larch meadows are threatened by two contrasting pressures: abandonment (resulting into forests) and intensification (resulting into intensive, treeless meadows). To compare the three possible land-use alternatives and to quantify their ecosystem service provision, we conducted a multi-criteria decision analysis (MCDA). Six criteria were selected by experts and enclosed in the classifications of the ecosystem service concept. Criteria importance was ranked by stakeholders and indicator values were assessed qualitatively or quantitatively. In the MCDA model the spruce forest resulted as the best land-use alternative regarding the provision of ecosystem services, followed by the traditional larch meadow and then the intensive meadow. The combined approach of a MCDA using ecosystem services as criteria to compare land-use alternatives showed very well how criteria weightings and criteria indicator values influence the performance of the alternatives. In this context, the applied PROMETHEE software allows to visualize the consequences of land-use change for ecosystem service provision, which can be an effective tool during political discussions about land-use change or for round tables about landscape planning. In this way our research can contribute to practical solutions by structuring environmental problems and providing data for decisions.

Jan Staes: “ECOPLAN (Planning For Ecosystem Services)”

In June 2012, the Flemish government agency for Innovation by Science and Technology – “Strategic Basic Research Projects” granted a 4-year, +300 man month project on ecosystem services research after a very positive review by international experts and a broad support by the Flemish Policy end-users. The project started in January 2013. As the project leader, I would like to take the opportunity to present and discuss the concepts and first results of this project to the Ecosystem Services Research Community.

ECOPLAN is a trans-disciplinary project involving stakeholder-supported research on inventory, monitoring, mapping, quantification, determination of supply and demand, economical valuation and policy guidance on Ecosystem Services in Flanders. It is a state-of-the-art project which goes beyond existing, locally and temporarily applicable regional ES-assessments, and covers a wide scope of scientific challenges involved in planning for ecosystem services.

ECOPLAN aims to develop spatially explicit information and tools for the assessment of ecosystem services and the evaluation of functional ecosystems as a cost-efficient and multi-purpose strategy to

improve environmental quality. We will develop open-source end-products and knowledge to identify, quantify, value and validate-monitor ecosystem services.

ECOPLAN wants to progress in resolving the following important scientific challenges regarding ecosystem services research:

- Develop scientifically sound methods for a more precise and policy relevant valuation of demand for ES
- Characterizing structure and dynamics of service providing units by hybrid modeling that combines object based modeling with pixel based modeling
- To develop and use conceptual modeling approaches to resolve complexity issues in the field of ES research
- Quantify accuracy that is needed for different levels of decision support and land use management
- Develop and apply validation methods for ES
- Develop and apply innovative Remote sensing techniques for ES research

Brian D. Fath: “Ecosystem service valuation of land use change in Baltimore, Maryland, USA: change along the complex systems cycle”

Nature provides a vast array of ecological services for human use, which historically have gone under- or unvalued. The push to recognize and value these Ecosystem Services helps get a place at the negotiating table regarding environmental management. Questions remain about the proper valuation methods.

Using the value transfer method, we gather per hectare, per year 2010USD values for each Land Use Land Cover type and map them for Baltimore, Maryland from 1973 and 2010. The value transfer method has received much criticism for generalizing the function of ecosystems, and has been challenged by the use of production function tools like InVEST (Integrated Valuation of Ecosystem Services and Trade-offs), developed by the Natural Capital Project. Therefore, for comparison we use the value transfer method and the InVEST tool for ESRI’s ArcMap to map how the annual economic value (both market and non-market) of carbon sequestration provided by 11 different land use/land cover (LULC) types has changed from 1973 to 2010. Land use change is part of a broader ecological dynamic, so as land is reverted back to a natural state it will follow a typical secondary successional path. Holling’s complex system cycle can inform about expected changes in the various ecosystem service types.

This research provides a short-term snapshot of that dynamic.

Tanzila Chand: “Indicators of Ecosystem Services Interrelation with Indirect Land Use Change”

Energy is one of the provisioning ecosystem services, but increasing extractions of wood and extensive cultivation of energy crops are resulting in both direct and indirect impacts. Direct impacts may include reduced food availability, carbon sequestration, impacts on water resources, soil fertility and erosion. Indirect impacts are due to replacing prior land use with bioenergy crops that may cause food, feed or fiber crops to be grown somewhere else and in the end may contribute to convert natural vegetation or cause other adverse impacts on ecosystem services. Obviously, indirect land use change (iLUC) may be related to any type of agricultural expansion or new crop introduction, but here it is mainly discussed in the context of expanding bioenergy crop areas. The research approach will be a qualitative analysis of indicators to maximize the provisioning services like bioenergy supply with minimized negative effects on the regulating services like C-sequestration and soil fertility. Understanding the impact of different feedstock, related production practices and the environmental conditions under which they are implemented on ecosystem services and the interaction between indicators of ecosystem properties due to indirect land use change would help to improve and optimize biomass production. A set of selected biophysical indicators (e.g production yield and carbon storage of the area, regeneration potential and growth period of the plants, co-products and residues, competing uses of feedstock and land) and production practices (use of co-products and residues, sustainable harvesting of forest wood, short rotation crops, and use of abandoned or degraded land) will be analyzed in a matrix for their impacts on ecosystem services. Combining these approaches may contribute to identify indicators for iLUC assessment, impacts on ecosystem services, and finally to enhance the sustainability of biomass production.

Katja Arzt: “Environmental Trading Desk for ecological services made by National Natural Landscapes”

Environmental Trading Desk To Strengthen Local Responsibility

EUROPARC Germany is a registered charitable non-profit organization with the aim to support national natural landscapes like biosphere reserves, national parks and nature parks in their ambition to protect nature and landscapes and to foster their sustainable development.

EUROPARC Germany wants to establish a so called “environmental trading desk”. It will trade ecological services made by the regional parks in Germany. Our vision is to set up qualified standards for regional carbon compensation projects and use the MoorFuture -Standard. In wetland-, forest- and agro-forestry projects the achieved ecological services for climate protection will be quantified (ex-ante). All projects will also support ecological services like water purification or biodiversity. If

possible and not too cost expensive, we are going to quantify these effects as well. Companies which like to support regional environments or like to voluntarily compensate for their environmental interventions can buy these ecological services via “certificates”. After successful sale of the certificates projects will then be financed. To establish this innovative financial tool EUROPARC Germany already finished a pre-study financed by BfN. The concept is due to be put in practice, if EUROPARCs gets enough grants. We are interested to discuss our concepts with experts and learn about effective ways to quantify ecological services.

Aletta Bonn, Mark Reed, Chris Evans: “Valuing peatland ecosystem services for sustainable management”

Peatlands provide vital services to society, globally and nationally, and provide the largest global store of terrestrial carbon. While covering only 3% of the global land area, the world’s temperate and boreal peatlands hold the largest terrestrial carbon store with an estimated 30% of global terrestrial carbon. Drained peatlands, however, contribute disproportionately to global greenhouse gas (GHG) emissions. Globally, degraded peatlands are responsible for 25% CO₂ emissions from the land use sector, and in the European Union 80% of CO₂ emissions from agricultural land use are attributable to degraded peatlands. Peatland restoration therefore provides a major opportunity to mitigation against climate change. Drained peatlands lead to significant anthropogenic CO₂ emissions, loss of biodiversity and water quality reduction.

Building on the IUCN UK Commission of Inquiry on Peatlands, we developed a transdisciplinary Valuing Nature Network to assess and value peatland ecosystem services. Using expert workshops with natural and socio-economic scientists, policy advisers, restoration practitioners and business representatives, we reviewed the evidence for spatio-temporal configuration of stocks and flows of services and derived new insights for assessing the value of peatlands for environmental decision-making. We identified the regulatory mechanisms necessary to develop new markets for peatland restoration and conservation, specifically through Payments for Ecosystem Services (PES) schemes. As an applied output we are working towards development of a peatland code for sustainable management and potential voluntary carbon credits. We compare this to similar PES schemes for peatlands in Germany.

Lennart Kümper-Schlake: "Application of Ecosystem Services in China - Insights from research and the implementation of TEEB"

In the field of environmental change, the application of ecosystem services (ES) seems to be a success story, both in science and policy. The concept is increasingly applied in scientific analysis, policy assessments and global initiatives like TEEB - The Economics of Ecosystems and Biodiversity. There is little doubt about the value of the ES concept for research activities at different scales and its potential to inform policy, economy and civil society and to support decision-making. However, in ES applications at the science-policy interface, profound challenges remain, in particular on communicating about ES.

This paper reflects the application and understanding of ES in a Sino-German research collaboration on Environmental Governance and Landscape Management (since 2007), and in the process of TEEB's national implementation in China (since 2012). To further understanding of the potentials and implications of integrating the ES concept into science or at the interface of science and policy, challenges that occur e.g. in the Chinese context, shall be discussed (selection):

>> Communication challenges due to vague knowledge of ES definitions and competing terminology

>> Comprehension gaps between natural and social scientists, leading and non-leading scientists, scientists, user-groups and decision-makers

>> Lack of general understanding for the potential of ES among decision-makers, implementing organisations and administrations

>> Different understanding for the purpose of specific ES applications between economic, policy/planning and scientific/analytical perspectives

ESP Thematic Working Group on “Ecosystem Service Indicators”

Challenges of Interrelation and Aggregation of Ecosystem Services for Indicator Construction

Indicators play a major role in several ecosystem service concepts. Therefore, the working group is looking forward to presentations of new indicator sets and approaches, new case study results or projects to optimize service indication. Besides these presentations we want to discuss how the relation between the indicandum and the indicator can be optimized, how we can include imports and exports of ecosystem services and how indicators can be best used for trade-off analysis. Taking into account the composition of working groups, the following focal questions will be discussed:

- How can the interrelations between indicators of ecosystem properties, ecosystem functions and services be represented in a satisfactory way?
- How can we distinguish and relate indicators of ecosystem service potentials, capacities, stocks and flows?
- What role does scale and distance play when constructing ecosystem service indicators, and how do we solve the problem that the supply of a service may be in a different location to the beneficiaries?

Session Organizers:

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Dagmar Haase,, Niki Frantzeskaki,, and Thomas Elmqvist: “Ecosystem Services in Urban Landscapes: Practical Applications and Governance Implications analysed for European and US cities”

Urban landscapes are the everyday environment for the majority of the global population live in urban areas. The continuous growth in the number and size of urban areas along with an increasing demand on resources and energy pose great challenges for ensuring human welfare in cities while preventing an increasing loss of biodiversity. The understanding of how urban ecosystems function, provide goods and services for urban dwellers, how they change and what allows and limits their performance, can add to the understanding of ecosystem change and governance in general in an ever more human-dominated world. The paper we suggest aims at introducing a framework and empirical examples bridging the knowledge gap between the global process of urbanisation, demand creation and provisioning of ecosystem services in urban regions/cities on the one hand and schemes of urban ecosystem services governance on the other. It bases on current research within the

European URBES project (<http://urbesproject.org/>). The presentation will present the components of the new framework: (1) new conceptualizations for characterizing need and provisioning of ecosystem services (and biodiversity) in urban landscapes and along rural-urban gradients, (2) integrated analytical tools for measuring, modelling and valuing urban ecosystems/environments exemplified at the service providing unit of urban green spaces/parks and (3) resulting implications for urban governance, planning policy decisions/actions at current and in the future in order to achieve more sustainable/resilient cities. Empirical examples from European and US cities will be discussed.

Joana Jagmann, Angela Hof, Michael Grothe and Thomas Schmitt: “Exploring indicators of the interrelatedness of biodiversity and selected ecosystem services of urban green”

Climate change adaptation and mitigation in urban conurbations, e.g. the Ruhr area will focus on vegetation and urban green areas due to their importance for both object- and area-related adaptation and mitigation means. Indicator development for decision support to the parks and green areas department faces the challenge that biodiversity and other ecosystem services of urban green may work on different temporal and spatial scales and that little empirical evidence on the interrelatedness of biodiversity for selected ecosystem services of urban green is available. In this context, a concept for empirical research is presented that focuses on the following issues: Do grasslands with differences in diversity imply similar structure but different intensity of use effects and benefits of ESS? Which functional relationships and interactions exist between the various parameters? What level of care and maintenance measures is recommendable, given that public administration may have insufficient funds for suitable programmes? Considering the available potentials of ecosystems and demand for ESS in the urban environment, biodiversity, micro-climate regulation and rainwater drainage services of grasslands including their interactions are investigated. In addition to assessments of biodiversity and ecosystem services with traditional methods of vegetation and landscape ecology, appropriate indicators will be developed to describe services and relationships between biodiversity and ESS and to evaluate their benefits for human wellbeing. Another objective of the study is the co-design of ecosystem service indicators with the Bochum city parks and green areas department concerning use, management and conservation of the studied ecosystem type to integrate the value of its services in local decision-making.

Emily Lorance Rall: “Quantifying the Immeasurable: the use of biophysical data to assess cultural ecosystem services in urban areas”

There are many challenges remaining in assessing urban ecosystem services (ES), particularly cultural services. After a long period of acknowledgement but rare application, there has been a recent surge in studies which have attempted to measure these services, despite their incommensurable and intangible nature. Many of these assessments take place at national and regional scales, or if at a landscape scale then usually in rural settings using economic or social valuation methods. Though a few examples exist of biophysical data being used to measure the cultural ES of cities, there is a lack of clarity on what biophysical indicators are appropriate for assessing cultural ES in urban environments, and when social valuation measures are more applicable.

This paper assesses potential biophysical indicators for cultural services in urban areas by: 1) presenting the results of a review of cultural ES indicators and methods, 2) discussing ecological structures and patterns in urban areas which have been found to be particularly important for cultural ES, and 3) examining potential biophysical indicators for cultural ES against a set of evaluation criteria in three case study cities—Berlin, New York and Rotterdam. Evaluation of potential criteria is informed by expert consultation and a survey of data availability in each of the case study cities. The results of the paper provide insight into the applicability of biophysical indicators for assessing cultural ES in urban areas, including issues of indicator sensitivity and significant research gaps. The research is set within the context of the EU FP7-ERA-NET project URBES (Urban Biodiversity and Ecosystem Services, 2012-2014), which aims to fill scientific gaps on the relationship between biodiversity and ecosystem services for human well-being.

Adrienne Grêt-Regamey: “Defining interactive ecosystem services trade-offs for sustainable spatial planning in collaborative environments”

Given the pace, magnitude, and spatial reach of land use changes, regional and local implementable strategies to sustainably provide ecosystem services become increasingly important for supporting the growing human needs. Attempts to increase a single ecosystem service however often lead to reduction or losses of others. For making sound decisions about sustainable spatial development, knowledge and awareness of the interactions between ecosystem services are thus necessary. In this contribution, we show how interactive rulers embedded in 3D GIS-based collaborative environments can assist in making ecosystem services trade-offs explicit for sustainable spatial planning. The interactive rulers are slider bars that offer stakeholders the possibility to explore trade-offs in ecosystem services reflected in different landscape designs. The approach is illustrated in different

case studies in rural and urban environments. We show how such an approach can be used for defining transition pathways to reach sustainable development patterns in a participatory process. With this approach, the space for actions and behavioral alternatives become explicit - a crucial step for sustainable urban planning which calls for innovative strategies to adapt to these uncertain and rapid changes. We conclude about the effectiveness of the approach as a means of encouraging lay people and stakeholders to get involved efficiently in the development of land use patterns securing the long-term provision of needed services.

Katrien Van der Biest: “An integrated model to assess the effects of land use change on the delivery of multiple ecosystem services”

Application of the ecosystem services concept in decision making requires tools that allow rapid and transparent, yet complete and science-based assessment of ecosystem services. The complexity of ecosystems and the multidisciplinary nature of the ecosystem services approach however may impede the development of such models. A huge challenge exists in creating integrated models that take into account all of the biophysical and socio-economic knowledge we have about ecosystem services, and that remain transparent and manageable at the institutional level. Data paucity moreover can make application of such integrated models hard or impossible. The urgent demand for simple assessment tools for multiple services has stimulated the emergence of land use based proxy methods. Although these have been very powerful to create policy awareness on different levels, they are insufficient when it comes to land use and policy planning for ecosystem service delivery as they disregard the ecosystem's complexity. Discarding the complex ecological reality or scientific uncertainty poses serious risks for adverse effects of policies. The Ecosystem Service Bundle Index (EBI) is a prototype of a tool that allows to link land use planning with ecosystem service bundle optimization, capturing inherent ecological complexity and uncertainty associated with ecosystem services research in a complete and underpinned yet user-friendly way. The ecosystem service bundle index builds on a spatially explicit Bayesian network model that allows integration of biophysical and socio-economic processes as well as land use planning policies driving the delivery of bundles of ecosystem services. Particular emphasis is placed on the biophysical potential of an ecosystem to deliver services and the link with the actual land use.

Anna Radtke: “Comparing ecosystem service provision along a chronosequence of traditional coppice forests”

Coppice forests (German: Niederwälder) are a traditional forest type in Europe. Nowadays, only some remnants are left in Middle and Northern Europe. In Southern and Eastern Europe this type of forests is still widespread, but since last decades many coppices have been abandoned or converted into high forests in these regions as well. Against this background, it has been argued that coppice forest is of cultural importance and is beneficial for biodiversity. Therefore, we assessed the ecosystem services of traditional coppice forests to understand how coppice forest abandonment affects the ecosystem services provided. In our study, we quantified four relevant services along two chronosequences with coppice patches of different ages in South Tyrol, Southern Alps, North Italy. All indicators were quantitatively assessed within a PhD thesis (Table 1).

Now, the question remains (i) how the different indicators can be aggregated, (ii) how should be dealt with the trade-offs and (iii) if this ecosystem services approach can be integrated into practical forest planning. For the workshop, I could present two different methods from multi-criteria decision making (the outranking method called PROMETHEE, and the multi-objective optimization method goal programming) to illustrate how ecosystem services can be used for the standardized comparison of different land-use alternatives. I am particularly interested to discuss other options and the suitability of the ecosystem services concept for land management decisions.

Table 1. Changes in ecosystem service provision along a coppice chronosequence. “+” indicates positive performance; “-“ indicates negative performance.

	young stands 0 - 10 yrs	medium stands 11 - 30 yrs	old stands > 30 yrs	Indicator assessment method
plant diversity	+++	+	++	Vegetation samplings in the field
rockfall protection	+	++	+++	Calculated with a rockfall model
biomass production	++	+++	+	Calculated from equations
Invasive species	---	--	-	Systematic sampling of <i>Ailanthus altissima</i> and <i>Robinia pseudoacacia</i> regeneration
∑ synthesis	?	?	?	PROMETHEE / goal programming

Arantza Murillas-Maza: “The value of open ocean ecosystems: A case study for the Spanish Exclusive Economic Zone”

Valuing goods and services from open oceans provides arguments for the ocean’s protection and plays an increasingly important role in debates on the use and management of natural resources. This paper identifies and estimates the monetary value of some of the most important goods and services provided by open oceans. The list of goods and services considered includes food production, raw materials, water supply, CO₂ regulation, bioremediation of waste, biomass and biodiversity conservation. Therefore, not only values associated with productive uses are quantified but also values assigned to other biological ecosystem services. This paper constitutes a first attempt in the open ocean literature at evaluating services such as water supply, biomass and biodiversity conservation. To obtain their monetary value, different techniques, some not applied before in this area, have been used depending on the ecosystem service to be evaluated. As a general criterion we use the concept of net value added (revenues obtained from the services less incurred costs). Our methodology is illustrated by estimating the monetary values of goods and services provided by the open ocean ecosystem of Spain as defined by its Exclusive Economic Zone. The total economic value obtained measures the contribution of oceans to overall welfare and it may be an important instrument in managing open ocean ecosystems and developing environmental policies in the future.

Benjamin Kupilas, Armin W. Lorenz, Daniel Hering: “Does river restoration effect more than just hydromorphological improvement?”

Many European rivers have been heavily influenced by humans through pollution and regulation during the past centuries, affecting biodiversity, ecosystem functioning and resulting in the loss of goods and services they provide.

We introduce the project REFORM ("REstoring rivers FOR effective catchment Management"; <http://reformrivers.eu/>) focusing on approaches to investigate effects of river restoration on ecosystem services and functions applied in the project. REFORM is a four year, large scale integrated research project grouping the expertise of 25 research institutions and universities from 14 European countries. It addresses the challenges to achieve ecological objectives for rivers as required by the EU Water Framework Directive. Besides the presentation of general objectives in the field of ecosystem services and functions considered in the project, we focus on the concepts to analyze the following questions:

- Does hydromorphological restoration of rivers influence aquatic-terrestrial interactions (lateral aspect)?

- Does hydromorphological restoration improve the self-purification capacity of rivers (longitudinal aspect)?

The exchange of energy and nutrients between a river and its adjacent area is an important process in lotic ecosystems. We use stable isotope analysis ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) for different components of the food-web along rivers and their riparian zone to quantify the effect of river restoration on aquatic-terrestrial interaction. For our investigation we use examples of hydromorphologically restored sites across Europe in which either one large scale measure or smaller restoration measures have been implemented. These restored sites will be compared to “control sites” that are located upstream and are still degraded.

A rivers ability to degrade organic matter is an important process regulating the provision of “clean” water. To analyze the effect of hydromorphological restoration on the self-purification capacity of streams, we compare metabolism and sediment respiration of restored and degraded sites of the mid-sized mountain river Ruhr (Germany).

Sven Lautenbach **“Comparing indicator maps of pollination service”**

Pollination is one of showcases of ecosystem service research. A significant amount of economic important crops depends worldwide on pollination services provided by domestic and wild pollinators. Different approaches exist to describe and to map the service. This might lead to different recommendations for the protection of this ecosystem service. The presentation explores this by comparing indicator maps for pollination services at large scales. At the global scale, patterns of a monetary valuation of pollination benefits are compared against the contribution of pollination dependent crops towards the provisioning of essential nutrient components. Calculations were performed based on FAO data and a global yield data set on a raster of 10 sqkm cellsize. For the EU these maps are further compared against a map of estimated pollination provided by wild bees. Hotspots of agreement and disagreement are identified for all indicator map combinations. Based on that, the robustness of recommendations can be tested.

Ying Hou, Shudong Zhou, Benjamin Burkhard and Felix Müller **“Application of the DPSIR model to analyze socio-economic drivers of biodiversity, ecosystem services and human well-being in human-environmental systems”**

The research focuses on ecosystem services include connections with biodiversity and human well-being and the socio-economic drivers of their changes. Despite existing investigations, exact impacts

from human systems on the dynamics of biodiversity, ecosystem services and human well-being are usually still uncertain because of the insufficiency of quantitative analyses of the interrelationships between these changes and the social-economic drivers. Our research aims at discerning the socio-economic drivers of biodiversity, ecosystem services and human well-being in human-environment systems and demonstrating their impact.

In our work we propose a DPSIR framework coupling ecological integrity, ecosystem services as well as human well-being and suggest the DPSIR indicators for the case study area Jiangsu, China. Based on available statistical data, we revealed the factors significantly impacting biodiversity, ecosystem services and human well-being in the research area through principal component analysis and correlation analysis, which took the 13 prefecture-level cities of Jiangsu as samples. The results show that urbanization, industrialization and economic development are the predominant positive drivers of regional biodiversity, agricultural production and tourism services as well as rural residents' living standards at the prefecture-level city scale. Additionally, the knowledge, technology and finance inputs for agriculture also have generally positive impact on these aspects. Concerning regional carbon storage, non-cropland vegetation cover obviously plays a significantly positive role. Contrarily, the expanding of farming land and the increase of agricultural economy are two important negative driving forces of biodiversity, ecosystem capacity for agricultural production, regional tourism income and the well-being of the rural populations. Our study provides a promising approach based on the DPSIR model to quantitatively capture the socio-economic drivers of biodiversity, ecosystem services and human well-being for human-environment systems at the regional scale.

Chunping Mei: "Using INVEST Model mapping and valuing ecosystem services in Poyang Lake, China"

There are several methods for mapping and assigning value to ecosystem services, each with its own advantages and limitations. The Natural Capital Project has developed a new tool designed to facilitate integrated decision-making, bringing together credible, useful models based on ecological production functions and economic valuation methods. The intention is to incorporate biophysical and economic information about ecosystem services into conversion and natural resource decisions at an appropriate scale. The tool is called InVEST, for integrated Valuation of Ecosystem Services and Tradeoffs.

Poyang Lake is located in the north of Jiangxi Province to the south of the Yangtze River, is regarded as the largest freshwater lake in China, covering an area of 2,933 square kilometers. The lake depends on surface runoffs and rainfalls for water supply. Rivers flowing into the lake include the Ganjiang River, Fuhe River, Xinjiang River, Raohe River, Xiushui River, etc. As a famous scenic area,

the Poyang Lake has numerous sights, and it is also a migratory bird's conservation area with a reputation of Kingdom of Rare Birds.

The general idea for this paper, is to use the Invest model to lookup the status and tables of benefits per unit area of this habitat type, and thereby quantify overall natural capital of this area. And the results can be used to adjust the benefits and make into local water management policy.

Benjamin Burkhard, Anja Müller, Vera Tekken, Volker Grescho, Joachim Spangenberg, Christoph Görg, Monina Escalada, Kong Luen Heong, Dao Thanh Truong, Felix Müller and Josef Settele: "Ecosystem service indication and mapping in south-east Asian rice landscapes"

For the analysis of the human-environmental interactions within irrigated rice cropping systems in south-east Asian landscapes, ecosystem functions (ESF) and the services (ESS) they generate are quantified, indicated and presented in spatially explicit maps. The focus of the LEGATO project (www.legato-project.net) is on varying local as well as regional land use intensities and biodiversity, and the potential impacts of future climate, land use and demographic change. The participating European and Asian teams have defined the specific ESS in the respective social and ecological context they are working in based on results from stakeholder interviews and focus group discussions. Nutrient cycling has been selected as one focal ESF as well as biodiversity. Biocontrol and pollination have been chosen from the group of regulating ESS, from provisioning ESS crop (i.e. rice) production was selected and cultural identity, landscape aesthetics and knowledge systems represent the cultural ESS. Moreover, different aspects of human well-being such as income generation will be assessed.

The LEGATO study design, including seven intensive test areas of 15x15 km² in Vietnam and in the Philippines, has been set up in order to be representative for different rice cultivation strategies with varying production intensities and under different socio-ecological conditions. Non-monetary and monetary as well as spatially explicit ESS evaluation methods are applied in the test areas. The results will reveal service providing units (SPU) for the ESS mentioned above, including quantitative ESS supply assessments based on comprehensive field measurements, interviews and modeling results. Based on the Driver-Pressure-State-Impact-Response (DPSIR) model, the project consortium will be able to identify socio-ecological drivers of prevailing land use dynamics, the state of ESF, and resulting impacts on the supply of ESS. In the end, LEGATO will provide recommendations for sustainable land management based on ecological engineering principles under consideration of the multiple future risks.

Mark Frenzel et al.: **“Spatio-temporal assessments of ecosystem functions and services across different LTER Europe sites”**

The focus of this approach facilitated by the Life+ project EnvEurope (Environmental quality and pressures assessment across Europe: the LTER network as an integrated and shared system for ecosystem monitoring) is to link ecosystem services (ESS) to CORINE land cover (CLC) categories. This is based on a concept for land-cover based assessments of ESS (Burkhard et al, 2009) which we applied to about 10 LTER sites in different European countries. We use remote sensing data (in this case CLC) of the available CLC years (1990, 2000, and 2006), mapped these to the selected LTER sites and assigned ESS ranking maps to CLC. While this part of the approach can be applied using available data only, the decisive part is when local knowledge comes in: the ground validation is done by local LTER site managers who are in charge of adjusting CLC and the related ESS data for their sites. The idea is to make this a test case for the application of a cross-domain indicator for ESS trends over time and provide tools (maps) which allow an easy interpretation of the reasons and the quality of changes in ESS.

Poster session

May 7, 2013 4-5 pm

Christian Schneider: **“The limits of economic valuation of nature - A review”**

Many contributions to the ecosystem services discourse refer to ethical questions of the commodification of nature as well as to the risks and limits of economic valuation (e.g. Haines-Young et al. 2012, Potschin & Haines-Young 2011, Dempsey & Robertson 2011, Spangenberg & Settele 2010, McCauley 2006). Yet, relatively little effort was spent to adjust ES-approaches following these critical comments. Currently the main political and scientific focus lies on the development of monetary estimates.

But the ES-discourse is far from being homogeneous, and critical perspectives are essential to develop concepts of how to value and protect the biosphere in a holistic manner. Some scholars are anticipating criticism by using ES as a heuristically useful metaphor than as a standard commodity. Others focus on non-monetary measures.

Potschin & Haines-Young (2011) call on natural scientists to get involved in these topics to define and discuss “key research challenges in the biophysical arena”.

Following this call, the poster presents a review of critical comments on the ES-approach from various backgrounds. Methodological, social and political perspectives will be considered. The goal is to make critical perspectives accessible and to link it with conceptual discussions on ES at the workshop.

Gerald Busch: "Short rotation coppice on agricultural land. Synergies and trade-offs between ecosystem functions and economic return in the bio-energy region "Göttinger Land"

Within the BEST project („Bioenergieregionen stärken“ – www.best-forschung.de) both, economic and ecological options of SRC on arable land are investigated for the bio-energy region “Göttinger Land”. A spatial decision support system (sDSS) is being developed that allows for a comparison of annual cropping systems with SRC considering both, ecosystem functions and its associated ecosystem services as well as economic return. Underlying ecological indicators were evaluated by using a fuzzy-rule-set framework. Actor-oriented workshops built an important basis for implementing the landscape assessment framework. Further, regional planning goals as well as climate protection plans were integrated in the sDSS. The tool allows for a multi-criteria evaluation of distinct landscape patterns resulting from SRC implantation due to various stakeholder perspectives. The poster presentation shows first results of this visualization and evaluation process.

Uta Schirpke: "Effective management of Natura 2000 sites based on the concept of ecosystem services"

An effective management of Natura 2000 sites is essential to preserve biodiversity. The flow of benefits from the Natura 2000 network is of great importance to human well-being, especially regarding carbon sequestration, water provision and purification, natural hazards prevention, as well as tourism and recreation. However, conservation activities implicate direct and indirect costs for administration and conservation measures, and, in many cases, management plans cannot be realized due to scarce financial resources. To establish effective management procedures, the project ‘Making good Natura’ aims at developing and implementing innovative approaches based on the concept of ecosystems services. In a first step, ecosystem services, provided by different Natura 2000 sites in Italy, are quantified on a landscape scale. As the conservation of Natura 2000 sites depends also on land-use dynamics outside the protected area, buffer zones are used to analyze the interactions with the surrounding territory. After identifying the beneficiaries and the demand of ecosystem services, spatial flows of ecosystem services are defined and the economic value is estimated. Furthermore, innovative financing models (e.g., payments for ecosystem services,

permits, taxes, etc.) for funding the implementation of Natura 2000 management plans and conservation measures are created and applied to different study sites. Finally, instruments for better governance in conservation management and for the socio-economic development of local communities are developed.

Jan Thiele: “Do positive effects of green infrastructure on biodiversity translate into enhanced ecosystem services?”

Intensively-used agricultural landscapes have faced a strong decrease in biodiversity over the last decades which likely deteriorates ecosystem services, such as biological control of pests, pollination of crops etc. Semi-natural edges between fields, and along roads and rivers (green infrastructure) may mitigate long-term biodiversity loss and, thus, sustain ecosystem services. We hypothesize that the connectivity of green infrastructure in agricultural landscapes is positively correlated with biodiversity, which in turn is correlated with ecosystem services.

In a recently started project, we study the diversity of carabids, spiders and vascular plants in the Westphalian Basin, at local and landscape scales. Eight study areas of 1 km² were investigated in 2012. Based on mappings of aerial images in GIS, we compiled a random sampled of 100 plots, stratified by type of green infrastructure (ditches, field margins and hedges). For field inventories of local-scale biodiversity, carabids and spiders were collected using Barber pitfall traps (four traps per plot). Vascular plant species were sampled on elongated plots of 25 m² using the method of Braun-Blanquet. Additionally, lists of vascular plants (species pools) were compiled for each study area through field walks along all edges and through all semi-natural landscape elements.

Field data are currently being processed. Results will be presented at the workshop in May. In a next step, we will assess natural biological pest control on arable fields at increasing distances from the sampling plots in green infrastructure elements in order to test, if there is a positive effect of biodiversity on ecosystem services.

Susanne Frank and Christine Fürst: “Integrated ecosystem services assessment with a special focus on forest services”

In the research project RegioPower, lignocellulosic biomass is addressed in different dimensions: (i) supply, demand, transport, and market opportunities; (ii) the landscapes’ potential to provide it; (iii) the various management strategies under changing environmental conditions with regard to different ecosystem services. Six project partners are dealing with these issues in different work packages. We focus on the up-scaling of land management practices in forestry and agriculture using

the planning support tool GISCAM. On the basis of market analyses and yield modelling, which are carried out by our project partners, we adapt GISCAM for the simulation of land management scenarios. We aim at supporting dialog and discussion between regional planners, land use managers, and stakeholders in order to figure out best development options for our model region.

The application of GISCAM facilitates accounting for the provision of different ecosystem services spatially explicitly at the landscape level. It allows estimating consequences of land use/management change. Referring to the Millennium Ecosystem Assessment (2005), we have a special focus on forest related ecosystem services, such as wood production, food and fodder, hunting and game production, biodiversity protection, climate regulation, water provision, and recreation. Literature reviews, questionnaires, and stakeholder interviews will deliver the basis for an actor-driven scenario development of regional change scenarios.

The main challenge is to translate the demand of certain assortments, which will be derived from questionnaires and workshops, into a spatial demand, which can be visualized in GISCAM. Starting with the information on the demand of product groups, we can derive the amount of demanded wood in cubic meters. This amount of lignocellulosic biomass can be assigned to tree species, time slots, and harvesting regimes. Using a complementary approach, the existing stands, which were identified in the land use map, will be used to derive the amount of currently available lignocellulosic biomass and hence the expected assortments.

Liwei Ma **“Carbon capture and storage analysis as regional functions of ecosystem services based on land use / land cover - A case study in Germany”**

Land cover dramatically impacts supplies of ecosystem to human well-being. As one of these services, carbon sequestration, carbon capture and storage (CCS) plays an important role in reducing atmospheric greenhouse gases. Detailed site studies on carbon sequestration, carbon capture and storage have been done to quantify the exact amount of ecosystem services. However, monitoring in multi-land use area is a very difficult test. Therefore, proxy based indicators can be very helpful.

Our study aims at showing land covers' influences on carbon sequestration, carbon capture and storage in the Bornhöved Lake area, Germany. The land covers in this area include discontinuous urban fabric, industry and commerce, open-cast mining, meadows and pasture, grassland, cereals maize, rapeseed, broad leafed forest, coniferous forest, mixed forest, grove, swamp and peat bog as well as water bodies. We indicate carbon sequestration, carbon capture and storage related to aboveground biomass, belowground biomass, dead wood and soil carbon. Carbon sequestration in the urban, industry or mining areas is based on published values from regions with similar land

covers, climate conditions and urbanization levels. Aboveground biomass and belowground biomass build on the analysis of integrated inventory plot data and regression modeling; dead wood and soil carbon are tested by integrated investigation and published values. Our study suggests three hypotheses: (1) carbon capture and storage are different among different land covers; (2) the ratio of aboveground biomass, belowground biomass, dead wood and soil carbon varies among land covers and (3) interactions of aboveground biomass, belowground biomass, dead wood and soil carbon differ from one land cover to another.

Simone Beichler **“Exploring the use of participatory mapping in indicator development – The case of cultural ecosystem services in an urban region”**

There is little literature on the link between ecosystem services and the wellbeing of different groups in the population. However, taking urban regions under climate change as an example this information could be a crucial prerequisite to adaptation measures, asking the question what happens to whom if a service disappears? In the case study of the urban region of Rostock (Germany) six different cultural ecosystem services were mapped in a group exercise and all individuals allocated values on a qualitative scale. An extensive survey captured personal data like age, education and length of residence. In addition more complex data was enquired like the attributes influencing quality ranks, ranks according to importance of a service for personal wellbeing and ranks according to satisfaction with service provision in the urban region. The poster shows first results of a methodological examination of this participatory mapping approach. Hereby, we explore spatial and statistical methods to capture the importance of the distance to home, the relation to specific land use types and the coexistence of different services. What role do group preferences, distance and spatial overlay play when constructing ecosystem service indicators for urban regions?

Annelies Boerema: **“Temporal evolution of ecosystem services in a project area in an estuary”**

Estuaries are under high anthropogenic stress causing conditions that are not always in line with the objectives of the different stakeholders of the estuary, such as port development which depends for instance on sediment conditions in the fairway, or habitat conservation which depends on biophysical quality conditions, etc. Many projects and management measures are developed in the estuary to improve all types of conditions to create benefits for stakeholders. For the evaluation of projects, it is recommended to value the impact on ecosystem services (biophysically or monetary). The outcome of ecosystem services analysis methods, such as cost-benefit analysis, is however still

discussed because of the many uncertainties that are still involved e.g. about the accuracy of the calculations.

One important aspect is the temporal development of the project site. An intervention in a dynamic ecosystem such as an estuary will force the ecosystem to evolve to a new dynamic equilibrium situation, but this will take some time. Hence, the impact of the project on the delivery of ecosystem services will also evolve over time. This means that the benefits of the project will not be constant over time. It is important to incorporate this in the evaluation to improve the accuracy of the qualitative impact calculation, which forms a crucial basis for the economic valuation afterwards.

The temporal variation in the delivery of ecosystem services in the project area will be analysed for a case study. By investigating the temporal evolution of the benefits of an estuarine project, it is for instance possible to compare this with the annual maintenance costs to analyse the duration for which it is beneficial to maintain the project.

Anne Böhnke-Henrichs: “Ecosystem service assessments for implementing the Marine Strategy Framework Directive: approaches, obstacles and way forward”

Human well-being highly relies on healthy (marine) ecosystems and their capacity to provide ecosystem services (e.g. fish and other sea food, climate regulation, moderation of storm floods or tsunamis, habitat for (commercially used) species and opportunities for recreation). However, the world’s oceans and coastal ecosystems are currently severely threatened and continue degrading facing impacts by multiple marine sectors as fisheries, aquaculture, shipping, energy (oil, gas and renewable) and tourism. Global marine policies are adopting the ecosystem approach in order to achieve the improvement, restoration, or protection of coastal and marine ecosystems and their resources.

An example of this type of legislation is the European Union’s (EU) Marine Strategy Framework Directive (MSFD), developed as the ecological arm of the EU Maritime Policy. The MSFD asks to achieve a good environmental status in European regional seas by 2020. For doing so, the directive requires the application of the ecosystem approach to manage human activities in order to mitigate not only single-sector but also collective pressures and ensure sustainable use levels. One central aspect of the ecosystem approach is to take into consideration the value of the whole bundle of ecosystem services (ESs) and the trade-offs which may occur when implementing different management options for decision making.

The on-going FP7 project ODEMM (Options for Delivering Ecosystem-based Marine Management, <http://www.liv.ac.uk/odemmm/>) is aiming to provide scientific background for implementing the MSFD: different sustainable management options are developed and are compared, based among

others, on the costs and benefits related to the change of ES provision under the different management options.

This poster will present the approach ODEMM has taken to assess ESs in the context of MSFD implementation. It will also focus on obstacles ODEMM experienced regarding marine ES assessments and ecosystem-based marine management and will explore possible solutions to deal with those obstacles.

Lars Koschke et al.: **“Do you have a spare 5 minutes? - Stakeholder participation as a challenge in ecosystem services studies”**

The concept of ecosystem services has great potential to focus the attention of public and decision makers on the importance of natural systems for human well-being. It is therefore increasingly utilised in application-oriented conservation research. Yet, the operationalisation of the concept for the preparation of plans and recommendations and decision support for land managers may not be rated as satisfactory. In addition to the development of methods for the quantification and valuation of ecosystem services, the effective and appropriate participation of stakeholders may be another major methodical and conceptual challenge for a successful implementation of ecosystem services. In ecosystem services studies the approaches to stakeholder engagement are very diverse as a result of varying objectives and levels of analysis. Based on an online survey on “Stakeholder participation in ecosystem services studies” (https://www.soscisurvey.de/ESandSH_survey/) which is currently carried out, we want to identify realised benefits, drawbacks, and challenges related to the application of the concept in stakeholder processes. This will be supported by a literature review. This contribution is an attempt to identify causes for less successful participation processes and pivotal aspects that should be accounted for in the design of studies to improve the involvement of stakeholders.

Initial results support the view that there are particular requirements for a proper communication of the concept (terminology, definitions) and the motivation of the stakeholders (relevance of the information provided). Together with efforts to develop standardised methods for quantification, the focus on stakeholder processes as a key element of the ecosystem services concept may represent a means to increase the relevance and reliability of study results.

Marion Kandziora, Katja Dörnhöfer, Natascha Oppelt, Felix Müller: “The influence of land use changes on ecosystem services supply in Northern Germany”

Satellite image classification is an important tool to investigate land use / land cover (LULC) changes globally for different time steps. LULC changes influence all ecosystem services in different intensities, as specific LULC supplies different ecosystem services in varying amounts.

LULC changes for 10 LULC classes (sealed areas, water bodies, broad-leaved forest, coniferous forest, bogs, mineral extraction sites, cereals, maize, rapeseed and grasslands) were investigated by applying a supervised maximum-likelihood classification with Envi 4.2 for several Landsat TM images in two agriculturally dominated case study areas in Northern Germany (the 50 km² Kielstau basin and the 60 km² Bornhöved Lakes District in Schleswig-Holstein) for the years 1987, 1989, 2007, 2009, 2010 and 2011. Changes in forest areas are minimal. The loss in grassland areas from the 1980s to 2007 is the most obvious change. Grassland areas were converted to arable land and the share of maize, rapeseed and cereals vary significantly for the individual years. In recent years the share of maize, especially for renewable energy generation, has increased in most areas in Northern Germany, which triggers the recent trade-off discussion regarding renewable energies. The influence of crop rotation and intensification of arable land in these two case study areas was analysed in regards to the supply of ecosystem services. Individual crops are prone to different intensities of soil erosion, pesticide use and carbon sequestration. The focus lies in the loss of grassland areas when analysing e.g. regulating ecosystem services like nutrient regulation, water purification, carbon sequestration and provisioning services like fodder, biomass for energy, and crops for human nutrition. The holistic analysis of all ecosystem services for several years is emphasized.

Ariane Walz: “The role of social valuation in ecosystem service assessment on the urban-rural fringe”

Social valuation is believed to capture values additional to economic and bio-physical measures in ecosystem service assessment. With this contribution, we aim for a better understanding in what ways and with what effects social valuation can be included in ecosystem service assessment. In the emerging study, we will be investigating the role of social valuation in assessing ecosystem service provision, utilisation and fluxes along an exemplary urban-rural gradient. Using both qualitative and quantitative methods to assess social valuation, social preferences and actual use of ecosystem services from stakeholders and the public will be examined and fluxes of ecosystem services be mapped out. Furthermore, we will compare results from social valuation with economically

quantified ecosystem services to give an indication about differences, similarities, advantages and risks between the approaches.

Roy Remme **“Spatial modelling of ecosystem services in support of biophysical ecosystem accounting for Limburg province, the Netherlands”**

An application of ecosystem services which is receiving increasing interest is ecosystem accounting. Ecosystem accounting is designed to monitor changes of the condition, extent, and properties of ecosystems to deliver ecosystem services over time, using both biophysical quantities and monetary values. Ecosystem accounting is a policy instrument which draws interest at larger administrative scales (e.g. provincial or national). To quantify the changes in ecosystem service flow, spatial analysis is a key tool. The main objective of this study is to assess how multiple ecosystem services can be biophysically mapped and analysed in a way which is consistent with ecosystem accounting, as defined by the United Nations’ System of Environmental Economic Accounting – Experimental Ecosystem Accounting. Limburg province in the Netherlands is used as a case study. Spatial models have been developed for seven ecosystem services: fodder production, crop production, drinking water extraction, hunting, air quality regulation, carbon sequestration and recreational cycling. The annual flows have been analysed for a base year (2010). Total flows for the whole province and mean flows per hectare have been recorded and assessed for eight land cover classes. Results show that the extent of land cover classes is highly determining the quantities of delivered ecosystem services. Uncertainties in underlying data, such as high spatial aggregation or the necessity to combine multiple data types, caused large uncertainty in the spatial outputs of the models. For an ecosystem accounting scheme with a spatial component to be successful, systematic spatial data collection needs to be improved for multiple ecosystem services. Additionally, there is a need to more closely assess which effects spatial uncertainties have on the accounting of total annual ecosystem service flows.

PLENARY II

National ecosystem service assessments

May 8, 2013 1-3 pm

David Vačkář: “Ecosystem services assessments in the Czech Republic: integration, frameworks and applications”

Recently, ecosystem services assessments have been promoted in the Czech Republic in several projects. We offer to present our experiences and share approaches, findings and applications developed so far. We would present frameworks used in integrated assessments of ecosystem services from the perspective of global change, environmental security, sustainability analysis of social-ecological systems and national-wide assessment.

The integrated assessment of ecosystem services in the Czech Republic is the “umbrella” exercise. The goal of this assessment is to map ecosystem service values in the Czech Republic. To achieve this task, we are preparing a consolidated layer of ecosystems and a database of ecosystem service values. The methodology developed within the project should support national assessment and strategic planning.

Another illustrative example is focusing on the assessment of ecosystem services trade-offs, using InVEST modelling tool in a pilot assessment in Třeboňsko wetlands biosphere reserve. Ecosystem services concept here should contribute to the development of long-term social-ecological research platform.

Integrated assessment of global change impacts on ecosystem services in the Czech Republic utilizes a multi-scale approach, global-to-local. The aim of the project is to develop integrated approaches to the assessment of global changes on environmental security of the Czech Republic and evaluation of global security risks. The project is developing methodological and information tools which will provide service to the monitoring and evaluation of environmental security. Integrated assessment and scenarios will contribute to increasing security of citizens and mitigation of risks resulting from environmental changes.

Keren Klass: “Planning Israel's National Ecosystem Assessment: open questions and dilemmas”

At the end of 2012, Hamaarag began the process of formulating a plan for a national-scale ecosystem assessment. During the initial planning phase (Dec. 2012-May 2013), work was invested primarily in three areas: (i) formulation of the conceptual framework; (ii) a multidisciplinary team of experts to coordinate the writing of the various assessment chapters, as well as aid in determining the scope and methods of the assessment; and (iii) formation of a diverse Assessment Council, composed of a variety of stakeholders and clients including representatives from national government agencies, NGOs, the private sector, and regional governments.

Throughout this phase, numerous issues and questions arose and demanded discussion, consultation, and consideration of at times opposing purposes and limitations. For example, the process of recruiting stakeholders presented the core assessment team, largely composed of academics, with novel challenges, including determining whether the assessment could contribute to the needs of a very wide range of stakeholders who affect or depend on the provision of different ecosystem services. Formulation of the conceptual framework and the process of recruiting lead authors for the various assessment chapters gave rise to a number of additional dilemmas on both the scientific and logistical levels.

Practical information on the development of national or regional-level ecosystem assessments can potentially be very useful for new projects; however, few detailed descriptions of this process and lessons learned are available online or in the literature. In this presentation I will describe the planning phase of Israel's National Ecosystem Assessment, focusing on issues and dilemmas arising from the formulation of the conceptual framework, the process of stakeholder recruitment, and locating coordinating lead authors. By highlighting the difficulties and the solutions reached during this phase of the Israeli assessment, I will address important general issues that could potentially arise in most national-scale ecosystem assessments.

Stefan Marzelli, Adrienne Grêt-Regamey, Thomas Köllner, Christoph Moning, Sven-Erik Rabe & Sabrina Daube: “Concept and challenges of ecosystem services at national level”

On behalf of the German Federal Agency for Nature Conservation (BfN) as a contribution to the German national TEEB-process a catalogue of national ecosystem services and according indicators shall be developed.

The ongoing work comprises the selection and rationale of appropriate ecosystem services and the selection of indicators at the national level. The indicators are selected by a twofold approach. On the one hand they are elaborated from an expert's point of view taking into account what the best

way is to describe the service itself in terms of potential, stock and demand. On the other hand they are selected looking at available data sources at a federal level in order to make such a system of ecosystem services easy to start with.

Of course quite some bottlenecks, challenges and limitations are faced with such an approach. They start with a clear, common understanding of ecosystem services, the distinction of intermediate and final ecosystem services, the discussion what is indicating potential, stock and demand of services and finally how to deal with data sources. We will present the concept and its challenges also indicating where further developments could take place.

Laura Mononen & Petteri Vihervaara: “Ecosystem service indicators of Finland”

Finnish Environment Institute has an ongoing Ecosystem Service Indicator project (2012-2014) that is funded by the Ministry of the Environment. Project aims to develop a collection of ecosystem service indicators to assess the state and development of ecosystems' ability to provide services in national scale. Research is aimed to support the targets of Aichi and CBD.

Indicators must answer specific questions concerning on ecosystem services and assess the realization of chosen political actions. Sustainability and the meaning for biodiversity should be kept in mind. Therefore ecosystem indicators that are relevant for biodiversity are emphasized.

After data needs are identified, suitable datasets that enable reliable assessment of ecosystem services both temporally and spatially will be looked for. Results will be reported in www.biodiversity.fi.

By the end of the year 2013 the goal is to complete a preliminary list of indicators for main habitat types (forests, mires, Baltic Sea, inland waters, farmlands, Alpine habitats, urban areas, shores, rocky and esker habitats). More thorough pilot work will concentrate on mires and farmlands. List will be used in the 5th CBD national report.

Research is done in cooperation with many research organizations, authorities and non-governmental actors. New knowledge will be utilized by many actors and therefore it is necessary to involve experts to develop indicators for measuring ecosystem services and thereby monitor environment's state.

Christian Albert, Jennifer Hauck, Christoph Görg: “Options for a National Ecosystem Assessment in Germany: Preliminary Results of a Scoping Study and Issues for Discussion”

The European Union in its Biodiversity Strategy puts forward a bold vision – namely to halt the loss of biodiversity and the degradation of ecosystem services by 2020, and to protect, value and appropriately restore biodiversity and the ecosystem services it provides by 2050.

In Target 2, Action 5, the Strategy states that member states ... will map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020. Only few member states such as Great Britain have already conducted national assessments; in many member states, preparation and implementation processes are currently underway.

This contribution reports on a recently initiated scoping study for a National Ecosystem Assessment in Germany. The scoping study shall help designing a potential future assessment in a way that is as effective as possible and explicitly addresses the interest of its potential users in politics, administration, economy and society. Its key objectives are: (i) to identify in how far such an assessment is desired and doable, (ii) to identify potential clients and users, as well as their interests and expectations in, and requirements of such an assessment, (iii) to contact the scientific community and to explore their interests and motivations to co-develop an assessment (e.g. as lead or contributing authors), and (iv) to develop, publish and disseminate a methodological framework for preparing and conceptualizing ecosystem assessments at the interface between politics, science, and society.

The presentation will describe the process of the scoping study, as well as some preliminary results. However, the scoping study is research in progress. We would like to take this opportunity to involve the scientific community in this early stage and highly welcome any comments and suggestions for the further development.

FUTURE CONCEPTS

Bettina Matzdorf: “Foundation of a national branch of the ESP”

The international ESP is well established. The bottom up approach with regard to structure and main focuses works well and brought up the thematic working groups and biome expert groups. At the national and international level the exchange and collaboration of researchers work quite well under

this kind of ESP structures. However, a core idea of the ESP was and still is to promote the collaboration between researchers and the practitioners. We still see in this area a need for further efforts. Based on our broad experiences with transdisciplinary research we think for the specific challenges a national ESP network could be very helpful.

ZALF (lead Bettina Matzdorf) want to start the process of founding a national ESP network. We still discussed the idea of this German ESP network with some key player of the ESP. We want to use the workshop to present and discuss first ideas.

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