BOOK OF ABSTRACT

I. SESSION DESCRIPTION

ID: B2a

Ecosystem services assessment methods for riverine and wetland ecosystems

	Title	Name	Organisation	E-mail
Host:	Dr.	Mauro Carolli	Leibniz-Institute für Gewässerökologie und Binnenfischerei	carolli@igb-berlin.de
	Dr.	Jan H. Janse	PBL Netherlands Environmental Assessment Agency; and Neth. Institute of Ecology	jan.janse@pbl.nl
Co-host(s):	Dr.	Simone Podschun	Leibniz-Institute für Gewässerökologie und Binnenfischerei	podschun@igb-berlin.de
	Dr.	Martin Pusch	Leibniz-Institute für Gewässerökologie und Binnenfischerei	pusch@igb-berlin.de
	Dr.	Anne van Dam	N-IHE Institute for Water Education	a.vandam@un-ihe.org

Abstract:

River and their related floodplains, wetlands and lakes are among the most complex and dynamic ecosystems and often still represent biodiversity hotspots. They are generally recognized as indispensable for key regulating ecosystem services such as freshwater provision, natural water purification, net carbon sequestration, flood protection as well as biodiversity and food provision. They provide 'nature-based solutions' for several Sustainable Development Goals (SDGs) from their very nature. In freshwater ecosystems physical and ecological processes have been historically modified, leading to a loss in the capacity to provide ES, underlying that, despite international agreements, laws and directives on their

protection and 'wise use', these services are often not well valued in practice. The quantification of these services is still not consistent, and case studies that include various ecosystem services are still not common (Hanna et al., 2018).

Moreover, in several catchments, conflicts have arisen among the different stakeholders involved in the management of freshwater ecosystems, whereby the decision makers have to deal with legal constraints from different laws. The contribution of rivers and wetlands to these services depends on local or regional context. The efficacy of international policies would benefit from a global picture of these services, and generalized insights on their effectiveness dependent on circumstances, hydrological and ecological features, use and management, and how they will react to climate change. This would bring the 'climate' and 'nature' communities closer together. This session aims to combine modelling and assessment studies on ecosystem services from different wetland types from various climatic regions to help building this global picture and to sustain international policy goals.

The session begins with three opening talks about different ES projects. In the RESI project – River Ecosystem Service Index – an integrated approach was developed that uses several indicators to quantify various ES provided by rivers and floodplains as well as their synergies and trade-offs for different case studies in Germany (Podschun et al. 2018). The HyMoCARES project aimed to develop a conceptual framework and operational tools to integrate ES in Alpine river basin planning and management, with a special focus on hydromorphological factors. A third introduction will be on a project incorporating aquatic ecosystem services in a global-scale environmental model (Janse et al., 2019). Furthermore, we invite studies that deal with the ES quantification in riverine and wetland ecosystems and studies that deal with the analysis of ES bundles, synergies, and trade-offs, from the catchment to the global scales. This session is linked to another session about: "Frontiers in Planning and Implementing Nature-based Solutions in River Landscapes: Insights and Innovations from Interdisciplinary Research".

Goals and objectives of the session:

Bring together modelling and assessment studies at global or regional scales on the ecosystem services of inland wetlands and lakes, to assess general insights for prioritization of protection measures, wise use and management of these ecosystems. We explore how the ES can support river basin management through: – necessary data quantity and quality for a sound assessment of the ES in riverine ecosystems – exchange of experiences of development and use of methods (e.g., qualitative methods, quantitative methods, models) to quantify riverine ES – cross-sectoral approach for the management of riverine landscapes (analysis of bundles, synergies, and trade-offs; scenarios; implementation of the ES concept in practice). This session, together with the session on Implementing nature-based solutions in river

landscapes, also aims to contribute to the (re)activating of the ESP Working Group on Inland waters.

Planned output / Deliverables:

To be decided: joint publication or special issue, contribution to a policy-oriented forum.

Related to ESP Working Group/National Network:

Biome working group: BWG 2A – Freshwater

II. SESSION PROGRAM

Date of session: Tuesday, 22 October 2019
Time of session: 10:30 – 15:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
10:30–10:35	Mauro	Carolli	Leibniz-Institute of Freshwater Ecology and Inland Fisheries	Introduction to the session
10:35–10:45	Simone	Podschun	Leibniz-Institute of Freshwater Ecology and Inland Fisheries	Assessing the ecosystem service composition in rivers and floodplains – The River Ecosystem Service Index (RESI)
10:45–10:55	Lena	Hornung	Leibniz-Institute of Freshwater Ecology and Inland Fisheries	Linking ecosystem services and measures in river and floodplain management
10:55–11:05	Mauro	Carolli	Leibniz-Institute of Freshwater Ecology and Inland Fisheries	Hydromorphology and river ecosystem services: the HyMoCARES project
11:05–11:15	Nangware Kajia	Msofe	School of Environment, Northeast Normal University, Changchun 130024, China	Planning and management of the riverine ecosystem: Estimates of ecosystem services values response to land use/cover change on the Kilombero River catchment, Southern Tanzania

Time	First name	Surname	Organization	Title of presentation
11:15–11:25	Stefano Davide	Murgese	SEAcoop STP	Ecosystem services valuation for the definition of protected areas management plans and for increasing climate change resilience: the case of Riverine Gesso and Stura Park (Cuneo Province, Piedmont Region, Italy)
11:25–11:35	Agnes	Vari	MTA Centre for Ecological Research, GINOP Sustainable Ecosystems Group, Tihany	Flood regulation as an ecosystem service – disentangling mechanisms, frameworks and the messages behind assessments
11:35–12-00				Discussion
13:30–13:40	Yonatan	Yaakobi	The Porter School of the Environment and Earth Sciences (PSEES), Tel Aviv University	How much is an urban stream worth? Economic assessment of cultural ecosystem services of an urban stream in the Galilee
13:40–13:50	Kåre	Flatlandsmo	Økosystemtenester AS	Environmental cost of hydropower production
13:50–14:00	Jan H	Janse	PBL Neth. Environmental Assessment Agency, Den Haag, the Netherlands	Towards a global model for regulating ecosystem services of inland wetlands
14:00–14:10	Ralf-Uwe	Syrbe	Leibniz Institute of Ecological Urban and Regional Development	Ecosystem services and stakeholder perspectives in mangrove forests. Results from Singapore, Brazil, Fiji, and South Africa
14:10–14:20	Vytautas	Narusevicius	Vilnius University	Challenges of ecosystem services assessment in protected small islands of inland waters
14:20–14:30	Session organizers			Synthesis: approaches for aquatic ecosystem services

Time	First name	Surname	Organization	Title of presentation
14:30–15:00	All participants			General discussion: (a) Perspectives for ecosystem services of aquatic systems; (b) Reviving the ESP working group on freshwater ecosystems

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: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Hydromorphology and river ecosystem services: the HyMoCARES project

First author: Mauro Carolli

Other author(s): Martin Pusch

Affiliation: Dept. 2 Ecosystem Research, Leibniz-Institute für Gewässerökologie und Binnenfischerei, Berlin, Deutschland, Germany

Contact: carolli@igb-berlin.de

Rivers and their floodplains support human activities with several important ecosystem services. Alpine rivers flow into densely populated and intensely used areas, they have been historically exploited for their services, and their hydrology and morphology have been profoundly regulated and modified. Hydromorphology has a fundamental role in shaping and maintain river habitats, river landscapes and the related ecological functions and its alterations have consequences on the provisioning of ecosystem services. In the HyMoCARES project we developed an approach to identify qualitatively through a conceptual framework the relationships among river restoration actions (and management actions in general), hydromorphology and river ecosystem services. HyMoCARES is a project funded by the EU Interreg Alpine Space which involves thirteen partners from six different countries. By applying a set of tools (e.g. hydrological modelling, hydraulic modelling, habitat modelling) as well as using existing data, we quantified, when possible, effects of hydromorphological changes on

river ecosystem services. This approach has been applied to several case studies that involves different management actions and restoration projects, planned or already realized. In detail, we are going to describe the effects of water withdrawals, the effects of channel widening and the effects of artificial replenishment of sediments. Consequences on ecosystem services are described qualitatively for all the involved services and quantified when possible, including effects of selected actions in climate change scenarios. We targeted management actions and restoration projects that are common in the Alpine space, with the final aim to provide a framework to assist decision makers in the management of river ecosystems.

Keywords: hydromorphology, restoration projects, river management, tools, framework

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

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Environmental cost of hydropower production

First author: Kåre Flatlandsmo
Affiliation: Økosystemtenester AS, Norway
Contact: kaare@okosystemtenester.no

Norwegian governmental authorities have recently initiated a work to revise the terms of numerous hydropower licenses. The licenses are due for revision of their environmental and production conditions based on a priority list presented by the authorities. High priority is given to watersheds where substantial environmental benefits may be achieved combined with a goal of keeping the loss of hydropower production at a minimum.

The scope of work presented here has been to develop a guide to be utilized by environmental organizations (NGOs – Non-governmental organizations). The topic is how to get involved in a correct manner to the process of revising the terms, and how to be able to influence the process.

An ecosystem services approach has been adopted to quantify the damage of nature caused by hydropower production. The scope of work is based on a Contingent Valuation survey constructed with scenarios which offer possible future project alternatives or governmental actions. The basic valuation study was carried out some 15 years ago, and methods of benefit

transfer has now been adopted to adjust the damage cost of hydropower production in time and space accordingly. The present scope shows that there is a linear correspondence between the extent of hydropower production and the corresponding damage cost of nature. In general, damage cost amounts to approximately 1/3 of the value generated by hydropower production. This is, however, not including the recent impact of tourism and the value of increasing outdoor life in general.

An important part of the presented work has been to analyze the implementation of the EU Water Frame Directive into national legislation. There seems to be a contradiction between the sectorial aims of hydropower production and the general goals of the Water Frame Directive which still are to be solved at a national level.

Keywords: Environmental cost, Hydropower, Ecosystem Services, Contingent Valuation, EU Water Frame Directive

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

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Linking ecosystem services and measures in river and floodplain management

First author: Lena K. Hornung
Other author(s): Simone A. Podschun, Martin Pusch
Affiliation: Leibniz-Institute of Freshwater Ecology and Inland Fisheries. Mueggelseedamm 301, 12587 Berlin, Germany
Contact: lena.hornung@posteo.de

The management of rivers and floodplains is subject to multiple legal frameworks. Thus, methods that allow the comparison of different management options are needed. With the aim of elaborating a comprehensive overview on the potential impact of river and floodplain management measures on ESS provision, we developed a matrix approach combining a scientific literature review and an expert-based approach.

Here, we present an applicable and transparent matrix approach for Central Europe linking an array of 17 management measures with the provision of 23 ecosystem services (ESS). In the overall matrix, 44 % of the links were found to be positive or strongly positive and 11 % were negative or strongly negative, while the other links were characterized as ambiguous or with no effects. Overall, the effect spectra of management measures on various ESS often indicate reduced provisioning ESS, in particular those related to agriculture, while regulating and cultural ESS are increased. The management measures habitat restoration, floodplain restoration and flood risk reduction on agricultural land showed the most positive effects on ESS, followed by dyke relocation. Besides the evaluation of the measures, the comprehensive approach enabled to uncover knowledge gaps considering the effects of management measures for the ESS retention of Corg, N or P, and cultural ESS.

Taking such an integrative approach enabled us to (a) provide a comprehensive overview and identify gaps in research, (b) show potential unintended positive or negative effects of MM commonly implemented under the WFD and FRD regarding effects on the river and the floodplain, (c) identify MM that influence a particular high number of ESS in a positive manner, or produce a low number of trade-offs. With this, the matrix provides a basis to inform decision makers using the ESS approach to foster the cross-sectoral management of rivers and floodplains.

Keywords: matrix, Water Framework Directive, multifunctional, integrated management, expert-based approach

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

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Towards a global model for regulating ecosystem services of inland wetlands

First author: Jan H. Janse

Other author(s): Jeroen J.M. de Klein, Lucas dos Santos, Anne A. van Dam, Edwin Hes, Jos T.A. Verhoeven

Affiliation: PBL Neth. Environmental Assessment Agency, Den Haag, and Neth. Inst. of Ecology NIOO-KNAW, Wageningen, The Netherlands

Contact: jan.janse@pbl.nl

Natural wetlands play an important role in the provision of key ecosystem services like the provision of clean water to the world, carbon sequestration, adaptation to climate change, and support for biodiversity; although they are sometimes also associated with adverse climate effects. Despite their value, wetlands are disappearing at an alarming rate, and the remaining wetlands are threatened by hydrological changes, pollution and climate change. Policy makers at the global level need to know to what extent, on the global scale, these ecosystem services are impaired, how this links to global land-use and climate change, and how wetlands functioning can be improved to optimize these services. Wetlands are, however, currently grossly under-represented in global environmental models and assessments (Janse et al. 2019, Curr. Op. Env. Sust. 36, 11-19).

Here we present the outlines of a generic model describing the effects of climate and land-use changes on the functioning of freshwater wetlands world-wide, expressed in terms of area and water resources, biomass production, carbon emissions, water quality and threats to biodiversity. Core variables are water level, nutrients, carbon and vegetation. The main processes linking these are described in a generic way, building on existing elements, accounting for climate zones and main wetland types (rain-/groundwater fed and floodplain wetlands) as minimally necessary for a global picture. The model is embedded in, and receives input from, existing global hydrological, climate and land-use models. It projects the contribution of wetlands to key (regulating) ecosystem services linked to the Sustainable Development Goals, and may serve as a background for more specific regional assessments. The model has been preliminarily tested with input from various climate regions, and is now

apt for validation, for which we seek cooperation with colleagues from different parts of the world.

Keywords: global hydrology, water quality, carbon sequestration, climate adaptation, biodiversity

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

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Planning and management of the riverine ecosystem: Estimates of ecosystem services values response to land use/cover change on the Kilombero River catchment, Southern Tanzania

First author: Nangware Kajia Msofe
Other author(s): Lianxi Sheng, Li Zhenxin, James Lyimo, Mengistie Kindu
Affiliation: School of Environment, Northeast Normal University, Changchun 130024, China
Contact: mof742@nenu.edu.cn

Land use/cover change (LUCC) attributed to natural factors and human activities are a major driver behind the loss of ecosystem services. We assessed changes in ecosystem services values (ESV) due to LUCC during the period 1990–2018 in Kilombero River catchment in southeastern Tanzania, which contains one of the largest inland freshwater wetland. The LULC analysis used moderate resolution Landsat images of 1990, 2004 and 2008 and analyzed using Maximum Likelihood Classification (MLC) algorithm. The ESVs were estimated by using modified value coefficients. The results revealed that forest, grassland, wetland and water declined by whereas agriculture and bushland increased during the 1990–2018 periods. Consequently, the total estimated ESVs of the Kilombero catchment decreased by US$ 396.4 million (10.8%) during the study period. The loss of ESV is attributed to significant decreased in the values of individual ecosystem functions such as water regulation, waste treatment, erosion control, climate regulation, water supply, nutrient cycling and habitat/refugia. The findings of this study provided a means to compare magnitude of changes in ESVs which can be used as the bases for discussion during formulation of the strategies for the management and conservation of the Kilombero River catchment and inform various stakeholders on the trade offs involved in land resources uses of this freshwater ecosystem.

Keywords: Land use/cover change; Landsat images; ecosystem services values; Kilombero River catchment; land resource uses

6. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Ecosystem services valuation for the definition of protected areas management plans and for increasing climate change resilience: the case of Riverine Gesso and Stura Park (Cuneo Province, Piedmont Region, Italy)

First author: Stefano Davide Murgese
Other author(s): Mariolina Pianezzola, Emma Paola, Salizzoni Giorgio, Quaglio Laura, Canalis Stefano, Crosetto Marta, Cimini Marco Allocco
Affiliation: SEAcoop STP, Italy
Contact: murgese@seacoop.com

Protected areas management plans are generally based on information collected within parks/reserves borders, whereas dynamics influencing ecosystems often develop at larger scale. Ecosystem Services (ES) valuation allow overcoming this potential limitation (i.e. the study of nutrient concentration of water must be extended to hydrological/hydrogeological watersheds). Furthermore, indicators based on ES provide a direct information on policies performances regarding biodiversity and ecosystems resilience to climate change (CC) impacts and allow the prompt activation of corrective measures. Finally, the monetary value of ES provision by protected areas is an effective communication tool when dealing with other land-management authorities and for public information.

Based on these considerations, for the definition of the Riverine Gesso and Stura Park Management Plan, the valuation of specific ES was introduced as support tool to define management indicators. ES were selected according to three main factors: (1) institutional goals of the Park, (2) specific environmental conditions of investigated areas and their surroundings, (3) the ongoing definition of the Forestry Management Plan for the riverine corridor, that includes the studied protected areas. Considered ES were the following: food provision, potential wood provision, climate regulation (carbon sequestration), habitat quality, nutrient regulation in freshwaters, flood risk mitigation, educational activities.

The ES valuation provided the following outputs, which were included in the Riverine Gesso and Stura Park management plan: (a) performance indicators based on ES valuation that depict, in a comprehensive manner, the impacts of climate modifications on ecosystems, allowing a consistent management activity to preserve and increase protected-areas resilience to CC; (b) specific ES influence areas to be considered for the definition of effective management policies and for the calculation of ES indicators; (c) a communication tool to increase people awareness on the relevance of nature conservation.

Keywords: ecosystem services, riverine ecosystems, climate change, environmental indicator, resilience

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

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Challenges of ecosystem services assessment in protected small islands of inland waters

First author: Vytautas Narusevicius
Affiliation: Vilnius University, Lithuania
Contact: narusevicius.vytautas@gmail.com

As a result of first steps of implementation of the LIFE project in Lithuania on proper management of the habitats as well as creation of new suitable breeding sites in Special Protected Areas for species of EU importance, the uncommon issue appeared during the selection of appropriate basic ecosystem for further identification of relevant ecosystem services to be monitored, taking into account the specificity of the target sites (small islands and sandy floodplains in inland water bodies, scattered in the territory of Lithuania) and their habitats, as well as the Project activities (restoration and management of above mentioned sites). The exercise was solved by selecting the most relevant ecosystem services, common to sparsely vegetated areas and dunes.

Main user groups of ecosystem services in the Project areas were identified as follows: local community (benefiting from the full spectrum of ecosystem services), inhabitants of surrounding municipalities and users of the Project areas on the national level – numerous visitors of state protected areas, lakes, watercourses and other recreational and ecotourism

destinations, situated relatively close to the Project activities' areas. But, taking into account, again, specificity of expected Project impact and some already existing overuse and disturbance practices in the Project activities' sites, even social survey results in some cases could not guarantee expected outputs in the increase of positive and sustainable use of provided and improved cultural services.

The presentation is expected to open at least short discussions again about the scaling and restored ecosystem services evaluation in specific cases when these areas have a limited public access.

Keywords: Small islands, inland waters, protected areas, social survey, maintenance and cultural ecosystem services assessment

8. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Assessing the ecosystem service composition in rivers and floodplains – The River Ecosystem Service Index (RESI)

First author: Simone Podschun
Other author(s): Lena Hornung, Martin Pusch, RESI Team
Affiliation: Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Germany
Contact: podschun@igb-berlin.de

Aiming at the optimization of single uses, rivers and floodplains have been intensely used and altered over the past centuries. Despite the inherent connectivity of river and floodplain ecosystems integrated assessment and thus management approaches are lacking. The ecosystem service (ES) concept could support a comprehensive evaluation of management alternatives by assessing their impact on the ecosystem and human wellbeing in an integrated way. However, ES studies on riverine landscapes are still rare, are quite case study specific (due to the complexity of these ecosystems) and are focused on a few ES. Hence, we aimed to develop a River Ecosystem Service Index (RESI) designed to assess the various ES offered by rivers and floodplains, which could be used to assist decision making processes towards integrated management approaches.

Here we present three case studies in Germany: Danube, Nebel and Nahe, where provisioning, regulating and cultural ES were assessed. The methods were developed using available data (e.g. environmental monitoring, land use) and reported in standardized indicator factsheets for each ES. All ES assessments refer to the uniform RESI scale ranging from 1 (very low) to 5 (very high) ES supply and were performed based on the common spatial scale of 1 km river-floodplain sections (including the compartments active, non-active floodplain and river course). The results clearly show changes in ES composition and enable the analysis of interactions between the ES comparing different river-floodplain sections as well as status quo and scenarios. Through the spatially explicit RESI the consequences of management measures become transparent to stakeholders. Hot and cold spots of ES supply could be recognized, providing insights into best management areas and areas with a high potential for development. Hence, using ES as a common language, the RESI facilitates interdisciplinary thinking and management, and thereby enhances the knowledge exchange between science-practice.

Keywords: bundles, trade-offs, freshwater, GIS, blue infrastructure

9. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Ecosystem services and stakeholder perspectives in mangrove forests. Results from Singapore, Brazil, Fiji, and South Africa

First author: Ralf-Uwe Syrbe
Other author(s): Karsten Grunewald, Robin Gutting, Véronique Helfer, Chris Ulpinnis, Hauke Reuter, Olga JeskeMartin Zimmer
Affiliation: Leibniz Institute of Ecological Urban and Regional Development, Germany
Contact: r.syrbe@ioer.de

The conservation of mangrove areas and their biodiversity requires a sound knowledge of land-use impacts and the related threats to the ecosystem. Mangrove forests provide many ecosystem services, which are not only essential for local population, but also for connected ecosystems nearby, and the global climate. This study identifies and characterizes the main ecosystem services of mangroves, based on empirical work with stakeholders conducted in the frame of the DiSeMiNation project. Detailed analyses of sediments from corresponding

mangrove ecosystems link stakeholder perspectives with those ecosystem processes that underlie the above services. This will be translated into recommendations for sustainable use by local communities, and contribute to the spatial planning.

Mangrove forests in four countries, namely Singapore, Brazil, Fiji and South Africa, have been examined through stakeholder surveys and workshops with scientists, conservationists, government officials, community leaders, educators, resource users, and coastal managers. This presentation shows preliminary results. The most appreciated services of mangrove ecosystems are their nursery function and cultural (e.g. recreational, educational) values. These are followed by regulating services like erosion control and carbon storage. Only in the Brazilian and Fijian study areas, where the extraction of food and other life-supporting goods are explicitly allowed for local population, the provision of crab, fish and wood have been highly valued, too.

The stakeholders' opinions about governance differ considerably. Conservationists and fish companies would like to forbid the extraction. Neighboring inhabitants require the permission to use crabs, fish, timber and other mangrove goods. However, some of them also ask for a fair control to prevent unsustainable use and commercial extraction in large amounts. The project team seeks for approaches to 'transfer' its scientific findings into management using the identified knowledge gaps that have been addressed.

Keywords: Wetlands, Intertidal, Governance, Nature conservation

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

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Flood regulation as an ecosystem service – disentangling mechanisms, frameworks and the messages behind assessments

First author: Agnes Vari

Other author(s): Zsolt Kozma, Zsolt Pinke, Zsolt Jolánkai, Géza Jolánkai, Beáta Pataki, Bálint Czúcz

Affiliation: MTA Centre for Ecological Research, GINOP Sustainable Ecosystems Group, Tihany, Hungary

Contact: vari.agnes@okologia.mta.hu

Flood events have been increasing in recent decades and pose an ever greater risk to human settlements and landscapes under intense anthropogenic use. The efficiency of artificial flood protection infrastructure has been questioned in the light of increasing extreme weather issues and rising defence costs, therefore it is rather the flood regulation capacity of the natural landscape that has to be focused on. For evaluating the ecosystem service (ES) "flood regulation" within the ES framework, however, it is important to define it in a clear and consistent way.

This is a challenging task for several reasons. (1) The different frameworks (TEEB, MA, CICES) do not define and categorize flood regulation clearly, (2) the definitions do not comply with the actual hydrologic functions underlying the process of "flood regulation" and (3) the cascade framework of ES (especially the question of what is the "potential ES") is difficult to fit with present day human-made geomorphologic changes within former floodplains.

The present work considers these aspects and proposes a (conceptual) framework in order to assess "flood regulation" ES in a way, which reflects the physical processes better, and is also more responsive to decision making needs. This framework relies on a small systematic review clarifying the features decisive for regulating floods and sets them into relation with other factors (management measures) as well as other ES. It also offers a solution towards a more integrated water management strategy: a risk-based assessment of benefits/losses versus measures as offered by the EU Floods Directive too, is considered and an alignment to the ES

concept is drafted. We illustrate this framework with aspects from the Hungarian national MAES assessment.

Developing a clear picture helps to achieve a climate-smart land use and water management and to move towards nature based solutions for efficient flood management.

Keywords: hydrology, water retention, flood mitigation, potential ecosystem service, alternative land use scenarios

11. Type of submission: ***Abstract***

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

How much is an urban stream worth? Economic assessment of cultural ecosystem services of an urban stream in the Galilee

First author: Yonatan Yaakobi
Other author(s): Avital Gasith, Nir Becker
Affiliation: The Porter School of the Environment and Earth Sciences (PSEES), Tel Aviv University, Israel
Contact: yoni.yaakobi@gmail.com

Streams cross and border numerous different cities worldwide. Urban streams are phenomenal assets that contribute to residents' social, economic and cultural well-being. Especially in Israel where 90% of the population is urban, being amongst the highest in the world. However, urban streams have often been overlooked, hidden, buried and degraded.

The water of the Ein-Zahav Stream, which crosses the city Kiryat Shemona in the Upper Galilee-Israel, was pumped for many years to provide drinking water for the residents as well as for a mineral water company. This act has caused the stream to run dry. Following public pressure, the stream flow was restored, but since, the stream and its surrounding park continue to be threatened.

The goal was to conduct an economic evaluation of the non-material benefits people obtain from recreation at the Ein-Zahav Stream and quantify these values against a situation where the stream does not function anymore.

We conducted ten stakeholder interviews, a face-to-face survey with residents and visitors (N=208) and over 50 observations. Economic evaluation of these benefits was carried out by three non-market valuation methods: Travel Cost Method, Contingent Valuation Method and Choice Experiment.

Results show that the annual benefit from flowing water in the stream for recreation purposes is estimated at 0.178 million Euros/per year, while the total value of the stream includes non-use values of 580 million Euros/per year. The water component is worth 4 Euros/per visit, while the streambanks are worth 3 Euros/per visit.

The results indicate the substantial value of the stream for recreation. Which is generally similar to what was found in other streams in Israel and elsewhere. This study supports other reports that underscore the importance of quantifying non-market benefits of recreation in urban nature and can assist decision-makers in taking informed decisions regarding the stream and its banks

Keywords: urban stream, cultural services, travel cost method, contingent valuation method, choice experiment