BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: S5

Progress and challenges in the operationalization of the ecosystem services approach into policy & practice for aquatic resources management

Hosts:

	Title	Name	Organisation	E-mail
Host:	Prof. Dr.	Mary Kelly-Quinn	University College Dublin	mary.kelly-quinn@ucd.ie
Co-hosts:	Prof. Dr.	José María Bodoque del Pozo	University of Castilla-La Mancha	josemaria.bodoque@uclm.es
	Prof.	Mike Christie	Aberystwyth University	mec@aber.ac.uk
	MSc.	Joost Backx	Rijkswaterstaat	joost.backx@rws.nl
	Dr.	Marieke de Lange	Rijkswaterstaat	marieke.de.lange@rws.nl

Abstract:

Although the concept of ecosystem services has been the focus of a considerable body of research for more than a decade, there is little evidence that this science has become streamlined within policy or practice or used in decisions to restore natural capital and use it sustainably. This special session is proposed and hosted by researchers in the EU Joint Programming Initiative (JPI) Thematic Annual Programming (TAP) project AQUATAP_ES. This, the first Water JPI TAP, brings together researchers on ecosystem services from freshwater and marine disciplines and is considering what is needed to foster integration of the ecosystem service concept into decision-making relating to the management of aquatic resources. This proposed session will invite presentations that address progress, challenges and impediments in relation to operationalisation of ecosystem services science into policy and practice. Presentations will cover lessons learned from case studies and the tools and supports needed by stakeholders. This special session will also provide an opportunity to present experience and advise in relation to communicating with stakeholders.

Goals and objectives of the session:

The overall goal of the session is to take stock of progress in relation to the integration of ecosystem services science into aquatic resources management.

1. Provide a synthesis of progress and experience in operationalisation of the ecosystem services approach. This would be illustrated with case studies.
2. Highlight the key challenges and impediments. Here again case studies would be useful.
3. Identify the range of accessible and relevant tools available to stakeholders for analysis and decision support.

Planned output / Deliverables:

A special issue of a relevant journal/ Policy brief

Related to ESP Working Group/National Network:

Sectoral working group: SWG 5 – ES in Water management

II. SESSION PROGRAM

Date of session: Thursday, 10 June 2021

Time of session: 9:30 – 12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
9:30 9:45	Marko	Vainu	Estonian Environment Agency	Progress and challenges of the assessment of river ecosystem services in Estonia: the case of Viru subcatchment
9:45 10:00	Robert	Aps	University of Tartu	Indicators of marine ecosystem services inform the Baltic Sea ecosystem-based fisheries management and the maritime spatial planning
10:00 10:15	Daniel	Norton	Limerick University	Natural capital accounting: integrating ecosystem services into catchment management
10:15 10:30	Sonja	Wanke	Deltares	Addressing Ecosystem Services within Integrated Multi-Trophic Aquaculture (IMTA) Systems and Conventional Aquaculture Systems through Bayesian Networks
11:00 11:15	Marcin	Penk	University College Dublin	An ecosystem service-based decision-support tool for river basin management
11:15 11:30	Michael	Christie	Aberystwyth University	An evaluation of the ecosystem service benefits associated with achieving the EU WFD target of all rivers attaining 'satisfactory' ecological condition

Time	First name	Surname	Organization	Title of presentation
11:30 11:45	Lukas	Ritzenhofen	Leibniz-Institute for Baltic Sea Research Warnemünde & Marine Research Institute, Klaipeda University	Ecosystem Service Assessment within the Water Framework Directive - Mussel Cultivation as Controversial Measure
11:45 12:00	Claudia	Caro	UNALM	Ecosystem services as a resilience descriptor in habitat risk assessment using the InVEST model
12:00 12:15	Eerika	Albrecht	University of Eastern	Trade-offs between hydropower and biodiversity - A case study on water governance in Kemi river basin
12:15 12:30	José	Bodoque	University of Castilla-La Mancha	Data and modelling needs to support integration of the ecosystem services approach into water resources management

III. ABSTRACTS

Abstracts are ordered based on the session program. The first author is the presenting author unless indicated otherwise.

1. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 – Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Progress and challenges of the assessment of river ecosystem services in Estonia: the case of Viru subcatchment

Presenting author: Marko Vainu
Affiliation: Estonian Environment Agency, Estonia
Contact: marko.vainu@envir.ee

The methodology for assessing the provision and consumption of aquatic ecosystem services in Estonia was first developed in 2016, but it was never applied in practice. In 2019, the project LIFE IP CleanEST was initiated by the Estonian Ministry of the Environment. Its general aim is to

improve the status of water bodies in the Viru subcatchment in northeastern Estonia. One of the project actions is to compile a practically applicable methodology for assessing aquatic ecosystem services and to test the methodology on water bodies in the project area. The assessment results were, on one hand, meant to provide information for choosing the locations, where activities improving the status of the water bodies would likely result in the largest improvement in the provision of the services. On the other hand, repeated assessment results are to be used in the end of the project to evaluate the success of the activities. If the assessment of ecosystem services proves to be an applicable and effective measure in the test area, then the Ministry is interested in applying it more generally in Estonian aquatic resources management. To achieve the goal set by the project, the 2016 methodology was taken as a starting point. Firstly, the focus was set on the services provided by river ecosystems. The list of lotic ecosystem services relevant for Estonia was updated according to the classification of CICES v.5.1, and the list of indicators for measuring the provision/status and the consumption/pressure of the services was reworked. It covers 20 services and ca. 80 indicators. The methodology was applied on 20 Water Framework Directive water bodies in northeastern Estonia using data from 2019 and 2020. In the presentation, the methodology, the results of the first assessment, the encountered challenges and possible policy inputs will be covered.

Keywords: aquatic ecosystem services, Estonia, rivers, assessment methodology, assessment results

2. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 – Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Indicators of marine ecosystem services inform the Baltic Sea ecosystem-based fisheries management and the maritime spatial planning

Presenting author: Robert Aps
Other author(s): Jonne Kotta, Liisi Lees
Affiliation: Estonian Marine Institute, University of Tartu, Estonia
Contact: robert.aps@ut.ee

The marine ecosystem services (MES) are the direct and indirect contributions of marine ecosystems to human well-being and a crucial issue in this context is to consider the direct or indirect nature of MES. Therefore, prior to benefits being realized, some MESs need to be coupled with other forms of capital, i.e. they contribute indirectly to human well-being. The aspect of direct and indirect services is relevant to maritime spatial planning (MSP), ecosystem-based management (EBM) and decision-making where the implications of different management measures are evaluated. In a case of provisioning MES 'Sea Food', the fishing gear, vessel, and fuel is required to catch fish; moreover, specific knowledge is needed, for instance, which 'Sea Food' can be harvested where and when. The Baltic Sea internationally regulated fisheries are managed under the EU's Common Fisheries Policy (CFP) by using the Total Allowable Catches (TACs) and including the input from Regional Baltic Sea Fisheries Forum (BALTFISH) and the Baltic Sea Advisory Council. As a first step, the fishing mortalities and spawning stock sizes of the Baltic Sea internationally regulated pelagic fishery resources are evaluated by International Council for the Exploration of the Sea (ICES) against maximum sustainable yield (MSY) and precautionary approach (PA) reference points. As an example, the relevant MES 'Sea Food' indicators are: (1) the amount of fish landed, (2) capital investment required (gear, vessel, fuel etc.), (3) return on investment (ROI). This study is a part of INTERREG CB project "From MARine Ecosystem Accounting to integrated governance for sustainable planning of marine and coastal areas (MAREA)". Issue is exemplified by the results of the Case Study in progress aiming at advancing the integration of MES into the ecosystem-based fisheries management (EBFM) framework and the sustainable MSP processes.

Keywords: Baltic Sea, marine ecosystem services (MES), indirect MES 'Sea Food', ecosystem-based fisheries management, maritime spatial planning

3. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 - Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Natural capital accounting: integrating ecosystem services into catchment management

Presenting author: Daniel Norton

Other author(s): Catherine Farrell, Lisa Coleman, Mary Kelly-Quinn, Carl Obst, Cathal O'Donoghue, Stephen Kinsella, Jane Stout

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The INCASE (Irish Natural Capital Accounting for Sustainable Environments) project is piloting the UN System of Environmental and Economic Accounting (SEEA) – Ecosystem Accounting (EA) at catchment scale in Ireland. We present examples from the study catchments to demonstrate how ecosystem services approaches fit within, and support the SEEA-EA, particularly from the perspective of freshwater ecosystems. Building the core accounts (extent, condition, services, benefits) of the SEEA-EA framework requires the integration of an array datasets. In Ireland, CORINE remote sensing data are presently the only standard, reliable time series data available to build extent accounts. Given the low resolution of CORINE, freshwater rivers and lakes are often undetected given they are less than the Minimum Mapping Unit (MMU). Datasets developed by the Irish Environmental Protection Agency (EPA) overlain on CORINE, inform the extent of freshwater rivers and lakes within a catchment. Data gathered under the Water Framework Directive by the EPA provides comprehensive time series data for ecological status to sub-basin level for all catchments in Ireland. Ecological status is a pre-aggregated index which may be used as a sub-index as part of Stage 3 of Condition accounts outlined in the SEEA-EA framework, and is used widely in European case studies. Further data are also gathered on pressures, and the EPA characterises rivers At Risk of achieving good ecological status in the future, allowing for identification of targeted measures. Aligning data gathered under the Water Framework Directive, with datasets from focused ecosystem services approaches, supports development of services accounts (supply and use tables) for water provisioning and water quality. However, lack of data curtails the number of water-related ecosystem services that can be considered at present. Furthermore, information on the flow of other 'competing services' such as food and timber production, is also necessary to inform decision making and make trade-offs in relation to benefits, such as the sustainable use of water resources and protection of ecosystem services.

Keywords: catchment scale, rivers, water quality

3rd ESP EUROPE CONFERENCE Tartu, Estonia 2021 7-10 June
Ecosystem Services Science, Policy and Practice in the face of Global Changes

4. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 – Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Addressing Ecosystem Services within Integrated Multi-Trophic Aquaculture (IMTA) Systems and Conventional Aquaculture Systems through Bayesian Networks

Presenting author: Sonja Wanke
Other author(s): Sophie Vergouwen, Luca van Duren
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In recent years, the Integrated Multi-Trophic Aquaculture (IMTA) approach has gained more attention as a promising circular approach towards the sustainable aquaculture practices around the globe. Several trophic levels of species are co-cultured to optimally make use of organic feed input into marine systems and reduce rest streams. Consequently, nutrient enrichment and its associated ecological impacts should be minimized. The EU funded project IMPAQT looks at the design, development, and validation of tools to enable an IMTA framework for inland, coastal and offshore production systems. A selection of the IMTA tools focuses on the use of ecosystem services in portraying the diversity, benefits, and impacts of multi-trophic aquaculture. IMTA systems can provide valuable ecosystem services such as provisioning of aquaculture products, purification of water, or oxygen production when managed correctly. In order to understand and analyse the effects of ecosystem services of an IMTA as well as the benefits compared to standard aquaculture systems, a Bayesian Network was developed. These statistical models function on the basis of causal dependencies between system elements of interest. The developed network includes various ecosystem services relevant for IMTA and compares them to the portfolio and composition of ecosystem services provided by standard aquaculture systems. The results from a comparative assessment for a North Sea and an Eastern Mediterranean Sea case study will be presented and the benefits and drawbacks of such an implemented system discussed.

Keywords: Integrated Multi-Trophic Aquaculture (IMTA), Bayesian Network analysis, ecosystem services assessment, IMPAQT

5. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 – Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

An ecosystem service-based decision-support tool for river basin management

Presenting author: Marcin Penk

Affiliation: University College Dublin, Ireland

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Surface freshwaters cover less than 1% of the Earth's surface but contribute a disproportionately high level of ecosystem services, including water for consumption and food production, regulation of flooding as well as places for recreation and appreciation of nature. However, freshwaters are among the most degraded and threatened ecosystems, undermining these services. The ecosystem services framework can be a useful management tool to facilitate a focus on targets, both in terms of pressure mitigation and ecosystem services enhancement that are of direct interest to policy makers, managers and stakeholders who are concerned with river health. We developed an evidence-based decision-support tool for Ireland's rivers using a Bayesian Belief Network (BBN) model capable of linking management decisions to the desired ecosystem service outcomes through biotic and abiotic cause-and-effect chains. Using three case studies we demonstrated that the individual and interactive effects of globally pervasive freshwater stressors can be expressed in relatively simple terms of changes to ecosystem services and benefits; focusing on wildlife value, water quality, and angling. This evidence was then presented to stakeholders and policy makers in a series of deliberative workshops, where participants could evaluate alternative policy options to identify 'shared' visions for catchment management solutions that maximise societal benefits.

Keywords: river freshwater resources, nature contributions to people, environmental management

3rd ESP EUROPE CONFERENCE Tartu, Estonia 2021 7-10 June
Ecosystem Services Science, Policy and Practice in the face of Global Changes

6. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 – Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

An evaluation of the ecosystem service benefits associated with achieving the EU WFD target of all rivers attaining 'satisfactory' ecological condition

Presenting author: Michael Christie

Other author(s): Ewa Siwicka, Michael Bruen, Craig Bullock, Hugh Feeley, Thibault Hallouin, Fiona Kelly, Mary Kelly-Quinn

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The EU 'Water Framework Directive' failed to achieve its target of having 100% of its freshwater ecosystems in 'satisfactory' ecological condition by 2015: only 40% achieved 'satisfactory' condition. A new deadline has now been set for 2027. A potential contributing factor to the lack of progress is that the benefits of enhancing water quality are not made explicit. Using the case study of freshwater ecosystems in Ireland, this research evaluates the ecosystem services benefits associated with meeting the WFD targets. Our evaluation was based on a 'choice experiment', which estimated public 'willingness to pay' (WTP) for enhancements to five river services across three river catchments. Data from these case study rivers were then aggregated to estimate the total benefits of achieving satisfactory condition across all Irish rivers. The river service most highly valued was improvements to river wildlife (€54 to €68 per household per year), water quality (€48 to €59), and water health (€45 to €59). Adding across these river services, it was estimated that, on average, Irish people would be willing to pay between €214 to €250 per household per year to meet the EU WFD targets. When aggregated to the Irish population, meeting the EU WFD targets would generate around €389m of benefits. The benefits associated with three catchment management scenarios was also evaluated. A policy of riparian management was estimated to generate river services benefits of €160m per year, while an 'Extensification' option was estimated generate €43m per year in benefits. Land-use intensification, however, was estimated to result in a welfare loss of €73m per year. Ecosystem service valuations, such as the one described above, not only demonstrate that EU citizens highly value enhancements to the ecological condition of rivers but may also provide useful information to feed into cost-benefit assessments of alternative catchment management scenarios.

Keywords: freshwater ecosystem services, river, value, choice experiments, catchment management

7. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 – Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Ecosystem Service Assessment within the Water Framework Directive – Mussel Cultivation as Controversial Measure

Presenting author: Lukas Ritzenhofen

Other author(s): Johanna Schumacher, Gerald Schernewski

Affiliation: Leibniz-Institute for Baltic Sea Research Warnemünde, Rostock, Germany; Marine Research Institute, Klaipeda University, Lithuania

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After 20 years and through two management cycles, the EU Water Framework Directive (WFD) implementation has shown only limited success. Especially inner coastal water bodies are still only rated with a ‘moderate’ or ‘poor’ ecological status. Additionally, eutrophication in most European coastal waters is expected to further increase in the upcoming decades because of human population growth, entailing intensified agriculture practice, and climate change. Land based measures are difficult to implement, because the major nutrient input emerges from diffuse sources. Supportive internal measures like mussel mitigation to combat eutrophication are recommended. Yet, they are subject of controversial stakeholder discussion, which hampers the implementation and planning process. The aim of this study is to evaluate if an ecosystem service assessment (ESA) can be a tool within the WFD implementation to support the communication with stakeholders and to improve and accelerate planning and implementation of new mitigation measures. The general suitability of a marine ESA as communication method was tested with stakeholders and experts. They compared different mussel farm mitigation scenarios for case study areas in Denmark, Germany and Lithuania. To optimize the ESA process towards a fast and comprehensible communication tool a digital and a paper based approach were compared. Finally, the ESA will be paired with a GIS based site selection approach.mFirst results show that the application of an ESA improves the discussion with stakeholders and reveals

potential misperceptions and concerns and leads to a more focused discussion. A digital ESA has the advantage of real time analysis which can accelerate the assessment process substantial. The inclusion of site selection helps stakeholders to address concerns more directly to the system which gives valuable insights to the planner.

Keywords: ecosystem service assessment, water framework directive, mussel cultivation, stakeholder involvment

8. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 – Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Ecosystem services as a resilience descriptor in habitat risk assessment using the InVEST model

Presenting author: Claudia Caro
Other author(s): João Carlos Marques, Pedro P. Cunha, Zara Teixeira
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The prioritization of habitats for conservation to ensure the maximum benefit in the long-term ability of ecosystems to provide multiple services is a crucial step in the operationalization of the Ecosystem Services Approach. Such ability can be assessed using habitats' vulnerability as a proxy. Vulnerability is a function of exposure to stressors and of sensitivity to impact and resilience. Some approaches assume that vulnerability is lower when ecosystems provide more ES, as it increases the ecosystem adaptive capacity, while others assume the opposite, as multiple activities (exploiting multiple services) introduce multiple pressures. To establish a relationship between impact risk and ES supply potential, while accounting for these two apparently conflicting assumptions, this work proposes adding ecosystem services' abundance as a resilience descriptor, assigning different weights to provisioning, regulation, and cultural services, to a habitat risk assessment (HRA) model using the InVEST tool developed by the Natural Capital Project. This study (i) applies a modified HRA model (HRA_ES-2) to 21 habitats in an Atlantic coastal region adjacent to the Mondego River, in Portugal, as a case study; (ii) compares

the results with a non-modified HRA model (HRA-1) and with other previous approaches; (iii) and explores management scenarios that could be translated into better environmental conditions for selected habitats. Results show that there are significant statistical differences between the HRA-1 model and the HRA_ES-2 model, and between the HRA_ES-2 model with approaches from other authors that also take ES into consideration. Also, the HRA_ES-2 model is more in accordance with the social-environmental realm than the HRA-1 model. With this approach the user can account not only for the resilience of ecosystems, but also for the sensitivity associated to the potential impacts if ecosystem services are in demand, in a spatial explicit manner, which is an advantage compared to other approaches.

Keywords: ecosystem services abundance, vulnerability, EUNIS habitats, management, Mondego estuary

9. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 - Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Trade-offs between hydropower and biodiversity - A case study on water governance in Kemi river basin

Presenting author: Eerika Albrecht
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The relationship between hydropower projects and biodiversity conservation at the watershed level has often been studied as an ecosystem services trade-off within the ecosystem services literature. This paper studies the ecosystem services trade-offs and balancing between the interests of hydropower and nature conservation in Kemi river basin, which is second largest river basin in Finland, located in Lapland. Although, it is a heavily altered river ecosystem with 16 hydropower plants, it is home to many arctic species, many of which are endangered. Research data consists of 10 semi-structured interviews targeted at the stakeholders that participate in the water governance in Kemi river basin. Results show that there is a need to develop sustainable and adaptive water governance, which recognizes the ecological values, needs of the local

inhabitants and tourism, and safeguard the aquatic ecosystem services. Additionally, the study reveals the conflict between 'technology and nature' as the water management in Kemi river basin relies on water engineering, whereby local movement against the hydropower development builds its argument in deep ecology as minimizing the human interference with ecosystems and protection of individual species are biotypes as intrinsic value of nature.

Keywords: hydropower, water governance, ecosystem services trade-offs, biodiversity conservation, local stakeholders

10. Type of submission: Abstract

S. Sectoral Working Group sessions: S5 - Progress and challenges in the operationalisation of the ecosystem services approach for aquatic resources management

Data and modeling needs to support integration of the ecosystem services approach into water resources management

Presenting author: Jose Bodoque

Other author(s): Mary Kelly-Quinn, Michael Bruen, Joost Backx, Marieke de Lange, Kathryn Schoenrock

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Over the last 20 years, policies concerning aquatic resources have increasingly drawn attention to the central role of ecosystem processes and associated biodiversity in ensuring sustainable delivery of essential benefits from those resources for current and future human well-being. Accordingly, the ecosystem services (ES) approach has emerged as a promising theoretical framework for coupling and communicating benefits to society from the underlying ecology and ecosystem functioning. However, migration of the ES concept from a primarily theoretical environment to practical application presents numerous difficulties, among which is lack of information on data and model needs and their availability. Given the above, the objective of this research was to identify key data that should be prioritized for collection to characterize ES and for implementing different modeling approaches. To achieve this goal, we distributed a questionnaire focused on deciphering what questions practice, policy or both need to answer

regarding ES and what data and models are required to do so. To describe modeling needs, we conducted a comprehensive review covering scientific studies published in peer-reviewed journals, together with content included in other resources such as technical reports. The results show that most of the questions that those in the practice domain need to address can be tackled using data derived from habitat/ecosystem maps, land-use inputs and water quality indicators. Concerning the policy domain, besides the above, inputs from economic modelling, stakeholder analysis and hydrological regime are also acknowledged as highly useful. Over 35 modelling tools and approaches have been identified. Provisioning ES are characterised primarily with conceptual and physically based models, although other approaches based on stochastic/mathematical or life cycle analysis are also used. To characterise regulating ES, beyond the above, biogeochemically based modelling is also employed. Finally, cultural ES are characterised from spatial pattern analysis and questionnaire surveys designed to elicit perceptions.

Keywords: water policies, biodiversity, aquatic ecosystems, ecosystem services, modeling approach