



BOOK OF ABSTRACT

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I. SESSION DESCRIPTION

ID: B2b

Frontiers in Planning and Implementing Nature-based Solutions in River Landscapes

	Title	Name	Organisation	E-mail
Host:		Stefan Schmidt	Leibniz University Hannover	schmidt@umwelt.uni-hannover.de
Co-host(s):		Barbara Schröter	Leibniz Centre for Agricultural Landscape Research (ZALF)	Barbara.schroeter@zalf.de
		Christian Albert		Albert@umwelt.uni-hannover.de
		Jochen Hack		Hack@geo.tu-darmstadt.de

Abstract:

Many river landscapes around the world have been substantially transformed to enhance navigation, to produce energy and to enable agricultural production and settlement in former floodplain areas. While these changes have led to generally more uniform flow conditions, constant water tables and sharply defined embankments, they have given rise to several unintended challenges for society, for instance exacerbating floods, diminishing water quality and biodiversity loss. Rediscovery and reinventing nature-based solutions (NBS), i.e. activities inspired and supported by ecosystem processes to fulfill human and societal needs, are rapidly gaining popularity in science and policy. NBS promise to address challenges effectively and adaptively, simultaneously providing co-benefits for people and nature. However, substantial knowledge gaps still exist, particularly on planning and implementation practices, effectiveness and monitoring. Good practice examples are needed that showcase under which conditions NBS contribute to overcoming environmental, social and economic challenges and how such solutions can be successfully planned and realized in different contexts. Also, more



research and practical experimentation is needed on how to integrate different disciplines and collaborate with various stakeholders and decision-makers.

The aim of this session is to explore current frontiers of planning and implementing NBS in river landscapes. More specifically, we are interested in sharing insights and innovations regarding principles, barriers, and strategies for making NBS work in practice. More specifically, the session will feature contributions around three themes:

- i. Studies investigating the effectiveness of NBS towards ecological, social and economic outcomes. We will see contributions on ex-ante and ex-post evaluations of impacts of NBS, case studies and reviews of NBS benefits and costs, and comparisons between NBS and technical alternatives. Perspectives on distributional effects of NBS benefits across different actor groups will be addressed as well.
- ii. Studies exploring opportunities for successful planning and designing NBS. Which approaches have been used in inter- and transdisciplinary efforts to identify and spatially design NBS at local and regional scales? How can different knowledge systems be integrated in NBS planning processes, and how can results from NBS analyses be communicated and mainstreamed to provide useful knowledge for relevant stakeholders?
- iii. Studies shedding light on governance and business models for implementing NBS in different governance contexts and actor constellations. For example, how can we ensure adequate financing and funding, how can benefits and costs of NBS be distributed fairly, and how can government, civil society and business actors cooperate for NBS?

The symposium is associated with two working groups. First, it relates to TWG 14 – Application of Ecosystem Services in Planning and Management. Second, the symposium will serve as an opportunity to re-launch ESP's Biome Working Group (BWG) 2b on Rivers and Lakes.

Goals and objectives of the session:

The aim of the session is to share insights and experiences regarding the assessment, planning and implementation of NBS in river landscapes. By drawing on insights from cases and reviews, the session will identify successful approaches for assessing, planning, and governing NBS in practice. We also aim to reactivate Working Group (BWG) 2b on Rivers and Lakes or create a new working group dealing with NBS for safeguarding and/or improvement of ES of rivers (to be discussed with participants).

Planned output / Deliverables:

The outcomes of the symposium will be disseminated in the form of an edited special issue in a leading journal (proposal under review, final decision pending) and eventually in a joint paper. To enhance the immediate impact of the session outcomes, key insights from the presentations and discussions will be tweeted during the symposium itself.



The session is organized as a knowledge exchange and networking activity of the Ecosystem Services Partnership Working Groups 14 – Application of Ecosystem Services in Planning and Management and Biome Working Group 2B – Rivers & Lakes.

Related to ESP Working Group/National Network:

[ESP Biome Working Group: BWG 2B – Rivers & Lakes](#)

[ESP Thematic Working Group 14 – Application of Ecosystem Services in Planning and Management](#)

II. SESSION PROGRAM

Date of session: Thursday, 24 October 2019

Time of session: 10:30 – 12:00 & 13:30 – 15:00 & 16:30 – 18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
10:30–10:45	Stefan	Schmidt	Leibniz University Hannover	Welcome, introduction of ESP working group and aims of session, including introduction to Special Issue
10:45–11:00	Zhifang	Wang	Peking University	A framework for planning NBS in line with both theoretical paradigms and empirical contexts in local river systems, China
11:00–11:15	Christian	Albert	Leibniz University Hannover	Towards a Framework of Landscape Planning for Nature-based Solutions
11:15–11:30	Barbara	Schröter	Leibniz Centre for Agricultural Landscape Research (ZALF)	Implementation of Nature-based Solutions for riversheds in Costa Rica: a governance framework
11:30–11:45	Edward	Ott	Leibniz Centre for Agricultural	Risk and uncertainty in implementing natur-based

Time	First name	Surname	Organization	Title of presentation
			Landscape Research (ZALF)	solutions in river landscapes – a systematic review
11:45–12:00				Cross-cutting discussion
13:30–13:45	Jochen	Hack	Technische Universität Darmstadt	Dealing with different nature–society constellations in the co–design of urban green infrastructure
13:45–14:00	Mario	Brillinger	Leibniz University Hannover	The uptake of nature–based measures in German flood risk management plans: Comparing institutional structures and plan outcomes of three different governance regimes
14:00–14:15	Stefan	Schmidt	Leibniz University Hannover	A pragmatic approach for spatial mapping of nature–based solutions in the Lahn river landscape
14:15–14:30	Paulina	Guerrero	Leibniz University Hannover	Using biophysical–spatial units to locate NBS and evaluate their ecosystem services
14:30–14:45	Mariana Pereira	Carriles	Sao Paulo University	Analysis of the economic and environmental feasibility of the green and gray infrastructures for ecosystem services conservation in the Cantareira System – SP
14:45–15:00				Cross-cutting discussion
16:30–16:45	Jennifer	Henze	Leibniz University Hannover	Successful knowledge co–production? Insights from river management
16:45–17:00	Sarah	Gottwald	Leibniz University Hannover	Geodesign as a boundary management tool for planning resilient river landscapes



Time	First name	Surname	Organization	Title of presentation
17:00–17:15	Dalal	Hanna	McGill University	Identifying pathways to reduce discrepancies between ecosystem service demand and provision using a novel participatory method
17:15–17:30	Camila	Jericó-Daminello	Leibniz Universität Hannover/Alexander von Humboldt-Stiftung	Stakeholders' roles in ecosystem services co-production: a social network analysis in the Lahn river landscape, Germany
17:30–18:00				Cross-cutting discussion Introduction to next steps for compilation of special issue and joint discussion of future events planned with the ESP working group

III. ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. *Type of submission: **Abstract***

B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes

Towards a Framework of Landscape Planning for Nature-based Solutions

First author: Christian Albert

Other author(s): Barbara Schröter, Mario Brillinger, Paulina Guerrero, Sarah Gottwald, Jennifer Henze, Edward Ott, Stefan Schmidt

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Nature-based Solutions (NBS) find increasing interest and application in policy, science and practice to address societal challenges through harnessing ecological processes. For many of those challenges, such as the alleviation of flood risks, the effectiveness of NBS depend on a coordinated approach at the landscape level and a joined-up implementation. Knowledge and know-how required for the evaluation and design of suitable implementation measures can arguably be provided well by landscape planning. However, scientific understanding as to how landscape planning procedures need to be adapted and implemented for this specific field of application is still in its infancy.

This contribution aims to introduce a framework of landscape planning for NBS, and to demonstrate its application for the Lahn river landscape, Germany. The framework has been developed based on insights from a focused review of publications on contemporary landscape planning frameworks as well as on requirements for designing NBS. The framework was applied in the case study in the course of a living laboratory, consisting of a series of transdisciplinary workshops.

Our framework consists of a cycle of essential phases of landscape planning for nature-based solutions, including Identifying Context and Challenges, Developing a Shared Vision, Exploring NBS Scenarios, Crafting Solution Strategies, Implementing NBS, and Monitoring NBS Effects. Across all phases, three key NBS planning principles are obeyed, namely Systems



Understanding, Knowledge Co-Generation, and Iteration. By application in the Lahn case study, the generic phases of the framework are illustrated and specific methods for each phase are exemplified. Highlights include assessing stakeholder goals and networks, geodesigning scenarios, simulating spatial NBS potentials, and quantitative modelling of ecosystem services effects.

Our research contributes to the scientific advancement of landscape planning theory and concepts as relevant for NBS, and provides insights for practitioners regarding suitable methods and possible outputs.

Keywords: Planning theory, Planning Methods, Ecosystem Services, River Landscapes, Co-Creation

2. *Type of submission: **Abstract***

[B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes](#)

The uptake of nature-based measures in German flood risk management plans: Comparing institutional structures and plan outcomes of three different governance regimes

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Nature-based measures (NBM), defined as measures that use ecosystem processes to address societal challenges, are increasingly advocated as a promising strategy for flood risk management. A suitable field of application of NBMs like the restoration of floodplains could exist in the flood risk management plans (FRMPs) stipulated by the EU Floods Directive. Existing research suggests that the uptake of NBMs is limited in practice, and strongly influenced by the respective governance contexts. However, little knowledge is available regarding the actual extent of NBMs being proposed in FRMPs, and how the institutional framing of FRMPs influences this uptake.



The aim of this study is to assess the uptake of NBS in FRMPs of three German federal states with diverging institutional settings, namely Hesse, Saxony, and Lower-Saxony. Three research questions are addressed: (i) How do the FRMPs in the three German states differ regarding context for NBM uptake? (ii) What share of FRMP measures for flood risk reduction can be associated with NBMs in the three states? (iii) Which reasons can be identified that explain differences in the uptake of NBMs?

Our research design combined document and content analyses, including the development and application of specific coding schemes.

Overall, NBMs are rarely proposed in the FRMPs and different preferences for particular NBMs exist between the federal states. Our exploration of potential explanations for differences in uptake between states and watersheds showed that FRMP are more likely to include NBMs when they concern smaller rivers, low risk levels and cost-benefit relations. In conclusion, we find that changing the scope and valuation approaches of FRMPs may increase the uptake of NBMs. More research is needed to better understand how personal knowledge and preferences of FRMP managers influence the uptake of NBMs, in particular in relation to the existing institutional settings.

Keywords: flood risk management, nature-based solutions, integration, water governance, planning practice, institutional analysis



3. *Type of submission: **Abstract***

B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes

Analysis of the economic and environmental feasibility of the green and gray infrastructures for ecosystem services conservation in the Cantareira System – SP

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The Cantareira System is the most important water supply system to São Paulo Metropolitan Region and, between 2013 and 2015, its capacity was severely impacted during the last water crisis in São Paulo State. Two approaches can contribute to increase the capacity of water supply from Cantareira System: investing in grey infrastructure, engineering structures made by humans, and in green infrastructure, interconnected network of natural areas. Six portfolios were created to identify the most feasible solution for Cantareira's ecosystem services conservation, considering economic and environmental aspects. The environmental performance of each portfolio was identified, as well as the costs and benefits. The portfolios were combined and analyzed using the Benefit-cost method. The ecosystem services benefits stood out in most of the final economic values of the analyzed portfolios. As result, to conserve the ecosystem services and obtain water supply gains in Cantareira System is necessary to invest in improvements of ground cover in areas currently occupied with pastures in the watershed, the restoration of Cantareira's Permanent Preservation Areas in banks of waterways and the construction of Pedreira and Duas Pontes dams.

Keywords: Water resources. Environmental Economy. Ecosystem services



4. *Type of submission: **Abstract***

B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes

Geodesign as a boundary management tool for planning resilient river landscapes

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River landscapes are complex social ecological systems (SES) offering at least two challenges for planners: First, they are perceived and acted upon by various stakeholder and stakeholder groups. Arguably, a synergy of their different knowledge types and interests is beneficial to understand and finally solve challenges. However, boundaries exist between groups holding different knowledges and interests. Second, riverine SES are characterized by a strong connectivity which may threaten their resilience, because trade-offs tend to be high, e.g. enhancing pollination potential by increasing natural structures may have a negative impact on agricultural yield. Hence, if efforts to plan and implement interventions in river landscapes, social and ecological dimensions need to be taken into account. This is particularly true for nature-based solutions, recently proposed as promising actions to alleviate societal challenges by harnessing ecological processes.

The aim of this study is to present a participatory planning support tool designed to take into account both, the social and the ecological dimensions of landscape systems in an effort to identify spatial opportunities for nature-based solutions.

Our analysis was guided by the following research questions: (1) How are different knowledge sources integrated and communicated in the Geodesign workshop?; (2) What kinds of substantive outputs or products are created?; and (3) How do participants perceive the usability and usefulness of the Geodesign approach, compared with more conventional planning methods?



A Geodesing tool was build to serve as an interface between stakeholders and spatial information. Geodesign may act as a boundary management process between science and practice by translating information and promoting a common understanding and conflict mediation. The tool used touch tables and provided features such as mapping, sketching, impact evaluation and visualization. It was applied in a workshop with 11 stakeholders of the Lahn river landscape, Germany.

Participants were divided in two groups and given various data sources and the task to design spatially two different scenarios they were familiar with. Results highlight (1) the difficulties of the choice of data input and trade-offs between reliability of the results and technical feasibility; (2) that maps serve as a common interface facilitating exchange of ideas, promoting explicit statements and avoiding the need for specialised jargon.

Keywords: river landscape, resilience, social ecological systems, nature-based solutions, Geodesign

5. *Type of submission:* **Abstract**

[B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes](#)

Using biophysical-spatial units to locate NBS and evaluate their ecosystem services

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Compared to technical infrastructure, nature-based solutions (NBS) strive to work with nature and to move beyond business-as-usual practices in order to address societal challenges such as flood risks. This research aims to spatially locate NBS and to evaluate their capacity to provide selected ecosystem services for the Lahn river landscape case study in Germany. Our research design follows the functional landscape approach in using hydromorphological landscape units (HLU) based on biophysical spatial criteria to identify areas with current or potential function as NBS. For this paper, we focus on the NBS type 'working floodplain'. In a second step, we apply spatial models and the services providing units approach to assess the



ES provision potential of these HLU. We find that the case study area shows about 3.6 million hectares of already active floodplains areas, for which we recommend continued or modified protection measures. We further identify circa 0.4 million hectares of areas where the hydromorphological conditions are apt to support floodplains, yet are cut-off from the flooding regime and require rehabilitation measures. Using the HLU approach to identify NBS and assess their ecosystem services provision capacity has proved as a useful spatial approach to support NBS implementation and to investigate their co-benefits. Further research is needed to assess a broader spectrum of NBS and ecosystem services, and to test the applicability of our methods in other case studies.

Keywords: Nature-based solutions, ecosystem service valuation, rivers, restoration, GIS

6. *Type of submission: Invited speaker abstract*

[B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes](#)

Dealing with different nature–society constellations in the co–design of urban green infrastructure

First author: Jochen Hack

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The transformation of river landscapes due to urbanization has detrimental impact on river ecosystems and social well-being. These impacts have often been the result of a principle focus on housing and transportation services at the cost of social–ecological well-being. Nature-based solutions (NBS) in urban areas, such as green infrastructures, are intended to reconcile ecological and social well-being needs. This contribution presents an inter- and transdisciplinary approach to planning and design of multi-functional green infrastructures at the neighborhood level in Costa Rica. Based on a participatory co-design with local residents in the municipality of Flores three axis of green infrastructures – (1) at the street level, (2) at decentralized places in the neighborhood, and (3) along an urban stream – are developed and implemented in order to achieve a high degree of multi-functionality in improving ecology and social well-being. These three axis of green infrastructures represent different degrees



and forms of interactions along a continuum of nature–society relations. The participatory design and implementation process reveals important insights regarding how multi-functionality of NBS can successfully be identified and spatially designed at the local level.

Keywords: Green infrastructure, nature–based solutions, urban ecology, Co–Design, Costa Rica

7. *Type of submission: **Abstract***

[B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature–based solutions in river landscapes](#)

Identifying pathways to reduce discrepancies between ecosystem service demand and provision using a novel participatory method

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Discrepancies between ecosystem service demand – that is, the types and amounts of ecosystem services people would ideally like to benefit from – and the actual provision of services reflect people’s inability to receive desired benefits from nature, and can lead to conflict. Ecosystem service science has made progress in assessing discrepancies between ecosystem service demand and provision, however, little research focuses on identifying suitable actions that could be taken to reduce discrepancies. We develop a novel method that uses stakeholder analysis, a survey, and a participatory workshop to generate information about ecosystem service demand and provision discrepancies, and facilitates the community based creation of ideas for actions that can be taken to reduce them. We test these methods in a multifunctional region located alongside the Outaouais River, in the southern part of the municipalities of Bristol and Pontiac, Quebec, Canada. The results of our case study show how people can benefit from a wide array of ecosystem services on diverse components of multifunctional landscapes, but do not necessarily benefit from services equally. Provided with the opportunity, people came up with ideas for locally relevant actions that could be taken to reduce the majority of identified discrepancies between ecosystem service demand and provision. Key findings related to the methods we develop also emerged: different knowledge types can be complemented to create a broader, more complete picture of how people benefit



from nature; assessing satisfaction levels helps uncover nuances associated to discrepancies between ecosystem service demand and provision; social-learning can help develop novel ideas of actions to reduce those discrepancies; and, considering different perspectives of trade-offs can help avoid unanticipated and unwanted outcomes of actions. Researchers and practitioners seeking to understand discrepancies between ecosystem service demand and provision, and identify locally relevant actions to reduce those discrepancies can build from the methods we develop.

Keywords: Management, Multifunctional landscapes, Participatory assessments of ecosystem services

8. *Type of submission: Abstract*

[B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes](#)

Successful knowledge co-production? Insights from river management

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Navigating the evolution of river systems towards more sustainable pathways requires the active involvement, collaboration and coordination of diverse actors from science and practice. Identifying relevant stakeholders, understanding and connecting their different knowledge systems are an important prerequisite in order to design and implement successful participatory river landscape governance. We accompany a project that intends to achieve the aims of the Water Framework Directive by simultaneously including the demands of numerous stakeholders in an aspired development concept for a river landscape in Germany.

The aim of this contribution is to report and reflect upon the evolution of knowledge production within the early phase of the inter- and transdisciplinary collaboration among consortium members in a case study of river landscape governance in Germany.

Our research design assesses and compares data from different phases of the transdisciplinary process in order to illustrate the development of common aims for the river. For the



stakeholder analysis on the first stage we had participant observations in meetings of the case study project in order to learn about the activities of the people under study in their natural setting. After this first free approach, we decided to obtain more information about the different interests, aims, and intentions of the involved decision makers through twelve qualitative individual interviews. These took place before and after a workshop series which was organized with the project members and were extended with additional reflective interviews and evaluations from every single workshop.

First results provide evidence for a change of perspectives and opinions of the involved representatives over the workshop series and the still ongoing process. We find that a mutual project understanding is promoted through individual and collective exchange which may improve decision-making processes through early stakeholder awareness in terms of social robustness.

Keywords: transdisciplinary water research, knowledge co-production, stakeholder interaction, knowledge systems

9. *Type of submission: Abstract*

B. Biome Working Group sessions: [B2b Frontiers in planning and implementing nature-based solutions in river landscapes](#)

Stakeholders' roles in ecosystem services co-production: a social network analysis in the Lahn river landscape, Germany

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River landscapes are characterized by complex social-ecological dynamics in which ecosystem services often serve as connecting components between the people and nature. Those ecosystem services are often co-produced with contributions from nature and people, and provide benefits to a range of different stakeholders. Little scientific understanding is so far



available on how stakeholders perceive their roles in ecosystem services co-production, and if those self-perceptions are in line with the perspectives of others. Therefore, the aim of this study is to investigate the perception of stakeholders regarding their own roles and engagement in the co-production of local ecosystem services, and the networks of collaboration needed to manage those ecosystem services. We conducted a structured survey with representatives of nine local stakeholders groups. With respect to twelve local ecosystem services, participants were asked about their perceptions of their role in co-production and collaboration. The data revealed 24 social networks, two for each ecosystem service: one from a self-perception perspective (from the interviewee) and one from an attributed perspective (from the others groups). The results of the network analysis provide new insights on how the collaboration for ecosystem services co-production is perceived and who are the central stakeholders of each one of the networks. The main features of the networks (size, nodes and links) do not vary when comparing opposite perspectives. However, perceptions regarding the central importance (centrality degree) greatly differ between stakeholders' own perceptions and that of others. Besides, central roles are more equally distributed among different stakeholders when the attributed perspective is considered. From a self-perception perspective, there is a tendency of concentration in few stakeholders. We argue that understanding and considering differences in the perspectives on ecosystem services co-production is crucial for suitable ecosystem services governance, and discuss practical implications and suggestions for future research.

Keywords: Ecosystem services co-production, collaboration, social network analysis, stakeholders' perspectives, Lahn river landscape



10. *Type of submission: **Abstract***

B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes

Risk and uncertainty in implementing natur-based solutions in river landscapes – a systematic review

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Nature-based solutions (NBS) can contribute as stand-alone measures or in combination with green infrastructure and technical infrastructure to effectively address important societal challenges such as climate change and the loss of biodiversity. In river landscapes, they can furthermore make an effective contribution to flood protection and the reduction of flood risk. However, their targeted use to tackle societal challenges is associated with a variety of risks, which differ according to the context and scope of the measure. Risk is an important factor that significantly influences all human decision-making processes. This also applies to the planning and implementation of NBS in river landscapes. In this respect, it relates in particular to complex measures that must be implemented at the landscape scale and require an integrated management approach.

The review followed the guidelines for systematic reviews proposed by the Collaboration of Environmental Evidence. Its objective is the synthesis of available scientific knowledge on risk associated to the planning and implementation of NBS on different spatial scales, as well as on suitable governance structures to address these factors. We developed a standardized search string representing the dimensions of risk, river landscapes, NBS and governance. We included English speaking scientific literature, which underwent a rigorous step-wise screening process. We further identified risk factors based on the general risk literature to build a coding scheme. The coding scheme was then applied to the papers for a detailed evaluation.

Our classification identifies a number of distinct risk factors for NBS, and describes their characteristics. For example the performance of NBS is a common source of uncertainty, which hinders their planning and implementation. Our review sheds light on how specific risk and



uncertainty factors play out in actual cases. Finally, we discuss the implications for the practice of flood risk management and outline issues for further research.

Keywords: nature-based solutions, river restoration, risk, uncertainty, river landscapes

11. *Type of submission: Abstract*

B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes

A pragmatic approach for spatial mapping of nature-based solutions in the Lahn river landscape

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Nature-based solutions (NBS) becoming increasingly recognized as effective actions to alleviate societal challenges and achieve the United Nation's Sustainable Development Goals (SDGs). One scientific challenge to implement NBS in praxis is to localize areas potentially suitable for an effective application of NBS. Potential areas for NBS either already host NBS that need to be safeguarded or restored, or provide the socio-ecological conditions for establishing new NBS. Complex methods have been proposed to model potential locations of selected NBS, but are often too data and resource intensive to be applied in practice.

The aim of this article is to put forward a pragmatic method for spatial mapping of NBS, and to test its application in a participatory, extended peer-review process in the Lahn river landscape, Germany. Our method includes: (i) synthesizing a generic catalog of NBS in river landscapes, (ii) assessing the capacities of NBS to address specific societal challenges and SDGs in the case study, and (iii) applying key spatial indicators and best available data to explore potential areas for the implementation of selected NBS.

The generic catalog provides a systematic overview of more than 600 individual NBS for river landscapes and their respective potentials for addressing SDGs. Our analysis of NBS capacities



in the Lahn river landscape finds that ‘Re-naturalize floodplains through land use changes’, ‘Revitalizing historic floodplains’, and ‘Creating buffer strips’ are those actions beneficial for achieving the greatest number of distinct SDGs. The spatial analysis identifies about 4739 hectares of areas where NBS are already in place and need to be restored, and additional 1323 hectares with opportunities for further NBS creation.

The proposed method presents an easy replicable approach that facilitates spatial mapping of NBS for planning practitioners facing time and resource constraints. Our method also provides a basic step towards an effective selection and localization of NBS in river landscapes.

Keywords: Nature-based solutions; Landscape Planning; Sustainable Development Goals; Localisation, GIS

12. *Type of submission: Abstract*

[B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes](#)

Implementation of Nature-based Solutions for riversheds in Costa Rica: a governance framework

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Nature-based Solutions (NBS) are a relatively new concept that embraces experiences from existing concepts such as blue-green infrastructure, natural capital, ecosystem services or landscape functions. The additional element to existing concepts is that NBS need to provide simultaneous benefits for society, the economy and nature and have to alleviate a well-defined societal challenge. In the case of river landscapes NBS present a promising approach to support more sustainable development for people and nature. The revitalization of river floodplains, for instance, can alleviate societal risks of flooding of downstream communities and provide multiple co-benefits for recreation and biodiversity.

NBS are often piloted in individual demonstration projects with suitable context conditions. Governance structures are not examined systematically or considered only in the specific case



study context. But what happens when NBS shall be enforced in a general political context, not only in a pilot study? On the one hand small local initiatives can be found that undertake actions for the implementation of NBS like the reforestation of river banks, on the other hand there are also initiatives for changing rules at the national policy level in favor of NBS implementation.

To fill this knowledge gap we develop a governance framework for implementation of NBS in riversheds. The framework shows how integrative governance structures e.g. regarding the local and national level or different sectors can be reached. We apply the framework to the political setting of Costa Rica with special focus on the governance of the Tárcoles river. Based on document analysis and in-depth interviews with local experts we test the framework and discuss its suitability for the analysis of governance of NBS in other riversheds. Taken together, this can provide useful insights for both the analysis of river governance schemes and the actual design and implementation of governance in practice.

Keywords: water governance, integrative water resources management, boundary work, knowledge co-creation

13. *Type of submission: Abstract*

[B. Biome Working Group sessions: B2b Frontiers in planning and implementing nature-based solutions in river landscapes](#)

A framework for planning NBS in line with both theoretical paradigms and empirical contexts in local river systems, China

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As a topic theme in sustainable development worldwide, nature-based solutions recently attract more and more attention in China since ecological civilization progresses rapidly in recent years. NBS is an umbrella concept of sustainable use of nature to tackle societal challenges for multiple ecosystem services, whereby, most implementations of NBS involve random applications of varied “natural” solutions. Worldwide, there is lack of systematically understanding of what are the relationships between “nature” and “solutions”, and how to



systematically and appropriately plan NBS. This paper proposes a framework for planning NBS based upon both theoretical paradigms and empirical applications in Chinese contexts.

The framework starts with a new categorization of NBS into six conceptual paradigms: natural paradigm, progressive paradigm, native paradigm, cultural paradigm, novel paradigm and green paradigm. Each paradigm has its own theoretical/conceptual foundations, which differentiate “nature–solution” relationships with varied ecosystem forms and ecosystem services to be applied in different natural and societal conditions.

The conceptual framework is then applied to an ecological restoration planning of river ecosystems in a mountainous city, China. In accordance with natural succession of local river ecosystems and local practices with traditional wisdom, a solution fact sheet of six paradigms is first synthesized with detailed solutions and ecosystem services. To spatially plan the different paradigms of NBS, ecosystem importance, ecosystem quality and ecosystem social services are utilized to determine appropriate paradigm to be used locally. Ecosystem importance and quality are primarily assessed by ecological experts while the evaluation of ecosystem social services relies on collaborations with various stakeholders and decision-makers. The final plan of NBS spatially allocates varied solutions with specific design guidelines and governance strategies to be compared and discussed in an international context.

Keywords: NBS categorization, paradigm, planning framework, ecological restoration, river ecosystems