BOOK OF ABSTRACTS

1. SESSION DESCRIPTION

ID: T14

Title of session:

Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning.

Hosts:

	Title	Name	Organisation	E-mail
Host:	Prof. Dr.	Harald Zepp	Department of Geography, Ruhr-University Bochum	harald.zepp@rub.de
Host:	Dr.	Luis Inostroza	Department of Geography, Ruhr-University Bochum	Luis.inostroza@rub.de
Host:	Prof.	Stefano Salata	Department of Architecture and Urban Studies – Politecnico di Milano	stefano.salata@polimi.it
Co-Host:	Dr.	Silvia Ronchi	Department of Architecture and Urban Studies – Politecnico di Milano	silvia.ronchi@polimi.it

Co-Host:	Prof.	Andrea Arcidiacono	Department of Architecture and Urban Studies - Politecnico di Milano	andrea.arcidiacono@polimi.it

Session description:

The growing scientific knowledge generated around the Ecosystem Services (ES) concept is increasingly appreciated for enhancing policy making, land use planning and management (Koenig et al 2013; Fuerst et. al 2014; Hansen et al., 2015), and impact assessment (Geneletti & Zardo 2016). Indeed, once grounded into practice, the ES framework can be of great help for understanding the impacts of human activities on well-being, and the distribution of benefits flowing to society from the use of ecosystems in a sustainable manner. The interlink between the specific supply of ES and its spatial configuration has been largely explored in terms of mapping (Burkhard 2013; Zepp et. al 2016) and land cover changes (Mukul et. al. 2017). Mapping of ES allows for a direct integration into spatial planning (Maes et al., 2012), supporting the decision-making process to better analyze and evaluate the interaction between different ecosystems and their respective human pressures. Moreover, the integration of ES into spatial planning can foster multifunctional land use management approaches by addressing the trade-offs between different land-use options in terms of the flow of ES towards society. The use of the ES in spatial planning as a tool for enhancing multifunctionality and assessing trade-offs looking towards compensating and enhancing environmental deficits is promising but still in its infancy. Spatial distribution of environmental amenities and ES can have a positive or negative role and thus affecting urban resilience. At the same time the ES concept offers a powerful platform for participatory land planning (Fuerst

et. al. 2014). In this session, we aim at discussing the use of the ES concept and framework in spatial planning. Particularly, the session will explore and discuss different methods and indicators to transfer ES assessment to spatial planning. We welcome theoretical approaches as well as case studies, specifically looking at i) Urban Green Infrastructure at different scales (Hansen et al., 2016) and; ii) urban development and nature based solutions.

Goals and objectives of the session:

The goal of the session is to open the debate around different methodological approaches focusing on multiple ES assessment to estimate the current and expected trends in ES supply to support spatial planning. We will focus around 3 main concepts and their specific interlinks: 1) mapping Ecosystem Services, 2) their use as spatial planning tools and 3) how to address nature based solutions. To work out the goals of the session, we will use the set of following questions:

- How can the ES framework be methodologically and operationally incorporated into spatial planning?
- How can the results of scientifically sound assessment of ES be translated into urban design tools for the public, decision-makers and into land use regulation (e.g. Urban Green Infrastructures)?
- How can the ES concept help integrating stakeholders' information and participation into crucial definitions of context related ES that should be relevant in the spatial planning?
- How can political decisions underlying spatial planning processes be better informed using the ES trade-offs scheme?

Two issues are mainly focused on how to fill the gap that separates analysis and spatial tools (issues 1 and 2); while issues 2 and 3 are focused on how the application of ES helps in the decision-making processes (e.g. stakeholders participation and information and their effects on political

decisions).

Planned output / Deliverables:

The session will offer the possibility to publish in a special issue in a journal to be determined.

Related to ESP Working Group or National Network:

TWG 14 – Application of ES in Planning & Management

2. SESSION PROGRAM

Date of session: 14 December 2017
Time of session: 14:00 – 17:30

Timetable speakers

Time	First name	Name	Organization	Title of presentation
14:00	Session hosts		Introduction	
14:04	Harald	Zepp	Ruhr University Bochum, Germany	Ecosystem services framework as a tool to assess environmental trade-offs and synergies

Time	First name	Name	Organization	Title of presentation
14:18	Dandan	Yu	Nanjing Institute of Environmental Sciences (NIES), China	Establishment of a comprehensive indicator system for the assessment of biodiversity and ecosystem services
14:32	Hai	Liu	Hubei university, China	Study on Spatial – Temporal Dynamic Change of Trade – offs and synergistic Relationship between Ecosystem Services in Poyang Lake Basin
14:46	Caiyun	Qian	Lanzhou University, China	The change and tradeoffs-synergies analysis of ecosystem services: a case study of Bailongjiang Watershed, Gansu
15:00	Deyong	Yu	Beijing Normal University, China	Constraint relationships and drivers of ecosystem services: A case study in the agro-pastoral transitional zone of China

Time	First name	Name	Organization	Title of presentation
15:14	Alicia	Taylor	Victoria University of Wellington; New Zealand	Evaluating the uncertainties in New Zealand's GIS datasets; understanding where and when frameworks such as LUCI can enable robust decisions surrounding farm management practices
15:28	Bernard	Cosby	Centre for Ecology and Hydrology, United Kingdom	Comparing strengths and weaknesses of three ecosystem services models in a diverse river catchment in Wales, UK.
15:42	Break/Pause			
16:00	Blal Adem	Esmail	University of Trento, Italy	Assessing ecosystem services tradeoffs across agricultural landscapes in a mountain region

Time	First name	Name	Organization	Title of presentation
16:14	Shankar	Adhikari	Dep. of Forests, Ministry of Forests and Soil Conservation, Nepal	Identification, Prioritisation and Mapping of Ecosystem Services in Panchase Mountain Ecological Regions, Nepal
16:28	Luis	Inostroza	Ruhr University Bochum, Germany	Integrating ecosystem services supply potential from future land-use scenarios in protected area management: insights from Bangladesh
16:42	Peter	Mederly	Constantine the Philosopher University in Nitra, Slovakia	Ecosystem services assessment methods as an input for spatial planning and decision-making (Trnava, Slovakia)
16:56	Ralf-Uwe	Syrbe	Leibniz Institute of Ecological Urban and Regional Development, Germany	Options and challenges for implementing green spaces in urban development

3. ABSTRACTS

Type of submission: *Abstract*

T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Constraint relationships and drivers of ecosystem services: a case study in the agro-pastoral transitional zone of China

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The restoration of degraded vegetation can effectively improve ecosystem services, increase human well-being, and promote regional sustainable development.

Understanding the changing trends in ecosystem services and their drivers is an important step in informing decision makers for the development of reasonable landscape management measures. Understanding the linkage between ecosystem services is important for promoting ecosystem service management and sustainable development.

The relationships of ecosystem services were characterized as tradeoff and synergy in most of the current studies. Here, we found that there is another relationship, namely, constraint effect between ecosystem services, which was represented by extracting constraint line from the scatter plot. Selecting the agro-pastoral transitional zone of North China as the study area, we examined the relationships between paired ecosystem services of NPP, SC, SL, WY, and WR, in which the constraint effects of one ecosystem service on the others were represented by extracting upper constraint lines from the scatter plots of the paired ecosystem services through the method of segmented quantile regression on the levels of landscape, class, and ecoregion, respectively. The results indicated that there are seven kinds of constraint effects between the ten paired ecosystem services, namely, (1) positive linear, (2) negative linear, (3) logarithmic, (4) negative concave, (5) backwards

S-shaped, (6) hump-shaped, and (7) wave-shaped. The constraint line approach enriched the understanding of linkages between ecosystem services and the potential drivers and can be used by policy makers to detect and design the land use schemes in terms of ecosystem service optimization.

Keywords: ecosystem services, land use and cover change, climate change, constraint line

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Assessing ecosystem services tradeoffs across agricultural landscapes in a mountain region

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Multifunctionality of agricultural areas is at the core of policies promoting sustainability. Yet, assessing the potential benefits for biodiversity and understanding spatial and temporal tradeoffs among multiple ecosystem services (ES) remain key challenges, especially in mountainous landscapes. Here, we develop an approach to assess the tradeoffs and synergies in the ES associated with different agricultural production systems in mountain

landscapes. We evaluate the ES provided by seven study areas located in an Alpine region, in northern Italy, representing different types of mountain farming systems. We thus aim at providing guidance on the relationship between the intensity of use of agricultural land and the provision of ES. We performed a quantitative evaluation of 10 ecosystem service indicators for the seven study areas, producing the relative thematic, and hotspots maps and synthesis tables. A thematic aggregation of the indicators and correlation analysis followed to gain a better understanding of the spatial and temporal ES tradeoffs. Flow diagrams served to represent ES tradeoffs and characterize the study areas. Overall, despite the limited number of study areas, the findings suggest that the transition to intensive forms of agricultural exploitation, in addition to the loss of habitats, also involves a reduction in cultural and social services, in particular, those related to the cultural, aesthetic and perception. This study showed that within five of the study areas there is a synergy between the supply of at least one service related to habitat maintenance and the supply of at least one cultural service. For two of these areas, there is synergy between habitat maintenance and provision of forage. The

aggregated indicators substantiate hypotheses about expected dynamics and relationships between ES categories: provisioning and regulating ES are positively associated with cultural ES. The study can offer valuable and reliable references for local level landscape management and planning.

Keywords: ecosystem service tradeoffs, multifunctional agriculture, mountain agriculture, landscape planning

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Identification, prioritisation and mapping of ecosystem Services in Panchase Mountain ecological regions, Nepal

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Ecosystem services (ES) are critical to human well-being and the improvement of the quality of life, especially in developing countries. Improved understanding of the status of ES is required to help people improve quality of life. However, the status of ES is largely unknown in many biodiversity rich landscapes throughout Nepal. Therefore the study was carried out in one of the biodiversity

hotspots of Panchase Mountain Ecological region (PMER) of western Nepal to better understand the status of ES. The major objective of the study was to identify, prioritise and mapping of major ES in the PMER.

Primary data for the study were collected through key informant interviews, focus group discussions, a transect walk, and field observations. Similarly, secondary data were obtained from published and unpublished reports and satellite images of the study area. The data were analyzed both qualitatively and quantitatively. Thirty-seven ES were identified from the study landscape. Out of them, nine were provisioning services, thirteen regulating services, nine cultural services, and six supporting services. Interestingly, the prioritization of ES among stakeholders differed on the basis of their background, particular features of their landscape, professional engagement, and individual interests. For instances, forest users prioritized provisioning services such as food, water, timber, fuel wood, and fodder, whereas forest managers prioritized regulating and cultural services such as biodiversity conservation, flood regulation, carbon sequestration and eco-tourism. Mapping of the ES from the landscape for 1995 and 2015 showed that forest area and associated ES

increased, especially in the upland regions, while agriculture land and their ES decreased across the same duration, which is also supported by the responses of the respondents.

The study can be used as a reference by planner and policy makers in managing ES while increasing synergy and reducing trade-off among various services.

Keywords: ecosystem services, identification, mapping, prioritisation, Nepal

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Comparing strengths and weaknesses of three ecosystem services models in a diverse river catchment in Wales, UK

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With development of the ecosystem services (ES) approach, quantitative measures of environmental quality and socio-economic well-being have become targets for ES assessments and modelling. The Welsh Government (WG) in the UK has legislated goals for sustainable development to

secure the long-term well-being of Wales and its people. The Glastir Monitoring and Evaluation Programme (GMEP) was implemented by WG to provide independent, objective evidence on success of its Glastir agri-environment scheme in delivering these goals. ES models are being used by land-managers and policy-makers in Wales (and elsewhere) to make management decisions on land-use changes to deliver ecosystem services, so it is important to understand the reliability and validity of outputs from ES models.

We compare three spatially-explicit ES models used in GMEP: LUCI (Land Utilisation and Capability Indicator); ARIES (Artificial Intelligence for Ecosystem Services); and InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs). Model outputs were compared to observed data for river flow, soil carbon and nutrient export within the Conwy valley in North Wales (UK), a temperate catchment with widely varying land-use.

All water yield models performed well, providing comparable catchment maps of annual water yield which agreed well with observed annual flow data from two gauging stations. The carbon models all provided

overestimates for total carbon in the catchment, but values across the models were on the same order of magnitude as the observations. All nutrient retention models performed least well, partly due to the difficulties in assigning suitable export coefficients.

Ecosystem services modelling tools can provide useful decision support outputs. We show that, while the models provide broadly comparable quantitative outputs, each tool has its own unique features and strengths, therefore the choice of tool depends on the study question and user requirements.

Keywords: ecosystem services, models, comparisons, management, GMEP Wales

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Integrating ecosystem services supply potential from future land-use scenarios in protected area management: insights from Bangladesh

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Globally, the establishment of protected areas (PA) is a key strategy to conserve the declining forests and biodiversity. However, due to poor infrastructure and the limited capacity of PA managers, most of the PA's in tropical developing countries fail to achieve their management targets. In this paper, we assessed the potential to

integrate ecosystem services (ES) into land-use planning in order to better manage PAs. We first mapped the relative capacity of different land-use/land cover (LULC) to supply ES in and around the Satchari National Park (SNP) located in northeast Bangladesh. Two alternative scenarios were developed to envisage the likely future supply of ES in the area. Our study revealed relatively higher supply of supporting ES from LULC located inside the park compared to the ES supplied from surrounding forests, tea gardens, and oil palm and rubber plantations. Provisioning ES were greater in surrounding forests than from SNP. Both regulating and cultural ES were also higher in LULC within the park. Spatially explicit ES supply assessment and mapping was found to be useful for land use planning and the prioritization of future management actions. We suggest that PA managers should consider the ES framework as an effective tool for the future-oriented PAs management.

Keywords: conservation, spatial planning, participatory mapping, protected area, national park

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Type of submission: *Abstract*

T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Study on spatial-temporal dynamic change of trade-offs and synergistic relationship between ecosystem services in Poyang Lake Basin

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Social economy has been rapidly developing in recent years. Societal developments have resulted in a greater use of many natural resources to the extent that the ecosystem can no longer self-regulate. In order to meet the increasing demand of human beings, and to maximize the benefits of ecosystem services under the protection of ecosystem health, it is necessary to clarify the complex relationship between ecosystem services. As the largest freshwater lake

in China and one of the important lakes in the mainstream of Yangtze River, Poyang Lake plays an important role in flood storage and biodiversity protection. After 2000, driven by rapid urbanization, the ecological environment in Poyang lake basin has undergone dramatic changes. Understanding the trade-offs and synergy of ecosystem services is of great significance to ecological protection and sustainable development of Poyang lake basin. Therefore, in this study, we used Costanza's evaluation formula to estimate the ecosystem service value and its dynamic evolution of ten kinds of ecosystem services in six periods (1990-2015). Considering the spatial difference, we modified the research method combined with agricultural production service value. On this basis, we discuss the trade-offs and synergies among ecosystem services in different periods by using the correlation analysis. Results demonstrated that the ecosystem services value of Poyang lake basin in the period of 1990-2015 has been increasing steadily. Among all ecosystem services, gas regulation and hydrological regulation exhibit the highest ecosystem services values. Obvious differences in spatial patterns existed in different analysis area, in which medium value area distributed homogeneously, high value

area and low value area concentrated in the northern and central regions. In the relationship among ecosystem services in Poyang lake basin, the synergy relationship is about 62.2%, which is the dominant relationship among ecosystem services in Poyang lake basin. There is a significant synergy among gas regulation, support services and cultural services. The synergy relationship between raw material production and soil conservation is the strongest. There are few trade-offs in Poyang lake basin. And most of them are related to water supply, hydrological regulation, support services and cultural services.

Keywords: ecosystem services, spatial-temporal dynamic change, trade-offs and synergistic relationship, Poyang Lake Basin

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Ecosystem services assessment methods as an input for spatial planning and decision-making (Trnava, Slovakia)

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The presentation describes selected results of several approaches used for the ecosystem services (ES) assessment in the Trnava town (Slovakia); and their further incorporation into the planning and decision making process. Presentation is based on the OpenNESS case study

and follow-up research.

Assessment of selected 10 ES by two methods was realised for the Trnava functional area including city and 15 surrounding municipalities. Basic "Spreadsheet type" method (also known as the "Landscape matrix"), is based on the interpretation of the land-use classes capacity for ES provision. The "GreenFrame" method reflects selected positive and negative environmental features as the inputs for ES assessment instead of simple land-use matrix. Evaluated by the stakeholders, these methods are suitable for environmental assessment, first stage of spatial planning or the comparison of municipalities by their ES capacity.

The third method allows a more detailed ES assessment (comparison of ES supply, demand and balance), using GIS-based participative decision-making tool "QuickScan". Evaluation model was based on detailed land use and functional maps with 24 qualitative landscape features (representing mainly structural and functional traits). The capacity for 8 ES was calculated on the basis of expert´s valuation model, which was “calibrated” by group of stakeholders. Individual ESs were later merged into 4 main

groups (provisioning, regulating, supporting and cultural); for these groups the ES supply and demand was synthesized. Additional evaluation of the ES future balance takes into account approved urban plan for the Trnava and clearly shows the “hotspots” of ES delivery in both positive and negative sense. With the use of this method within the SEA and/or planning process, the importance of urban green areas for ES provision should be highlighted. The further stakeholder’s feedback including the proposal of relevant indicators, helps to propose more realistic and useable input for the local/regional planning and decision making.

Keywords: ecosystem services, ES assessment methods, urban environment, spatial planning, QuickScan

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

The change and tradeoffs-synergies analysis of ecosystem services: a case study of Bailongjiang watershed, Gansu

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Bailongjiang watershed of Gansu belongs to the upper reaches of Yangtze River water conservation areas and environment fragile area with frequent landslides and debris flow. Recently, the high-frequency and high-intensity human activities caused the deterioration of natural systems. Therefore, it is of great significance to study the changes of ecosystem services and trade-offs in

this watershed. In this paper, the spatial and temporal changes, spatial aggregation characteristics and the trade-offs/synergies between ecosystem services were quantitatively analyzed from 1990 to 2014 via the ecosystem service change index, spatial autocorrelation and correlation coefficient method. The results showed that the ESCI ranges of the four ecosystem services types were different in terms of water yield, carbon storage, soil conservation and crop production from 1990 to 2014a with the difference of spatial distribution. There are spatial autocorrelation in four typical ecosystem services, showing obvious clustering characteristics. The local positive correlation type "group" appears, the agglomeration is strong, the negative correlation type is scattered, the agglomeration is low, and the spatial heterogeneity is significant. There is a negative correlation tradeoffs between the two provisioning services (water yield and crop production), and there is a positive correlation synergies between the two regulating services (carbon stocks and soil conservation). The relationships between the provisioning and regulating services have both tradeoffs and synergies. There were both strong positive correlation synergies between water yield and soil conservation, water yield and

carbon storage, and there were both weak negative correlation tradeoffs between soil conservation and crop production.

Keywords: ecosystem services, spatiotemporal change, tradeoffs/synergies, Bailongjiang watershed

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Options and challenges for implementing green spaces in urban development

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Providing highly qualitative, healthy green areas in densely populated cities is a serious challenge. Cities need innovative solutions to increase public space with vital vegetation that we call urban green space. Not only parks, lawns and roadside green belong to these category, but also rivers, creeks, ponds and lakes together with their riparian biotopes are important part of it. And there are

many more opportunities to implement vegetation into housing areas (e.g. green roofs, green facades) in order to enhance human health and quality of life. The presentation gives an overview of possibilities and deepens particular issues. To develop coherent green networks, the necessary sites should be reserved very early step by step. Long before a complete biotope network can become apparent, a sound foundation must be set by planning.

In accordance with stakeholders, urban green space should be maintained and enhanced against the pressure of real estate market, traffic development as well as the overwhelming housing and industrial land consumption. This talk tries to provide a possible road map with a spectrum of suggestions and suitable starting points for developing green infrastructure in German and Chinese cities. Real examples from both countries describe how the planning approach has been applied. The cities found unique ways to combine ideas and thus to improve their effectiveness.

Keywords: urban planning, green infrastructure, landscape planning

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Evaluating the uncertainties in New Zealand's GIS datasets: understanding where and when frameworks such as LUCI can enable robust decisions surrounding farm management practices

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LUCI (the Land Use Capability Indicator) is a GIS framework that supports decision making and spatial planning of land management practices. This tool is used to enhance the benefits derived from ecosystem services. LUCI maps the trade-offs between individual ecosystem services and

identifies areas in the landscape where mitigation strategies will be most effective. Decision support tools like LUCI are reliant on GIS datasets to inform the algorithms of the landscape characteristics they are modelling. Applications to date cover a range of environmental settings with most research projects located in NZ and the UK. Although LUCI performs well in situations where local, high-resolution data is obtained, little is known about the robustness of LUCI's output when coarser scale soil, elevation, climate and land use datasets are used. This presentation will identify how varying quality and resolution of soil and elevation datasets impact the accuracy and precision of LUCI's output by examining the sensitivity of the LUCI model to input data. Looking specifically at the nitrogen, phosphorous, erosion and sediment service provision tools within LUCI, the changing reliability of the model output is discussed under different landscape settings and with data of varying quality. We compare LUCI outputs using elevation data at 2, 5 and 15 metre horizontal resolution along with two soil datasets. One dataset is coarse and nationally available and the other is newer and more detailed but not yet nationally available. We discuss the extent to which the quality of data impacts

predictive accuracies of ecosystem service tools over a range of soils, topography and climates. It is important to promote discussion surrounding dataset quality and understand what additional resources may be required to allow ecosystem service models to support robust predictions and subsequent decision making everywhere.

Keywords: ecosystem services, data quality, uncertainty, LUCI

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Establishment of a comprehensive indicator system for the assessment of biodiversity and ecosystem services

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Other author(s): Nan Lu, Bojie Fu
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Common indicators are needed to monitor biodiversity loss and the implications for the sustainable provision of ecosystem services (ES). A plethora of different sets of indicators may hinder the identification of major endpoints for large-scale assessments of biodiversity and ecosystem services (BES).

Objectives: We aim to describe the main challenges of indicators for BES assessment and provide suggestions for establishing a comprehensive indicator system.

Methods: An extensive literature review was conducted in this study. We review the main challenges of indicators for BES assessment and propose corresponding improvements from our perspectives of theory and practical applications.

Results: The main theoretical challenges of existing indicators include inconsistent definitions and classifications of ES, misunderstanding of linkages among biodiversity, ecosystem structure, functions and services, and practical problems relate to such issues as indicator representativeness, data availability, and uncertainty. Our suggested improvements include clarifying the main terms, concepts and classification of indicators, establishing a robust conceptual framework with clear interactions among different components and indicators, selecting indicators based on ecosystem properties, streaming existing data into one platform, and strengthening validation of proxies. The steps for constructing a comprehensive indicator system for BES assessment are summarized.

Conclusions: Clear definitions of key terms are

indispensable to classify indicators and construct a conceptualframework. Improved understanding of the relations among indicators of biodiversity, ecosystem functions, and ES across multiple scales can guide the development of the indicator system. The integrated indicator system is an important tool for BES assess-ment to support decision making for sustainable development.

Keywords: ecosystem services, biodiversity, indicator system, conceptual framework, scale

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Type of submission: *Abstract*

T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Ecosystem services framework as a tool to assess environmental trade-offs and synergies

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Following recent EU-directives, many countries in Europe, are implementing laws and regulations for protecting and improving the natural environment on the local and regional level. Mandatory compensation for the loss of nature is often restricted to replacing urban green by improving rural or peri-urban green spaces. When looking at real world situations ocurring in planning, scientists encounter argumentative lock-in-situation. This bears several shortcomings that, on the whole, leads to a

ongoing loss of open space.

We argue that the ecosystem services (ES) and nature-based-solutions (NBS) concepts can help to advance in the improvement of environmental conditions of the urban landscapes along the full range of spaces from technotopes to ecotopes. We propose an amalgamating of the ES and NBS concepts into the design of compensation measures. By taking into account the whole urban context, we suggest a methodology to counteract the shortcomings, aimed at strengthening urban resilience.

Keywords: compensation, environmental trade-offs, urban resilience

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T. Thematic Working Group sessions: T14 Ecosystem Services assessments and trade-offs. Methods and indicators for spatial planning

Ecosystem services assessment and mapping to support urban green infrastructure: the case of Barcelona, Spain

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Ecosystem services approach is an effective way of supporting urban green infrastructure plan. Protecting biodiversity, maintaining urban and sub-urban health life, and improving the benefits of human well-being depends largely on the availability and capacity of ecosystem services. The ecosystem services assessment and mapping can effectively carry out the spatial analysis and evaluation of the ecosystem, so as to better maintain and play the

multi-functional landscape service and promote the construction of the urban green infrastructure. On the contrary, integrated green infrastructure would deliver a wide variety of ecosystem services, which help to form the sustainable development landscape. In this paper, firstly, from the perspective of the landscape, uses 34 ecosystem services (as X axis) and different land use types (as Y axis) to build an ecosystem service evaluation model. Secondly, take Barcelona municipality as an example, to analyse and assess ecosystem services in Barcelona, which shows typical patterns of ecosystem services distribution and spatial characteristics. And mapping ecosystem services through GIS. And the spatial distribution characteristics and status of ecosystem services are obtained in different eco-environment. Finally, on this basis, to provide a reference for the plan and management of urban green infrastructure.

Keywords: ecosystem services, assessment framework, ecosystem services mapping, land cover types, green infrastructure