REFRESHING H_2O POLICY

An EU socio-economic workshop

COLLECTION OF GOOD PRACTICES AND SOURCES OF INSPIRATION

Compendium of experts' contributions to the workshop

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ACRONYMS

AST	Appraisal Summary Table
ATG WSD	Ad-hoc Technical Group on Water Scarcity and Droughts
ATP	Adaptation Tipping Point
BAU	Business As Usual
CAPEX	Capital Expenditures
CAP	Common Agricultural Policy
CBA	Cost-Benefit Analysis
CEA	Cost-Effectiveness Analysis
CFP	Common Fisheries Policy
CIS	Common Implementation Strategy
DAPP	Dynamic Adaptive Policy Pathway
DG ENV	Directorate-General for Environment
DPSIR	Drivers, pressures, state, impact and response
DWD	Drinking Water Directive
DWMP	Drainage and Wastewater Management Plan
EBM	Ecosystem-Based Management
EC	European Commission
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ES	Ecosytem Service
ESA	Economic and Social Analysis
EPA	Environmental Protection Agency
ERC	Environmental and resource cost
EU	European Union
FD	Floods Directive
FRD	Flood Risk Management
GDP	Gross Domestic Product

GES	Good Ecological/Environmental Status
HEU	Horizon Europe
HEM	Hydro-Economic Model
MCA	Multi-Criteria Analysis
MPA	Marine Protected Area
MS	Member States
MSFD	Marine Strategy Framework Directive
MSP	Marine Spatial Planning
NBS	Nature-based Solutions
NCA	Natural Capital Accounting
NGO	Non-Governmental Organization
NWEBS	National Water Environment Benefit Survey
OFB	Office Français de la Biodiversité
ONF	Office national des forêts
OPEX	Operational Expenditure
PoM	Programme of Measures
POMESA	CIS Working Group on Programme of Measures, Economic and Social Analysis
PPP	Polluter-Pays Principle
QALY	Quality-Adjusted Life Years
RBD	River Basin District
RBMP	River Basin Management Plan
SEA	Socio-Economic Assessment
SEEA-EA	System of Environmental Ecosystem Accounting – Ecosystem Accounting
SIVOM	Syndicat Intercommunal à vocation multiple
SME	Small and Medium Enterprise
UN	United Nations
UWWTD	Urban Wastewater Treatment Directive
WATECO	CIS Water Economics Working Group (former)
WFD	Water Framework Directive
WG	Working Group
WINEP	Water Industry National Environment Programme

WRMPS	Water Resource Management Plan
WWTP	WasteWater Treatment Plant

FOREWORD

The Refreshing H2O Policy workshop was held in Rotterdam on January 30-31 and February 1, 2023 in Rotterdam, the Netherlands, and organized by a group of European organizations active in research and consultancy in support to environmental policy making, illustrated below.

Most co-organizers also had a role in the workshop as topic leaders, in charge of introducing contributors, facilitating the discussions and summarizing the main outcomes. This document presents the synthesis of the workshop's discussions. It was developed by ACTeon building on the synthesis of the thematic discussions prepared by the topic leaders during the workshop; in particular, we would like to thank:

- ACTeon (France): Pierre Strosser, Gloria De Paoli, Rianne van Duinen, Cecilia Consalvo, Cloé Rivière and Clara Jarry;
- OECD (Organization for Economic Cooperation and Development): Aude Farnault;
- IIASA (International Institute for Applied System Analysis; Vienna): Taher Kahil;
- Universidad de Alcalà (Spain): Carlos Mario Gomez, Josefina Maestu:
- Rijkswaterstaat (Ministry of Infrastructure and Water Management, the Netherlands): Rob van der Veeren;
- OFB (French Office of Biodiversity, FR): Julien Gauthey.

Nevertheless, the largest credits for the contents of this document go to workshop contributors and participants: the organizing committee wants to thank all of them for providing their ideas, inputs and enthusiasms on the socio-economic aspects of blue policy for the whole duration of the workshop.

KEY HIGHLIGHTS

The Refreshing H2O Policy workshop provided a space for policy makers, practitioners and environmental / ecological socio-economists to get together and identify the disruptive breakthroughs in social and economic thinking required to support European Blue policy transition in facing present and future challenges, including climate change.

The workshop built on experiences in applying social and economic thinking, methods and tools to support decision making at different scales (local, metropolitan area, catchment, river basin and sea basin) including in the context of the implementation of the Water Framework Directive and the Marine Strategy Framework Directive. Sources of inspiration from "beyond the blue", including biodiversity and climate change, were also welcome. New perspectives, approaches and ideas were injected into the debate thanks to, among others, the participation of a young professionals from different disciplines and policy domains.

"Blue" or "H2O" management and policy encompasses management and policy decisions at different scales for both fresh and marine waters, bringing an overall integrated source-to-sea perspective.

The Refreshing H2O Policy workshop: key highlights

NOTE TO THE READER

The Refreshing H2O Policy workshop built on a rich basis of contributions by experts from all over Europe and beyond, on eight themes:

- Capturing the socio-economic importance of freshwater and marine ecosystems;
- Cost-recovery and financing;
- Decrypting our future;
- Supporting choices and decisions on priority actions;
- Uncertainty, shock and resilience;
- Supporting policy making with a natural capital perspective;
- Social challenges and change of behavior;
- Policy processes and governance.

The overall results of the workshop, including the main highlights of the thematic discussions and the plenary sessions, are presented in the workshop synthesis available at www.refreshingh2o.eu

This document, in turn, gathers all expert contributions and, thus, it is **a unique and rich collection of good practices in applying social and economic thinking in support to blue policy and management**, which can serve as a source of inspiration for those policy makers, researchers and practitioners wanting to innovate their current practices and make further step towards in facing present and future challenges, including climate change.

For further information, you can write a message to: contact@refreshingh20.eu

If you are interested in one or more of the good practices presented here, and you wish to contact the author(s), you can find the email address to be contacted on top of each contribution.

CAPTURING THE SOCIO-ECONOMIC IMPORTANCE OF FRESHWATER AND MARINE ECOSYSTEMS

ASSESSMENT OF COST OF DEGRADATION OF MARINE WASTE IN FRANCE UNDER SOCIO-ECONOMIC ANALYSIS OF FRESHWATER AND MARINE ECOSYSTEM IN THE FRAMEWORK OF MSFD

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Your experience in a nutshell

Context: I was working on the analysis of cost of degradation of D10- marine waste as a part of socio-economic analysis under MSFD (third cycle).

Objective: My goal was to mainly update the current cost of marine waste for France by talking to experts and understand if there are new projects have been introduced for waste depollution.

Approach: France has used maintenance cost approach: real expenditures that a socio-economic system needs in order to maintain the level of natural capital required to deliver a certain level of ecosystem services.

Results: The total expenditure devoted to depolluting the marine waters from marine waste for France is more than 8.8 million euros a year in 2018. A significant proportion of these costs (4 million euros) was related to remediation of environmental degradation by marine waste.

Key methodological challenges encountered

There were three main limits of the methods:

1. The reported level of the costs is deeply influenced by the sampling efforts: the more actively you look for expenditures, the more the costs of maintenance are increased.

2. The availability and organization of data with the concerned institute were not always up to the quality.

3. Method is really time-consuming. The data collection took almost one year and required one full-time person plus one available expert.

Informing decision-making: bottlenecks and opportunities

There are many decisions made based on the new results. However, the program of measure for the third cycle has not been finalised yet. During the second cycle the results helped in:

1. Raise awareness, inform, educate on ocean pollution by waste;

2. Fight against waste in sewage and stormwater systems;

3. Identify priority landfills and areas of waste accumulation and the different financing possibilities for their elimination;

4. Encourage the reduction, collection and recovery of land-based waste impacting the coastline and the sea;

5. Improve waste management in ports and facilitate the collection of waste when it is caught accidentally.

Way forward?

To improve the level of the quality of such assessments, it is crucial to develop some standards regarding:

1. A data collection framework or guidelines

2. An accounting system framework which would make it possible to link up with the national accountability system and companies' accountability systems to better organise the data collection

Key messages, questions or issues to address in workshop discussions

- The main goal will be to understand the difficulties faced by other countries during the estimation of cost of degradation and how they think of overcoming them.
- Also, it would be really interesting to understand the current programs of measures of other countries of marine waste.

LESSONS FROM CARRYING OUT THE MSFD ECONOMIC & SOCIAL ANALYSIS IN FRANCE[1]

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Your experience in a nutshell

Context

Since 2018, the French MSFD has been integrated into the Marine Spatial Planning (MSP) documents. Due to this specific context, the economic and social analysis (ESA) supports two perspectives: (i) one from the point of view of the blue economy and the socio-economic objectives defined in the MSP, (ii) the other from the point of view of the conservation of the marine environment and the environmental objectives set by the MSFD.

The current ESA in ongoing and will be available in June 2023.

Approaches

France has chosen to adapt the DPSIR framework to articulate the different MSDF steps (environmental and socio-economic initial assessment, good environmental status definition and targets, monitoring programs, program of measures).

France has chosen the maintenance cost-approach (cost based-approach) to assess the costs of degradation (strong sustainability principle).

Key methodological challenges encountered

The main methodological challenges encountered in the French ESA are the following:

- Definition of perimeter: (i) how to define the maritime part of the activities (e.g. coastal tourism); (ii) how to define the perimeter for terrestrial pollutions from watersheds (e.g. eutrophication, chemical pollutants, phyco-toxins and bacterial contamination);

- Local level assessment: problem of data collection and data accessibility;

- How to accurately characterize the interactions between human activities and the marine environment?

- For the assessment of the Cost of degradation : (i) difficulty in collecting the financial efforts of municipalities in relation to the marine environment; (ii) mainly based on public effort (what about the private sectors?)

Informing decision-making: bottlenecks and opportunities

We observe a difficulty of appropriation of the ESA and Good ecological status by local authorities and stakeholders, especially for the cost of degradation. The criticisms addressed to experts and scientists are the lack of recommendation and clarity. Furthermore, authorities contest the results on the Good ecological status. This situation raises the question of **articulation between scientific expertise and political decision-making**.

There is certainly a need for better support of authorities and stakeholders by experts and scientists for a better appropriation of scientific expertise.

[1] https://dcsmm.milieumarinfrance.fr/; Levrel et al. (2014) https://doi.org/10.1016/j.marpol.2014.03.028

Way forward?

Ecological accounting could be an interesting research direction to help public policy achieve the marine biodiversity conservation targets.

Key messages, questions or issues to address in workshop discussions

- Perimeter definition (maritime activities, discharges from watersheds).
- Articulation between scientific expertise and political decision-making.

ASSESSING THE ECONOMIC VALUE OF ECOSYSTEM SERVICES TO SUPPORT LOCAL WATER MANAGEMENT AND BIODIVERSITY PROTECTION

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Your experience in a nutshell

The « Tourbière de Saisies » is the largest bog in the Alps with a unique ecosystem. Many activities are practiced on the site, including skiing, hiking, and fruit and mushroom gathering. These socioeconomic activities contribute to local and regional economic development, but at the same time put pressure on the environment. The site was ranked as a Regional Nature Reserve and different management practices have been put in place to protect its biodiversity (monitoring protocol for certain species, forestry management, hunting and gathering supervision and awareness-raising activities). In the future, climate change and tourism activities will continue to put pressure on the environment. These challenges need to be addressed in the updated management plans, operated by two public institutions nominated by the Region: "Syndicat intercommunal à vocation multiple" (SIVOM)[2] and "Office national des forêts" (ONF)[3].

As part of ACTeon's consultancy work, a study was conducted for the "Region Auvergne Rhône-Alpes" to **identify and characterize the ecosystem services** provided by the « Tourbière de Saisies » to different stakeholders (socio-professionals, community and society at large), understand how they contribute to the regional economic development, and **formulate recommendations** for the management plan.

As a first step, ecosystem services were identified using a DPSIR[4] model allowing to identify some key parameters: the **driving forces** that have an impact on the peat bog (public policies and socio-economic activities) ; the **pressures** imposed by human activities that could potentially cause degradation of the natural environment (pollution, overexploitation of resources, etc.) ; the **ecological state** of the peat bog (current functioning and biophysical functions) ; the **services** provided by the bog and the facilities put in place to facilitate access to certain services (e.g. signposting and paths); the **management activities** put in place to ensure the good state and functioning of the bog.

Then, ecosystem services were **characterized and quantified in biophysical** (carbon storage quantity, retention capacity, water consumption, crop production) and **economical terms** (added value of an activity, market prices of harvested product, tutelary value of carbon, replacement cost, visitor expenditures...) using various sources of data (on-site data from previous studies on the peat bog, socio-economic reports, studies on other comparable peatlands and national databases) and the knowledge and expertise of stakeholders in the area (users and beneficiaries of the services). Interviews and workshops were organized with inhabitants and local experts to collect data and perception in the first stage and to consolidate and discuss indicators and results in the final stage of the project.

The analyses resulted in schematic representations of the key results and their uncertainties such as:

- The **diversity of services** provided by the bog and the beneficiaries of these services (professionals, communities, inhabitants or people visiting the area in general and the bog);
- The **services provided by the peat bog according to the spatial scales** at which their beneficiaries are located (from the local scale when a service benefits the inhabitants of the area to the global scale when a service benefits society as a whole);

[2] Responsible for inter-communal cooperation, with various responsibilities: collection and treatment of household waste, creation and maintenance of roads, sports facilities, social action, water, sanitation, fire, school affairs, economic development, urban planning, electrification, housing, environment, tourism and leisure, etc.
[3] Responsible for the management of public forests
[4] drivers, pressures, state, impact, and response

- The **different areas that are responsible for the services provided** to highlight the zones requiring adapted management to ensure the provision of different services while avoiding or limiting pressures of certain activities on the ecosystem and its functioning;
- The **provision of services over time** due to changes in the regulatory framework, governance and territorial development.

Key methodological challenges encountered

- To **combine different valuation methods** (biophysical, economic, qualitative) and to communicate about it with **different actors** (inhabitants, technical expert, naturalist) who have different expectations of such work.
- Lack of **technical data** to assess regulation services such as water quality, carbon sequestration of water storage.
- Determine the exact **link between the natural environment (the peat bog) and the welfare supply**. How does the peatland add value to the provision of this service? What are the benefits that we can derive from it?

Informing decision-making: bottlenecks and opportunities

The results of ecosystem services assessment were used to provide recommendations for the management plan of the wetland. The study identified possible adaptations in management actions that would optimize the services provided and their associated benefits while responding to social and economic issues. For example:

- The study identified the role that the peatland plays in the supply of drinking water for part of the downstream population. For the moment, knowledge about this service and its beneficiaries is too partial and needs to be completed. It was proposed to carry out **additional studies and communication** on this subject with the local elected officials and the agglomeration. This would allow a better understanding of the importance of the service provided.
- The study suggested integrating the peat bog into the territory's external communication and make it a summer attraction to better support the identity of the peat bog (a cultural service) while maximizing socio-economic benefits.

Mainly qualitative and quantitative results were used to carry out the recommendation stage. It was difficult for managers to grasp the monetary valuation of ecosystem services and then to use it as a tool for decision support.

Way forward?

- **Acquire knowledge** that helps to better understand the bog functions and the services it provides. Such knowledge will be essential to explain the added value and justification of protection actions beyond their simple contribution to the improvement of biodiversity. It could also avoid rough assumptions.
- Stronger **coordination between biophysical model and economics methods** to better target data requirements.

Key messages, questions or issues to address in workshop discussions.

- The study estimates ecosystem services provided by a protected area in France with the goal of making recommendations for a management plan. The study combined different methodologies, but faced challenges due to lack of technical data, which were addressed by transferring results from other similar sites and refining these estimates with local actors and experts.
- The process of the study highlighted the importance of dedicating time to communication to ensure the visibility of results, by providing clear and easy to understand information and putting the results into perspective.
- *How would you address the challenges mentioned?*
- *Future perspective on ecosystem services assessment (limit, opportunities, new projects, new political contexts)?*

WHY DO WE CARRY OUT SOCIO–ECONOMIC ASSESSMENT TO SUPPORT FRESH AND MARINE WATER POLICY? REFLECTIONS FROM LITHUANIA

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Your experience in a nutshell

Among requirements of the WFD and the MSFD, the socio-economic analysis of water uses, cost recovery, cost of degradation assessments, as well as the cost-effectiveness and cost-benefit analyses are usually part of the terms of references for external consultants, who usually carry out the aforementioned assessments in Lithuania. Each cycle's analysis contained some improvements in terms of methodology, scope of statistical data, types of water use analysed etc... Improvements in the analysis were usually related to the comments the EC made in its assessment report to Lithuania. However, number of water bodies at good status has not increased over the last two cycles of the implementation of the Directives in Lithuania. One of reasons mentioned is that the water monitoring has improved, and more substances can be tracked. Thus, the quality / status perhaps improved, just the better diagnosis of it does not allow to express that. Another reason – natural: perhaps it is too early to notice big changes / improvements, e.g., if a reason for not achieving a good status is straightening of rivers. Or, perhaps, there are too little efforts put to improve quality (and quantity – the latter is not yet relevant to Lithuania) of water resources? If so, who (which sectors) are those hindering implementation of the measures required? And how socio-economic assessments can help? Was really the conducted socio-economic analysis needed to Lithuanian institutions and people? Did this analysis help to set priorities for the management of water resources? Or was it carried out only because it is required by the Directives? The answer is not straightforward. It seems that there is some vicious circle, but, luckily, it raises up towards more knowledge and understanding – like spiral of development. So, what have been the main challenges, questions and bottlenecks while conducting the socio-economic analyses in Lithuania and what would be ways forward? Let's look at all the main steps of the socio-economic analysis according to the Directives:

Key methodological challenges encountered

Carry out an economic analysis of water uses (Article 5 of the WFD). Carry out an economic and social analysis of the use of marine waters (Art. 8.1 of the MSFD).

This task seems to be simplest to carry out, but is it really so? Is its importance understood well? There are a few challenges.

Not sufficient statistical data in Lithuania, not sufficient financial and human resources allocated for this task. This step is isolated, does not influence other steps of the assessment, as there is a lack of understanding of relationship among the environmental and socio-economic aspects. Baseline scenario does not play its role for the objective setting, mostly because forecasting is not an easy task; it is not entirely clear when it should be carried out. The importance of the water productivity indicator is not sufficiently acknowledged.

Assess the current levels of cost-recovery of water services including environmental and resource costs (ERC) (Article 9 of the WFD). Assess the cost of degradation of the marine environment (Art. 8.1 of the MSFD)

Definition of precise obligations on the assessment of cost recovery in the Directive is not entirely clear. There are known problems with the assessment of the environmental and resource costs. Agriculture is a very specific sector. First, because of the CAP and all the related support payments. In Lithuania, two methods were used: cost – according to the agricultural measures needed to achieve GES and benefits – it is assumed that the charge rate for nitrogen, set by the Law on Pollution Charges, reflects the damage caused by the unit of nitrogen; then the estimated nitrogen surplus generated by agriculture is used accordingly. But do the charge / tax rates in legislation really reflect the damage / benefit?

As Lithuania practically does not have its national studies on monetary assessment of GES, only benefit transfer method was applied for the CBA.

Support the selection of a programme of measures on the basis of cost effectiveness criteria to reach the environmental objectives of the WFD (Article 11 of the WFD). Support development of a programme of measures for implementation of the MSFD by ensuring that measures selected are cost-effective and technically feasible, and the impact assessment, including cost-benefit analyses, prior to the introduction of any new measure is carried out (Article 13 of the MSFD).

New measures for the PoM in accordance with the MSFD were suggested by the topic (descriptor) experts, based on the analysis of the previous cycle measures and their implementation. Effects and costs were assessed based on score (multicriteria) system for individual measures. A cost-benefit analysis was performed for the entire programme, using costs of degradation for the benefit estimate. Assumptions were made that the GES will be achieved in 2040 with the help of measures of all the PoM. This is a deficiency, which it is not easy to correct.

During the third cycle of the WFD implementation, because of the lack of human and financial resources, the EPA of Lithuania conducted this step by itself, using simplified method – measures were selected based on expert judgment, not on the cost-effectiveness analysis. Moreover, there is a lack of different measures to solve certain problem. There is no environmental economist in the state institutions. The message about the importance of the socio-economic behaviour of economic activities and human beings to water resources is not being adequately sent to the public.

Informing decision-making: bottlenecks and opportunities

Are results of socio-economic analysis well incorporated in the policy development and decision-making? – No.

Socio-economic analysis is an isolated exercise very often and does not influence objective setting for water resources. PoMs are also very much constrained only by finance possibilities. Focus on climate change issues left the water sector behind in Lithuania.

Policy makers do not see (understand) benefits of socio-economic analysis.

Nature protection and biodiversity is quite high on the agenda in Lithuania; here mapping and valuation of ecosystem services is gaining momentum. Hopefully it will also help with water resource management.

Way forward?

- There is a need to continuously improve collection, processing, and presentation of the statistical data. If the foundation, basis, data is not sufficient and strong, it is not possible to construct a good framework leading to efficient solutions.

- The importance of the baseline scenario should be stressed, and the baseline should also be given its place (also in the reporting).

- Constantly strive for better cooperation between ecologists and economists, as the latter are much dependent on the first.

- More funding! – as usual.

- "Institutional memory" must be ensured in responsible institutions, so that if the employee, responsible for a certain task, changes, the process remains clear and understandable to other [future] employees.

- It would be beneficial to carry out more national monetary assessment studies, related to the quality / ecosystem services of the waters.

Key messages, questions or issues to address in workshop discussions

- Economic considerations are not yet sufficiently included in the decision-making processes in the water resource management sector.
- Better understanding (and simpler explanation) of the importance of various human activities in terms of what kind of costs and benefits they bring to the society and how efficient measures to protect the inland water resources and the Baltic Sea are, is needed.
- Capacities and competences of the responsible institutions on the economic analysis in accordance with the two major water sector Directives are very poor. There are no specialists for such assessments in Lithuania.
- In Lithuania, because of a huge priority for the climate change sector in recent years, water sector was left behind. Also, this has to do with the fact that groundwater resources, used for drinking (the only source for drinking) in Lithuania is of a very good quality. What about in other countries?
- Too little cooperation between ecologists and economists. Work of these groups of scientists is isolated. E.g., results of the baseline scenario were practically not used by ecologists, who have their say on the possibility of achievement of GES in certain year.
- Moreover, requirements of the Directives on socio-economic analysis are vague, very little reporting to the EC, related to the socio-economic analysis, is required. This also contributes to the relatively low role of the socio-economic assessments in the whole water policy.
- More meetings / workshops like this, broader representation by and from all the EU countries, keeping up institutional memory in state institutions and time will hopefully help to integrate the socio-economic analysis in the decision-making and thus help to achieve GES in waters.

Assessing the economic value/value of benefits linked to water in the UK – taking stock[5]

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Your experience in a nutshell

In 2007, a **National Water Environment Benefit Survey (NWEBS)[6]** was conducted to derive people's Willingness-To-Pay for improvements in the aquatic environment for the purposes of developing River Basin Management Plans. Since then, these **water benefit (NWEBS) unit values** have been used extensively in a variety of regulatory and public investment decision-making contexts that focus on maintaining and improving the quality of the water environment.

The study for the UK Environment Agency (2022) aimed to provide a better set of evidence on water benefits that will support the design of more effective policies, the formulation of more robust business cases, and the achievement of an even better value for money to improve the water environment. More specifically, the study aimed to identify and engage with all the users of water benefit values regarding current and future use, **provide a better understanding of their needs, identify** the gaps associated with the NWEBs values, consider and appraise a range of options for further work.

The study used a range of approaches including literature review and stakeholder engagement (workshops and targeted interviews) that focused on the current and future needs in relation to valuing water environment. Next steps entailed the elaboration of a conceptual Gaps-Needs framework followed by the development of a scope and set of recommendations for the next work phases (e.g. new WTP survey(s), new deliberative research).

Key methodological challenges encountered

Despite the crucial role NWEBS benefit values have played to date, there are several notable **limitations**: NWEBS values only cover surface water bodies (and not groundwater); benefit values do not capture effects of changes in ecological and chemical water body status on human health[7] (physical and mental), and more generally on a number of regulating, supporting and cultural ecosystem services (e.g. water purification, climate regulation, biodiversity, cultural services); NWEBS values do not cover emerging issues and pollutants (e.g. microplastics, AMR), benefits of non-deterioration and of improving from good to high status as well as local preferences and benefits of special sites (e.g. protected areas). There are also challenges in assessing intraclass and marginal improvements as NWEBS benefit values capture the value of change in the overall water body status from one status class to another (e.g. from moderate to good).

The future scope and roadmap for water benefit values update considered the following key challenges:

- Ability and limitations of the **current scientific knowledge to identify and quantify marginal changes** in surface and groundwater quality and quantity and resulting impacts on ecosystem services (regulating, supporting). The issue of scientific uncertainty is also of a particular relevance to emerging pollutants (e.g. pharmaceuticals, microplastics, chemicals) as there is little scientific understanding of the potential impacts of these substances on aquatic environment and human health;

- Ability to translate marginal changes in water quality and quantity **into aspects of water environment that people are able to perceive** (e.g. visually, cognitively) to enable the use of valuation methods (e.g. Stated Preference studies).

[5] Unpublished work for Environment Agency on Water benefit update (2022).
[6] The survey covered England and Wales
[7] Beyond the safety of recreational contact with surface water

Informing decision-making: bottlenecks and opportunities

Over the last 15 years, NWEBS benefit values have been used extensively in a variety of contexts. These include appraisals informing RBMPs and Art.4 exemptions, WINEP (Water industry national environment programme), FCERM (Flood and Coastal Erosion Risk Management), option appraisals for assessment of abandoned mines remediation strategies. NWEBS values are also included in the HM Treasury's guidance for Natural Capital Assessments (ENCA). The use of NWEBS benefit values has allowed a systematic and transparent way of thinking to develop regarding the consequences of decisions affecting the water environment and allowed **consistency in accounting for anticipated benefits** across different scales, sectors and applications.

This study has developed a **roadmap** (based on the gaps and needs analysis) and the **recommended future scope of work** focusing on distinguishing between short-term and long-term options, simple and more complex, potentially costly solutions aiming to "future-proof" the water benefit values update for the next decade.

Way forward?

The Phase 2 of the study (deliberative research and pilot studies) is ongoing using the **roadmap** developed and the recommended future scope of work. It will provide stakeholders with a **better set of evidence on water benefits that will support the design of more effective policies and the achievement of an even better value for money to improve the water environment.**

Key for policy choices over resourcing future research work and other implications of updating water benefit values were:

- How much **existing benefit values** need updating in light of changing societal preferences and emerging issues (e.g. microplastics, AMR), and whether just some elements can be updated (new/ no new primary valuation studies, e.g. replacement of NWEBS with an enhanced set of benefit values; complementary use of NWEBS with additional benefit estimates (e.g. chemicals); enhanced use of existing NWEBS in conjunction with other benefit estimates for identified gaps that does not entail carrying out primary valuation studies) ;

- The need for **new components** to meet upcoming policy analysis requirements (e.g. benefits of non-deterioration, chemical status improvements, mental health benefits from blue space, benefits of reducing CSOs etc.);

- The order and **timing of updates**. In relation to timing of alternative options, it was recommended to sequence implementation starting from 1) using short-term, simple and readily available solutions to close a number of gaps (e.g. available research on human health benefits based on dose-response functions and exposure studies for (selected) priority substances ; available research on benefits of reducing CSOs ; monetary benefit unit values representing subjective wellbeing from blue space; a technical study setting out relative importance of different interlinked benefit components (fish, invertebrates, flow) that generates unequal set of weights ; deliberative research (focus groups) to identify regional/ catchment based differences in people's preferences (vs nation wide ones). 2) In the meantime, working on underlying deliberative research focusing on more fundamental aspects used by multiple components (e.g. changing preferences, emerging issues and threats (e.g. microplastics, AMR, CSO), local preferences) and commissioning relevant technical studies (e.g. chemicals, biodiversity, climate resilience). 3) Preparing and commissioning a new water benefit survey with a particular focus on new components to be included, while taking into account any potential future regulatory changes. The design of the survey needs to be repeatable and so contribute to the long-term benefits of the water benefit survey architecture.

Key messages, questions or issues to address in workshop discussions

- **Setting the scope for benefit valuation** – going beyond WFD parameters to reflect wider societal preferences and balancing different stakeholder needs for water benefit values (different purposes, scales of assessment)?
- **Ability to translate physical changes** in water quality and quantity **into aspects of water environment that people are able to perceive** (e.g. visually, cognitively) to enable the use of valuation methods and prioritisation of actions.
- Dealing with **lack of scientific knowledge and/or uncertainty** when valuing impacts of emerging pollutants (e.g. priority substances, microplastics) on aquatic environment.

Tools for analysing and measuring ecosystem services to capture the value of urban ecosystems[8]

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Your experience in a nutshell

The current study developed and applied a comprehensive and systematic methodology for selecting, comparing and scoring **ecosystem services assessment tools** according to scientific criteria and practical requirements. The purpose was to facilitate the use of empirical evidence as a rationale for greater nature-based solutions (NBS) implementation in cities. The scoring matrix used in the study assessed and ranked the suitability of six open-access, quantitative assessment tools in capturing multiple ecosystem services across different urban landscape domains and societal contexts. Based on specific screening and evaluation criteria, **i-Tree Eco** was judged to be the best performing and was subsequently applied to an urban case study (i.e. a large park in **Amsterdam** called **Park Frankendael**). The application of i-Tree Eco served to further test its effectiveness, feasibility and limitations under Dutch urban conditions. The end product of this study was the creation of a **value case** for Park Frankendael which highlights key quantitative, qualitative, monetised and non-financial insights into the multiple ecosystem services that are currently being provided by the park to the city and its residents.

Key methodological challenges encountered

The wide range of available 'off the shelf' ES assessment tools necessitated screening criteria to narrow down the tools to a more manageable number for evaluation and scoring. Many tools are still in the prototype stage or are restricted to certain geographical areas. There is also an unequal representation of tools across the scientific and grey literature. Some established tools have a lot of independent, peer-reviewed scientific analyses available while for more recently developed tools, third party reviews are rare. Since i-Tree Eco is a U.S.-based tool, there is at times limited flexibility in incorporating non-U.S. methods and values to better reflect international case study sites, even when such data available (which is not always the case).

When applied internationally, i-Tree Eco does not take into account non-tree forms of vegetation and water bodies, thus limiting the range of ecosystem services that can be captured (though trees are strongly associated with many relevant urban ecosystem services) . i-Tree is therefore best suited to those NBS where trees represent the predominant vegetation (i.e. parks, urban forests, street canopies). For the current study, it is reasonable to assume that the ecosystem services measured by i-Tree Eco for Park Frankendael are underestimated for two main reasons: a) only trees were used in calculations thus ignoring grass, shrubs, water bodies and other NBS elements that have been known to contribute to ecosystem services, and b) 11 percent of the trees in Park Frankendael are absent from the current analysis due to data and logistical limitations. The list of ecosystem services captured in this current study, either through i-Tree Eco or other methods, is certainly not exhaustive. Relevant urban ecosystem services that are missing from the current value case include noise attenuation, provision of agriculture, water purification, sediment regulation, pollination, and improvements in both individual mental health and social cohesion.

Certain prices that were used to calculate the value of ecosystem services (i.e. carbon price, social cost of different air pollutants, avoided runoff benefits, etc.) need to be updated and/or specified to specific locations. For avoided

[8] First publication (second one is pending): http://www.sustainablemediterraneanconstruction.eu/SMC/Special_Issue_n_4/031_A%20review%20of%20quantitative%20tools%20for%20assessing%20multiple%20urban%20ecosystem%20services.pdf

stormwater runoff, i- Tree is able to capture the effects of tree and land cover on hydrological processes, however only total annual quantities of surface runoff are calculated. What is missing from i-Tree is the temporal dimension of peak runoff for storm events, and how vegetation can contribute to its reduction when it is most needed. Greater temporal resolution is required in order to produce a time-dependent urban hydrograph for each NBS that is being assessed to capture the most valuable form of runoff reduction that NBS can provide in the event of storms and cloudburst.

There is at times limited flexibility in incorporating non-U.S. methods and values to better reflect international case study sites, even when such data available (which is not always the case).

Informing decision-making: bottlenecks and opportunities

While in academic and research communities there is a clear shift away from individual indicators to measure single ecosystem services towards comprehensive tools that measure multiple ecosystem services at a time, this is not yet the case for government authorities. More information is required by decision-makers about the existence, capabilities and requirements of these tools. A screening and scoring methodology, like what was used in this study, could help authorities standardise and facilitate the process of selecting an appropriate tool for a given set of circumstances. Any attempt to score multiple tools across different types of literature sources will always involve some level of subjectivity, therefore it would help to have the sources and reasoning behind any methodology presented in a transparent manner as a reference for future transferability.

The value case that was created for Park Frankendael can be expressed as the total economic value of annual ecosystem services flows (in a table) or as a graphic that simply highlights the types of ecosystem services being provided. Brenner et al. (2010) state that by expressing and relating these ecosystem services to human well-being, "valuation aims to make [NBS] comparable with other sectors of the economy (e.g. built capital) for appraising investments, planning activities, developing policies, or making decisions about land and resource use." Furthermore, the public distribution of a value case (as well the evidence and tools behind it) to a wider audience can raise awareness of the importance of urban nature, act as a catalyst for engaging local decision-makers and stakeholders in order to advocate for the protection of existing NBS in the city, and help shift the political discourse greater NBS implementation in development projects across a city.

Way forward?

Future applications of the i-Tree Eco tool in urban projects with natural ecosystem elements can further strengthen the value case for urban NBS and promote their inclusion into urban planning and decision-making. One of the limitations of the current evaluation approach is the lack of a "comparative concurrent application of multiple tools to a common location" as a way of measuring tool feasibility under practical conditions (Bagstad et al., 2013). By simultaneously applying several tools to a common case study, feasibility criteria in the scoring matrix could be more accurately evaluated and compared, rather than solely relying on literature review. This type of practical assessment is an encouraging prospect for future tool evaluations, however it would require significant amounts of data and time to undertake such an assessment and would necessitate a large team and coordination across each tool's application. Building on the current study, a practical assessment could be carried out with two or three of the highest scoring tools (i-Tree, B£ST, ARIES) to further validate the feasibility scores that each of them received in the scoring matrix. If case study applications can be performed for every tool, then values in the scoring matrix can be perceived as more robust and also more transferable to other, similar contexts.

Since there is no one tool that can capture the full range of urban ecosystem services, the combined use of several tools, optimally integrated to complement gaps in measurements, could be employed within an analytical

framework such as that of UNaLab (Roebeling, 2019) to create a more comprehensive assessment of urban ES across a wide range of NBS types and locations.

Key messages, questions or issues to address in workshop discussions

- Does anyone have experience in applying or combining multiple ecosystem services assessment tools to a given location in order to capture the widest possible range of ecosystem services, or to compare the effectiveness of each tool under practical considerations?
- Which ecosystem services should be prioritized in cities? Of course, this depends on local needs and interests however are there visible patterns as to which ecosystem services are most valued in urban contexts?
- How can we encourage the participation of citizens and communities in the measurement of ecosystem services? Beyond sharing the results of assessments, how can they engage in data collection, analysis and discussion?

COST-RECOVERY AND FINANCING

Water pricing and cost-recovery in the EU context[9]

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Your experience in a nutshell

The effectiveness of water pricing is low when water use is efficient (due to cultural, economic or environmental contexts). This implies that the impact of water pricing, as policy instrument, is very limited when water is scarce and main efficiency gains have already been achieved. In practice, this means that: a) In water scarce areas, irrigation water pricing is not effective below a certain threshold that can be significantly high (e.g. 1 EUR/m3) so that water pricing cannot be used beyond full cost recovery; b) Lack of effectiveness in domestic and urban uses, elasticity is very low (in general) and demand becomes less elastic when consumption is closed to low levels (e.g. 80 Liters/person/day); c) industry is achieving high level of efficiency driven by corporate and social reporting.

When water is abundant and price is low (such as for irrigation in some EU regions), it is critical to implement volumetric charges. Even at low values large water savings can be achieved compared to flat tariffs.

The monetization of ERC constitutes an "impossible" task that has already devoted unnecessary and wasteful attention, and which should be directed towards full financial cost recovery with an harmonization of cost computation and the inclusion of climate change adaptation investments.

Key methodological challenges encountered

a. Harmonised methodology to estimate financial costs: depreciation rate, type of costs involved, distribution of general expenses among users.

b. Estimation of ERC: Do we need to monetise them? Pragmatic approaches, e.g. Portugal, Italy, France.

Informing decision-making: bottlenecks and opportunities

- Involvement of all stakeholders, co-creation of the policy mix (including effective command & control measures).

-. "Agricultural exceptionalism": cross-subsidization between social groups. Need of policy transparency and agreed methodology.

- Rural vs. urban users: locational distribution of costs. Need of policy transparency and agreed methodology (sufficiency & equity).

- Supply guarantee as a economic concept in water scarce drought prone areas.

Way forward?

- Implementation of volumetric metering and billing for all uses (specially mining, agriculture, energy).

- Monitoring of 'hidden uses' such as groundwater, including low volume abstractions .

- Implementation of water markets for short term (within crop campaigns) and long term (permanent transfers).

[9] Berbel J. & Expósito, A. (2020). The theory and practice of water pricing and cost recovery in the Water Framework Directive. *Water Alternatives*, 13(3), 659-673.
Berbel et al. (2019). Analysis of irrigation water tariffs and taxes in Europe. *Water Policy*, *21*(4), 806-825.

- Inclusion of cost recovery for other uses beyond agriculture, urban and industrial, that is energy, mining, navigation and hydropower.

- Practical implementation of an ecotax, as an alternative to address E&R costs.

- Valuation and implementation of pricing for water supply guarantee as water scarcity becomes structural and droughts frequency increases.

- Assessment of new 'non pricing 'instruments from behavioral economics domain to induce demand changes.

Key messages, questions or issues to address in workshop discussions

- Harmonised methodology to estimate financial costs: depreciation rate, type of costs involved, distribution of general expenses among users.
- E&R costs: Do we need to monetise them? Pragmatic approaches, e.g. Portugal, Italy, France.
- Implementation of volumetric charges (irrigation, and all users).
- Cross-subsidization: decision to distribute multipurpose and joint services.
- Locational distribution of costs: remote rural users are generally charged less. Sufficiency and Equity principles.
- Hydropower and navigation. Case of Hydroelectric Environmental Fund in Sweden.
- Groundwater abstractions: measures to monitor, control and protect aquifers should be paid for by the users through a ley or tariff: "Agricultural exceptionalism".

EXPERIENCES AND LESSONS WITH TAXING PESTICIDES IN THE GREEN REFORM CONTEXT

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Your experience in a nutshell

Pesticides are second only to nitrates in causing failure of good chemical status in groundwater. At the EU level, the use of and risk associated with chemical pesticides, measured via the Harmonized Risk Indicator 1 (HRI1), shows a decrease of 14% from the baseline period of 2015-2017 to current levels and a further 1% decline compared to 2019. Controlling levels of and the risk associated with pesticide use is central to several EU policy frameworks such as the Farm to Fork Strategy, Zero Pollution initiative, REACH, and has also been made legally binding through legislations such as the Directive on sustainable use of pesticides, and the Regulation on plant protection products. Further, water quality standards and maximum permitted residue levels further provide regulatory risk assessment-based control. Such existing measures and frameworks can be viewed as falling under one of three categories: (a) source and emission control measures; (b) control of fate and destination measures; (c) control through fiscal measures along the production and supply chain. A fiscal measure can take the form of a tax being introduced on the use of pesticides. Such a tax can be structured with a tax base on all plant protection products and biocides approved for sale, a chargeable event being the reported application of pesticides, and include an operational requirement such as mandatory reporting of sales and use. However, when it comes to practice, there is still potential for widespread uptake of fiscal measures to control the use of harmful pesticides. A literature search on currently implemented taxes at the EU level revealed that out of the 27 EU member states currently only three, namely Denmark, Sweden, and France, have a mechanism in place for taxing the use of pesticides. Therefore, notwithstanding the considerable opportunity to control further environmental harm, it is important to analyze and understand the bottlenecks, lacunae, and systemic challenges that exist to taxing pesticides use.

Key methodological challenges encountered

Pesticides are of various types, chemical mixtures, and several newer chemicals are introduced to the market each year. This brings the first methodological challenge in designing a tax as all pesticides cannot be taxed equally. Secondly, seldom is the physical quantity of a pesticide proportional to the toxicity risk associated with its use. Therefore, this presents the second challenge in setting a policy mandate that is worded to reduce volume but in proportion to risk. While the first two are being addressed already, the third, and perhaps the most important methodological challenge is in the risk-assessment data available to make informed decisions. This is even more challenging when considering that pesticides do not exist as individual substances once applied to the environment but as complex mixtures of hundreds of chemicals. Assessing mixtures risk is a scientific field that is still developing. The fourth methodological challenge is in the acceptance of such as tax, as there are concerns that surround its effectiveness due to the ongoing debate on price sensitivity of demand for pesticides. The view that pesticides demand is not price sensitive has often been the cornerstone of political debates, however, as Böcker & Finger (2016) pointed out such inelasticity identified does not consider differences between short and long-term elasticities which are susceptible to be influences by behavioral changes and availability of competitive alternatives. Yet other challenges persist such as improving coherence with other policies, identifying, and eradicating counterproductive subsidies, and addressal of farmer's concerns over risk to incomes.

Way forward?

Challenges are only opportunities to pursue innovative solutions. To further reduce risk of pesticides use through fiscal measures, the way forward involves collecting data on actual pesticides application in addition to sales data, recording sales to non-agricultural sectors, conducting more studies to estimate toxicity load indicators including

common mixtures, improve uniformity in data reporting obligations across the EU, and conducting *ex-ante* macroeconomic modelling of taxes prior to introduction.

Key messages, questions or issues to address in workshop discussions

- What other challenges do you know of in applying taxes to pesticides use?
- In addition to some of the solutions identified, what other solutions can be worth considering?

FINANCING WATER INNOVATIONS[10]

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Your experience in a nutshell

Most EU MS have been able to attain high levels of compliance in the implementation of the directives related with controlling wastewater, supplying drinking water and managing flood risk (the UWWTD, DWD and FD) but there still are additional efforts required to meet the quality standards desired for surface and groundwater bodies. An ecosystem of innovations offers increasing opportunities to bridge this gap while reducing the pressures and recovering and protecting water ecosystems. However, in the EU a proper and structured financial framework for investments in innovative solutions in water is still work in progress and investment programs are still biased towards public funded investments in water supply, sanitation and flood protection. All this contrasts with the rapid advances seen in other areas where problems are being addressed through the approach brought about by the European Green Deal, which encourages new economic models and a mission approach to forge collaboration across value-chains and stakeholders. These new developments come with the new financial instruments to support innovations in the water sector and enhance water security while contributing to the objectives of decarbonization, climate change adaptation and sustainable development.

Key methodological challenges encountered

Main challenges in terms of data availability/access, integration between disciplines, methods & tools applied, communication of results:

- Show how water innovations play a crucial role as well as land, energy and materials, as an essential natural resource in the Green New Deal goals of generating growth at a sustainable rate.

- Understand water scarcity as a cross-cutting, horizontal theme included in, for example, urban and rural development, circular economy /resource recovery, digital technologies, food security, climate change, nature-based solutions or even conflict prevention and not as a standalone topic for grant applications.

- Identifying available and new financing tools at the EU level to tackle water scarcity and other challenges which fit with the role of water in the new EU Strategy on Adaptation to Climate Change and comply with the new European sustainable growth strategy based on the European Green Deal.

Informing decision-making: bottlenecks and opportunities

Strategic financing aims at matching policy ambitions with financial resources they are essential means that should be shaped to the ends of water policy. Developing a financial program for water innovations requires adapting financial instruments to the water security innovations, mobilizing financial resources from sectoral policies, allowing potential compensation for welfare losses resulting from the implementation of innovations, and sharing the burden of risk across public and private actors through regulations. A financial program for water can be a powerful mean to support a transition towards a water secure economy.

Alternatives to improve water security and water ecosystems do exist. However, at the end, market uptake of innovations in the water sectors depends on existing incentives and therefore on advances in water cost recovery.

[10] Water4All partnership' Pillar D: Demonstration activities. Deliverable 4.1: OUTLOOK OF EXISTING FINANCIAL / DEVELOPMENT PROGRAMMES. EIT(2022) A review of financial instruments available to startups, scaleups in the water sector –EIT Water Scarcity FINDING INNOVATIVE FINANCIAL SOLUTIONS TO WATER SCARCITY IN SOUTHERN EUROPE. OECD (2022), *Financing a Water Secure Future, OECD Studies on Water*, OECD Publishing, Paris, https://doi.org/10.1787/a2ecb261-en

The analysis of innovation opportunities and barriers should help factoring in affordability concerns and developing innovative economic policy instruments to facilitate the adoption and diffusion of innovations (e.g., of non-conventional water resources in water scarce regions).

Way forward?

Research priorities can be focused on supporting the economic analysis of water innovations considering their potential contribution to the European Green Deal in terms of water security, decarbonization, energy transition, etc. and the sustainability of growth while improving water ecosystems and enhancing water security.

This analysis will provide the objectives and the information needed to develop specific financial strategies for water innovations.

Key messages, questions or issues to address in workshop discussions.

- To what extent existing water financing instruments enable innovative investments in the water sector?
- What role is to be played by the private sector (i.e. commercial financiers) and how? There might be asymmetries between private preferences in terms of investment processes and policy priorities, an example of that being the financing of grey infrastructures versus nature-based solutions.
- How to reduce public grants dependency of water innovators?

Experiences with cost-recovery assessment in France[11]

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Your experience in a nutshell

- **Context**: Study performed with and for the OFB and all French Water Agencies and Water Offices for EU mandatory reporting requirements
- **Objectives**: Assessment of cost recovery of water and sanitation public service through water pricing

Key methodological challenges encountered

- **Challenges**: Collection, treatment and analysis of financial data of more than 22 000 water and sanitation services in order to highlight the 3 components [Tariff-Taxes-Transfers] of the financing of water uses

The study was realized, in 2018/2019, with and for the OFB and all French Water Agencies and Water Offices for EU mandatory reporting requirements. The main data sources, methodologies and assumptions used are described in a methodological report. Cost recovery ratios for water and wastewater utilities are presented in the table below.

Annual average 2013-2016		France		Total
	Millions d'€ Hors Taxes / an	**water**	**Sanitatiion**	
	Invoiced revenue	6 700	6 872	13 572
	Operating subsidy	102	420	522
	Operating revenue from services (1)	**6 802**	**7 292**	**14 095**
	Operating expenses (2) - OPEX	-4 520	-4 310	-8 830
	Gross operating surplus (3= 1-2)	**2 282**	**2 982**	**5 264**
	Other management income	150	128	278
	Financial income	11	9	20
	Exceptionnal income	89	95	184
	Other management expenses	-154	-141	-296
	Financial expenses	-248	-427	-674
	Exceptionnal expenses	-145	-137	-282
	Management and financial result (4)	**-297**	**-473**	**-770**
	Self-financing capacity - CAF (5=3+4)	**1 984**	**2 509**	**4 494**
	Investment grants	408	871	1 279
	Investment expenditure - CAPEX	-2 572	-3 574	-6 145
	Consumption of fixed capital (CCF MAX)	**-4 911**	**-6 085**	**-10 996**
	Drinking water supply	-4 911		-4 911
	Public sewerage		-6 085	-6 085
	Consumption of fixed capital (CCF MIN)	**2 888**	**-3 477**	**-6 365**
	Drinking water supply	-2 888		-2 888
	Sewerage		-3 477	-3 477
R1	Operating cost coverage rate	**148%**	**159%**	**154%**
R2	Coverage rate of investment expenses	**93%**	**95%**	**94%**
R3 Max	Renewal needs coverage rate	**74%**	**75%**	**75%**
R3 Min	Renewal needs coverage rate	**94%**	**99%**	**97%**

- *The recovery rate for operating expenses, R1, is 154%,*
- *The recovery rate for capital expenditure, R2, is 94%.*

[11] www.ireedd.com

- *The renewal rate of stock kof capital (equipment and network), R3, is between 75% and 97%, depending on the assumptions, high and low, adopted for the life of the equipment.*

Between the two cycles, 2009 and 2013/16:

- Operating revenues increased by almost €1,500 million., i.e 12.4%;
- Operating expenses increased by €230 million ., i.e 2.4%;
- Operating subsidies decreased by €61 million, i.e 10.4%;
- Cash flow from operations improved by €913 million, i.e 29%;
- Investment subsidies fell by €484 million, i.e 27.5%;
- Investment expenditure fell by €550 million, i.e. 8.2%.

These developments explain the evolution of the cost recovery ratios:

- The recovery rate of operating expenses increased from 140% in 2009 to 154% over the period 2013-2016 thanks to the improvement of the self financing capacity ;
- The recovery rate for capital expenditure increased from 80% to 94%.

This clear improvement in the recovery of investment expenditure is largely explained by the drop in investments (-8.2%, €550M per year). Indeed, if the level of investment had been the same as in 2009, all other things being equal, the recovery rate of investment costs would have been 84% instead of 94%.

Even if it's largely uncompleted, it is worth to present the result of an attempt to evaluate cost recovery of each category of user, including environmental costs. Table below presents the results.

Table 2 : Cost recovery ratios by user category, annual average over the period 2013-2016

Million € (Annual average 2013-2016)	Domestic	Commercial and administrations	Industry	Indus+APAD	Agriculture
Cost recovery of water uses WITHOUT environmental costs	98%	96%	99%	98%	89%
Cost recovery of water uses WITH environmental costs	85%	80%	85%	83%	60%

Key messages, questions or issues to address in workshop discussions

- The lack of investments may damage water and sanitation services sustainability. It could be explained by the difficulty for some local authorities to get access to loans; and/or the difficulty to increase price (as re-gard to ability to pay of some water users)
- These results question the financial sustainability of public water and sanitation service in France.

BRINGING ARTICLE 9 TO REALITY: EXPERIENCE FROM SPAIN

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Your experience in a nutshell

The WFD has provided an impulse to cost recovery at least in three ways. I1) t has increased the transparency on the water costs, changes and prices of water services; 2) It has provided a framework for integrating this information which was previously in different levels of administration and private companies and associations; 3) it has provided a rationale for the reform of water tariffs and charges as well as for the design of new ones, specially related to environmental and hydro morphological impacts, including diffuse pollution. 4) It has served to provide a diagnosis on the need for greater accountability and regulation.

Key methodological challenges encountered

The Key methodological challenges have been related to 1) the generation of common approaches to calculation of annual capital costs – specially for [public investments- 2) the collection of historical data on investments; 3) the lack of a system for collection of data on water supply and sanitation services in cities (beyond surveys is main cities) ; 4) The lack of a system for collection of data on costs, income and changes of water for irrigation; 5) the difficulty of accounting for subsidies; 5 The lack of clarity on how to apply and report on the exceptions. 6) The lack of formulae for integrating prices and charges in the Programme of Measures

Informing decision-making: bottlenecks and opportunities

The main impact of Article 9 has been helping in providing a rationale for decisions making in terms of tariffs reform and design. It has also helped in the more recent decision to create an Observatory of the Urban Water Cycle to create the basis for improved and increased benchmarking and regulation.

The key questions are: 1) whether it has lead to increased cost recovery, improving the practice and rational for subsidies to water services and 2) if it is providing an incentive to achieve the objectives of the WFR and improve water status, reducing pollution, water abstraction and HM pressures. The answer is that Article 9 has not been incorporated as an instrument of the PoM . Reporting on Article 9 has become a mere administrative task. Much data has not been updated or improved since 2008.

The key challenges ahead are rationalizing decisions on subsidies. What we do not recuperate are either environmental externalities or government/EU budget. Both decisions are taken by public authorities. This includes the EU and especially the Next Generation Funding. Controlling water and irrigation investment and how exceptions to Article 9 are applied is critical.

Way forward?

Article 9 design reflects the different objectives which guided/were behind the legislation. 1) the need for reducing subsidies to socio economic activities to comply with competition rules. 2) the need to ensure the sustainability of the water services in the long run by ensuring a regular source of sufficient income without the need for

subsidies; 3) it was explicit the need to insure that the application of Article 9 need to be coherent with the achievement of good water status which is the main objective of the WFD.

The tension between economic regulation and environmental regulation is clear in Article 9. There may need to be some reflection on whether the WFD needs to be more encompassing of both.

We need to consider how Article 9 can be better integrated in the PoM and ensure that it is not a mere administrative requirement.

Key messages, questions or issues to address in workshop discussions.

- What changes for Article 9 in the context of the WFD and beyond? Is it necessary to have a specific EC regulation on the contents of Article 9?
- What role of the EC in promoting transparency and coherence in the application of Article 9 Europe wide?
- What conditionality in EU funding?

A WORKFLOW TO SUPPORT PRIVATE FINANCING OF FRESHWATER RESTORATION

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Your experience in a nutshell

Current public funds are not sufficient to upscale nature restoration projects to meet EU ambitions on nature restoration.

Private sources as a potential additional source of funding, from philanthropy to lending and investments by the private sector.

HEU MERLIN (innovation action): support increased private involvement in upscaling restoration in 17 cases of restoration.

Ongoing work: a workflow to guide restoration managers – no implementation yet.

Key methodological challenges encountered

How to identify and characterise private opportunities: new value chains (e.g. sustainably produced commodities), new services (e.g. ecotourism), environmental markets (e.g. carbon credits, biodiversity offsets), payments for specific ESs.

Quantifying enhancement of natural capital and delivery of ecosystem services – key importance of scientific evidence for investor buy-in.

Quantifying value of ecosystem services, market opportunities and return on investment.

Risk assessment and mitigation for investments.

Informing decision-making: bottlenecks and opportunities

Buy-in and interest of restoration managers: a change in attitude and skills.

Bringing the restoration manager and private sector (investment) communities together: language, type of data and information.

Complexity of contractual and governance arrangements.

Way forward?

Building on the few successful examples.

Expecting large transaction costs: too data and time consuming for a European context?

Potential for misused or even abuse? E.g. carbon credits.

Key messages, questions or issues to address in workshop discussions

- Any evidence of successful and significant funding gap for restoration covered by private sources?
- Any experience of using natural capital assessment and ES assessment to support financial planning of restoration projects?
- Should efforts focus instead on strengthening financial flows through public sector?

FINANCING OF FLEMISH WATER POLICY WITH RESPECT TO WATER SUPPLY, WATER SANITATION AND WATER SYSTEM MANAGEMENT: A STATE OF AFFAIRS

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Your experience in a nutshell

Financing of water policy in Flanders currently faces a structural financing deficit. In addition, future challenges for water policy in Flanders are considerable (climate related risk such as droughts, water scarcity and flooding, further urbanisation, contaminants of emerging concern, stricter environmental standards). In order to take on these challenges it is the ambition to strengthen financing of water policy in Flanders in a step-wise approach.

As a first step in the process to strengthen financing of water policy in Flanders, a state of affairs of financing Flemish water policy has been drawn up. This resulted in an overview of how much resources go to water supply, water sanitation and water system management, how (via what instruments) these resources are collected and who contributes (households, industry and agriculture).

In 2020, financing of water policy in Flanders amounted to 2.87 billion euros. Most of the resources goes to water sanitation (48%), followed by water supply (36%) and water system management (16%). The drinking water bill is by far the most important financing instrument (52%), followed by self-services (24%), the general budget (21%) and charges (3%). Households contribute most (59%), followed by industry (35%) and agriculture (5%).

The analysis shows that for water supply and water sanitation specific financing instruments are in place, but that this is not the case for water system management. Water system related challenges like reducing the impact of droughts, water scarcity and flooding, ecological restoration or remediation heavily rely on the general budget. The Flemish financing system is, at least at this point, not self-supporting, robust and fit for the future.

A second step in the process is about estimating future financing needs. Preliminary results indicate financing needs will increase for all water tasks in the short to medium term: water supply (+10% to +30%), water sanitation (+9% to +56%) and water system management (14% to 154%). Water policy faces a structural financing deficit.

Next steps in the process to strengthen financing of water policy in Flanders include (1) further evaluation of the financing system in terms of its ability to cover future financing needs, (2) evaluation and further elaboration of the vision on financing water policy, (3) development of new or adaptation of existing financing instruments and (4) development of scenario's for financing future needs with varying levels of ambition.

Key methodological challenges encountered

Drafting the state of affairs of financing Flemish water policy requires lots of different data from a diversity of sources. Most data are administrative and financial data, but the data used is very often not readily available nor designed for analytical purposes. Next, the assessment of self-services required quite a bit of technical knowledge, expert judgement, assumptions .... As water tasks are intertwined allocating financing is sometimes somewhat arbitrary.

Estimating future financing needs is, to the extent possible, based on available assessments. Assessments, however, vary in objectives and assumptions which has an effect on the comparability of estimates. For certain water related issues like for instance flooding, water scarcity and droughts no real policy goals exist yet. As a consequence, estimates of financing needs for tackling these topics still needed to be produced and ambition levels needed to be set. Also, important synergies might exist between for instance tackling water scarcity and flood risks

and even asset management of public utilities. Producing estimates typically requires determining the set of measures necessary to reach determined goals/ambition levels via modelling and then applying cost factors.

Informing decision-making: bottlenecks and opportunities

The state of affairs of financing Flemish water policy in 2020 is an update of the economic analyses for the river basin management 2022-2027 and is mainly used to increase knowledge and awareness of water policy financing among our water policy partners.

Earlier estimates of future financing needs have been used to increase tariffs and mobilising all in all limited extra resources from the general budget. An increase of water tariffs, which is in fact semi-automatic based on regulations, is being watched with suspicion because of concerns over rising costs of living. A structural strengthening of the financing system has not been achieved. A proposal for an 'infiltration bonus' from a coalition of water partners has, for instance, not being considered so far by the political level. Increasing water financing is necessary but is not a silver bullet. Limited implementation capacity is already a bottleneck for increasing investments.

Way forward?

The process that is set up to strengthen financing of water policy in Flanders goes beyond estimating future financing, including elaboration of the vision on financing water policy, development of new or adaptation of existing financing instruments and development of scenarios for financing future needs. The hope is that this approach will at least stimulate debate and inspire integrated solutions that increase the robustness of water financing and the incentives for stakeholders.

A wider consideration of a system approach, system change, and co-benefits of water policy and measures could benefit achieving water policy goals and therefore deserves more attention in future work.

Key messages, questions, or issues to address in workshop discussions.

- Although uncertainty is high there is a clear need for additional financial resources.
- The robustness of the Flemish financing system can (and should) be improved through increasing the level to which the system is self-supporting.
- How to move from producing evidence on financing needs to effectively introducing new measures that strengthen financing of water policy?
- What financing instruments could be introduced to raise financial resources for supporting water system management (tackling flood risks, water scarcity, droughts …)?
- Raising financing versus changing behavior: perfect alternatives or an ideal combination?

Water scarcity: internalizing costs and signaling risks

Dr. Maha Cziesielski, Trinomics, maha.cziesielski@trinomics.eu

Your experience in a nutshell

Water scarcity defines the phenomenon of a long-term recurrent imbalance that arises from the overexploitation of water resources. It is caused when consumption is significantly higher than the natural availability of freshwater resources to renew it. Water scarcity is distinguished from drought by being a human-made phenomenon that is a consequence of the water consumption pressure exerted on natural water resources including surface and groundwaters. Furthermore, it can be aggravated by water pollution by reducing the suitability of different water uses and increasing treatment costs, as well as during drought episodes. As such, water scarcity will be one of the main climate change risks. Across Europe, reports under the WFD and the River Basin Management Plans (RBMPs) show that 10% of surface water bodies, and 17% of groundwater are under high pressure due to water abstraction. On average, 85% of water abstraction is conducted by the agricultural sector. Continuous, unsustainable abstraction of water especially in areas with high risks of scarcity will result in severe negative socio-economic impacts. As such, the correct pricing and taxation of water is essential to signal the value to end-users and incentivize more sustainable and resource efficient uses. Hence, a water scarcity fiscal measure should be included in all countries where unsustainable uses are already driving increases in scarcity risk and hazard levels.

The WEI+ aims to illustrate the pressure on the renewable freshwater resources and can be applied at national, river basin and sub-basin level, during specified periods (seasonal or annual), as consequences of water use for human purposes. The WEI+ indicator is used as part of the objectives to reduce stress on renewable freshwater resources in the Eight Environmental Action Programme, and one of the core indicators regularly updated by the EEA to inform policy makers on the water scarcity conditions in national territories as well as across Europe. The WEI+ index can be used to incorporate a water scarcity coefficient into the cost of water abstraction/use. If a per m3 extraction fee/tax exists, the coefficient assigned to the WEI+ level of the river basin in which the water resides would be used to multiply the levy. Hence, the water scarcity coefficient would signal to users the scarcity of the resources and, if coefficients are set correctly, incentivise the more efficient use of water.

Key methodological challenges encountered

Pricing of water used by industry, agriculture and households is often either subsidized or much less than the total cost of supplying and using it, and rarely considers the water resources pressures and stress. Therefore, pricing and taxation of water often does not capture the real value of water resources nor internalize the environmental damages caused by over-abstraction. The consequence is an inefficient price structure for water that encourages inefficient water uses. Hence, fiscal measures for correct pricing of water that internalize the costs of water scarcity and associated risks of over exploitation are urgently needed.

Other challenges include:

-In most Member States, small abstractions are exempted from controls and/or registering, despite the fact that water bodies suffering from significant abstraction pressures are not achieving good status

-Significant abstraction is often only estimated through surveys or cropping patterns, which leads to high degree of uncertainty in reported abstracted volumes

-Plenty of frameworks (WFD, Drought Management Plans, RBMPS etc) that address scarcity, but lack of legal obligation to address scarcity issues or to properly price water usage

-WEI+ method is a new assessment tool that more accurately predicts the water replenishment and availability. It is therefore not commonly used yet, and calculations maintain some limitations that need to be considered.

Informing decision-making: bottlenecks and opportunities

One of the key bottlenecks is that many countries do not see themselves within water scarcity risk yet, but fail to fully incorporate climate change predictions into long-term water resource management.

There is a need to intensify efforts to manage demand of water as well as improving efficient use of water and ensuring water-reuse. Considering the largest demand for water comes from the agricultural sector, further efforts need to be put into regulating irrigation demands and supporting agricultural producers in transitioning to more sustainable farming practices. Using market-based instruments and fiscal measures can lead to increased revenues that can be recycled into a range of different areas:

- In alignment with the Water Reuse Directive and the revision of the Urban Wastewater Treatment Directive, revenues be used to support the installation and implementation of treatments of wastewater for the reuse in agricultural irrigation, and wastewater recycling. The recycling of revenues to better treat wastewater and ensuring a more circular approach to the water sector directly supports achieving objectives of the above Directives as well as improving the environmental status of surface and groundwater, through alleviation of abstraction pressure.
- Revenues can also be used to directly support recycled water in agriculture by providing subsidy schemes, or tax breaks, for farmers who consume water from reuse processes.
- Revenues can also feed into R&D
- Water scarcity coefficient in water pricing presents an opportunity to improve water demand management and is in line with recommended tools for addressing scarcity under the WFD.

Way forward?

- *Water scarcity depends on various parameters and there should be considerations for additional indicators to assess the scarcity levels, and distinctly classify and define their relation to drought events*
- *Determining the correct water scarcity coefficient within country specific context*
- *Research into the feasibility of water allocation per sector and/or river basin should be explored*
- *Development of water infrastructure, rainwater, and greywater, harvesting, appropriate use of irrigation reservoirs, matching different water qualities to different uses*

Key messages, questions or issues to address in workshop discussions.

- Correct pricing of water is essential to promote the more sustainable use of resources, helping achieve water demand management.
- Water scarcity needs to be a component considered within the price structure of water, and should be added as a preventative measure for climate adaptation even if current water scarcity hazard levels appear low.
- Is the WEI+ an appropriate indicator to be used as a base for fiscal measures?

DECRYPTING OUR FUTURE

DUTCH DELTA SCENARIOS FOR STRATEGIC DECISIONS ON ADAPTIVE DELTA MANAGEMENT IN THE NETHERLANDS

Judith ter Maat, Deltares, judith.termaat@deltares.nll

Your experience in a nutshell

The Delta Programme is in place to protect the Netherlands from high water and flooding, to ensure a sufficient supply of fresh water, and to contribute to rendering the Netherlands climate-proof and water-resilient.

The delta scenarios—possible future scenarios for climatic and socioeconomic changes, with time horizons of 2050 and 2100—are crucial to identify possible bottlenecks now and in the future and to formulate the adaptative policy pathways.

The delta scenarios – as an analytical tool - describe the band-with of uncertain, plausible futures and identify potential impacts that have an important influence on the success or failure of a given strategy or measure. The measures and strategies can be evaluated under each scenario, which helps decision makers to prioritize their choices and come up with adaptative policy pathways. It helps them to make urgent decisions while dealing with long-term uncertainties.

Key methodological challenges encountered

Lack of data, only key sectors were addressed.

Interdisciplinary research in partnerships.

'Ruimtescanner' tool for describing spatial autonomous developments.

National water model and impact modules for simulating the water system issues, including impacts.

Stakeholder engagement workshops.

Informing decision-making: bottlenecks and opportunities

Results of the scenarios (so called bottleneck analysis) and strategies analysis (finding solutions) performed by Deltares and others, are published and used by the Dutch government (ministries, provinces, water boards, etc.) to formulate the adaptation policy pathway to make the Netherlands more climate proof and water resilient.

Way forward?

Water and subsoil-based planning: what is the context that you have effect on?

Transitions that have spatial implications: agriculture and energy.

Nature restoration and biodiversity.

Housing developments.

Key messages, questions or issues to address in workshop discussions

- Which developments do you consider in your analysis? What is (not) autonomous, e.g. energy transition?
- Which time horizon should you use and is still interesting for various stakeholders: 2030, 2050, 2100 and/or further (sea level rise, glacier melt, low water, etc.)? Similar for temporal and spatial resolution.
- Are spatial developments autonomous from a water management perspective?
- Determine the band-with for the scenarios; what is the plausible band-with for long-term developments?
- How to deal with more extreme events? Stress tests for out-of-band investigation situations?

PATHWAYS TO TRANSFORMATION

Manuel Lago, Ecologic Institute, Manuel.lago@ecologic.eu I

Your experience in a nutshell

"*Social-ecological transformation*" is an umbrella term which describes recent political, socioeconomic, and cultural shifts resulting from attempts to address the current social-ecological crisis. But, how do we even get there? What tools are needed? What results can we expect?

The aim of this communication is to share experience as coordinator of the H2020 AQUACROSS project (2015-2019). The project aimed to support EU efforts to protect aquatic biodiversity and ensure the provision of aquatic ecosystem services. In addition, to increase knowledge and application of ecosystem-based management (EBM) for aquatic ecosystems to support Biodiversity Strategy targets.

Key results of the project were:

1. Highlight and document the need for CHANGE! (in current practices, assessments, approaches) if we are aiming to achieve the objectives of the EU BioDiv Strategy for 2030.

2. Showcase the added value of integrative policy and EBM assessment frameworks for the protection of aquatic biodiversity

3. Improve understanding of aquatic biodiversity, supporting ecosystems and related services across Europe, and the drivers and pressures that affect it

4. The role of local stakeholders and the elicitation of societal preferences for biodiversity protection

5. Development of effective support tools: A method (aqualinks) to assess causalities, an integrative information platform to facilitate the use and dissemination of integrated data, research methods and results across aquatic domains,

6. Application of ecosystem-based management concepts in aquatic ecosystems at different scales: is EBM worth pursuing? Findings from Case Study work.

Key methodological challenges encountered

The project fundamentally stressed the need to overcome traditional management approaches for the protection of aquatic biodiversity. Specifically, we need to overcome approaches that:

- Focus ONLY on the recovery of flag species, target single hot spots, single pressures, specific impacts, etc. (and despite getting measurable outcomes risk to degrade resilience and increase ecosystems' vulnerability).

- Deal with uncoordinated policies (water, energy, climate change, food, land use,…), that pursue partial objectives at the expense of worsening prospects in other policy realms and result in unsustainable cumulative pressures.

- Maximize the provision of some environmental services (such as drinking water, water for irrigation, urban soil, dilution of pollutants, ….), at the expense of impairing the capacity of the ecosystem to provide other valuable services in the present and the future (including those services linked to ecosystems self regulation and support)

Informing decision-making: bottlenecks and opportunities

If systems thinking analysis is so promising as a tool to inform new policy developments in the paths to transformation, Why then EBM is not widely accepted? The reasons are varied:

- EBMs involve complex social choices and trade-offs (as for example: short term opportunity costs vs long term benefits; reduced pressures and lower provision of commercial services vs enhanced security, reduced risk, better adaptation prospects, etc.)

- They imply multiple benefits and compete badly with specialised traditional alternatives. Opportunities are linked to synergies of multiple benefits across stakeholders and policy domains that can only be reaped by cooperation instead of competition.

- EBMs require institutional changes: to build cooperation to foster collective action and share the array of EGS obtained across different stakeholders and policy domains (and break institutional silos along with disciplinary borders and myopic short term commercial interest).

Way forward?

Although further research and broader examples of application are still needed, EBM/SES analysis is increasingly more accepted in the development of Land-use planning, BioDiv protection, adaptation to climate change and marine policies. The MSFD specifically calls for the application of ecosystem-based management. However, EBMs application is still eluding water policy and further efforts are needed. This is despite EBM´s several benefits for River Basin Management Planning.

- It helps to better understand the full picture

- It helps to identify where best to act

- It incorporates aquatic biodiversity into river basin planning

- It helps to structure socio-economic assessments (under article 5 of the WFD)

- Link to Ecosystem Services can capture the broad values of multi-functional measures

- Useful for communicating the added value of the Water Framework Directive to stakeholders and financiers.

Key messages, questions or issues to address in workshop discussions

- Can (simplified) systems analysis thinking be applied to advise env. decision-making?
- Should social scientists/economists take the lead with the promotion of integrative assessments?

Investigating the future of sectors to support sector diversification in New Caledonia[12]

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Your experience in a nutshell

Context: New Caledonia has extraordinarily diverse terrestrial and marine ecosystems, which are threatened partly by mining activities. Its economic growth, heavily dependent on the nickel industry and monetary transfers from metropolitan France, is decelerating and is not based on a sustainable development model. The New Caledonian economy lacks diversity, which contributes to limiting its resilience. In a context of health, economic and ecological crises, the issue is knowing where New Caledonia could be headed if the territory were to follow a strong sustainable path. For this purpose, we explored the activity sectors of interest from an ambitious and realistic prospective angle.

Objectives: The objectives of the experience were to: Demonstrate the interests of a more sustainable path for New Caledonia; Identify the most promising sectors for its future; Analyze their socio-economic impact potential; Build an argument for the ecological transition. Thus, the study aims at orienting and boosting the territory's ecological transition within a strong sustainability perspective.

Overall approach & process: For this purpose, the key steps were the following:
1) Diagnose and analyze the current model
2) Define the great principles of a strong sustainable transition, adapted to New Caledonia
3) Analyze and select the promising sectors thanks to socioeconomic and environmental indicators
4) Co-construct the future scenario
5) Analyze the socioeconomic impacts of this scenario for New Caledonia
6) Define the corresponding budget to invest into the sectors and achieve the defined scenario.

For this, we built our expertise on several processes. First, a collaborative approach was chosen, including a technical committee with institutional actors, statistical institutes, civil society representatives, customary representatives, private sectors. Also, a deep sectorial literature review, interviews with the different sectors enabled to characterize precisely the state of the art and the future scenarios, as well as the actions to implement them. Finally, we used our internal tools to evaluate socioeconomic incidences and to define the monetary envelope required to achieve the strong sustainability economic diversification of New Caledonia, in order to build strong and operational arguments to the local decision-makers.

Key (obtained or expected) results:
On the current situation of the sectors:
- The currently productive and employment providing sectors (nickel industry, building, metallurgy) have strong environmental impacts and generate little local wealth (import of equipment and fossil fuels).
- Natural resources dependent sectors (fishing, aquaculture, agriculture, forestry) have strong socio-economic impacts. Their transformation towards practices compatible with strong sustainability is necessary to reduce wealth leakage.
- Tourism and energy sectors have moderate socio-economic impacts today, but could benefit from better impacts thanks to a sustainable restructuring of models.
- The circular economy is little or not integrated into the value chains of business sectors.

[12]Deliverables on the AFD website: https://www.afd.fr/fr/ressources/etude-potentiel-diversification-economique-soutenabilite-forte-nouvelle-caledonie
Motion design was created to disseminate the results of the project: https://www.youtube.com/watch?v=ud9-M-QHi_g

On the future perspectives:
The following sectors are promising for the diversification of New Caledonia economy in an ecological transition perspective : agroecological transition, sustainable sylviculture, sustainable valorization of halieutic resources, renewable energies, sustainable tourism, sustainable valorization of natural substances (emerging sector). This development could provide by 2040 a rise of 11.7% of production, a rise of 12.4% in added value, and a support of 16% more jobs, compared to the levels of 2015. For this, 140.5 billion F CFP (~1.17 billion EUR) should be invested in the development of those sectors.

Key methodological challenges encountered

- The main challenges for the study were:
- The lack of data specific data on the studied sectors and their characteristics in New Caledonia,
- The lack of recent quantified data on the studied sectors (in particular, for demographic data, agricultural data),
- The appearance of COVID-19 crisis after the state of the art,
- The political context of New Caledonia, with strong and determining relationships and positions impacting the study achievement (for example, the specific position of common law representatives, or the independence referendum held during the study and questioning several simulated results),
- The existence of a strong mining industry which was not compatible with the conception of strong sustainability,
- Some difficulties to mobilize key local actors much concerned by the study results,
- The communication of technoeconomic results to a diversity of non-economists' stakeholders.

Those challenges were overcome by making assumptions to overcome the lack of data, reorientating the study with contextual adapted objectives, and using pedagogical and adapted means to ensure a collaborative approach, and to communicate the right information to disseminate the results within New Caledonia society and economy.

Informing decision-making: bottlenecks and opportunities

To disseminate the results, several methods were used:
- The partnership of the study with a local recognized and competent partner on socioeconomic and environmental issues of New Caledonia,
- The inclusion of key network heads / local recognized representatives in technical committees, consulted all throughout the study,
- The creation of a motion-design video to present the scenarios and communicate the results basically and straight forward to a diversity of stakeholders including the civil society,
- The presentation of the results within several working groups or key conferences such as: The Pacific States conference, The AFD and CEROM 7th conference on "Overseas territories in transitions: challenges and future visions",

Way forward?

The study enabled to build a solid and complete argument for the uptake of the ecological transition in New Caledonia. In order to go forward, a lead would be to look deeper into the sectorial roadmaps built. This can enable the different sectors to take in hand very practical and directly implementable actions to fulfill the strong sustainability transition of the territory.

Concerning the future characteristics of New Caledonia, concertation should also be pursued to ensure the definition of a common desirable future.

Key messages, questions or issues to address in workshop discussions.

- The strong sustainability model is a key framework to consider the future of our societies.
- A strong sustainability future is possible in New Caledonia.
- Concertation is a key process to ensure the fulfillment of change of practices or path recommendations.

SUPPORTING CHOICES AND DECISIONS ON PRIORITY ACTIONS

Lessons from implementing economics to support the WFD implementation[13]

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Your experience in a nutshell

With Master's degrees in Agricultural Development Economics and in Environmental and Natural Resources Economics from AgroParisTech (France) and a PhD in Economics from Montpellier Supagro (France), I have 18 years of experience as an environmental economist applied to geosciences, contributing to and coordinating the economic component of applied research projects at the local, national and European levels.

My experience in economics for WFD implementation began in 2005, in the context of developing the very first economic analyses for the WFD. During the period 2005-10 I have essentially contributed to projects related to the WFD, with a focus on groundwater, either with the French water agencies or in the framework of European projects. The aim was to propose new methodological developments and/or to provide reference studies in economics for the implementation of the WFD. I have been involved in several activities during that period of time: reference costs assessment, first cost-effectiveness analyses, monetary benefit evaluation, including benefit transfers. At that time, economics was used with the idea of choosing the most cost-effective actions to achieve good groundwater status in the context of a constrained budget (cost-effectiveness analysis), or even to justify a derogation from the good status objective at disproportionate costs (cost-benefit analysis).

I continue to use economics for the design and evaluation of groundwater protection programs, BUT NOT directly related to WFD requirements. I am particularly involved in the development of methods to design and assess groundwater protection programs using nature-based solutions (e.g. agroecology, forest conservation, urban green infrastructures, wetland restoration). My current research activities contribute to the four principles of sustainability economics applied to groundwater protection: (i) a systemic approach integrating human activities and aquifers; (ii) long term consideration; (iii) cost-effectiveness approaches applied to groundwater quality restoration; and (iv) analysis of different dimensions of social and environmental justice in groundwater protection programs.

Key methodological challenges encountered

From this experience, I could report numerous methodological, ethical and operational challenges associated with the implementation of economics as required by the WFD. I will focus here specifically on four challenges related to cost-effectiveness analysis and monetary valuation of benefits applied to groundwater protection programs.

The first, and perhaps most challenging issue, is the ("industrial") scale at which economic analyses had to be implemented. The large number of water bodies and the impossibility of conducting detailed analyses on each of

[13] Neverre N., Surdyk N., HERIVAUX C., Baran N. (2022). Restoring groundwater quality at the drinking water catchment scale: a multidisciplinary and participatory approach. Journal of Environmental Planning and Management, 314, 115022. https://doi.org/10.1016/j.jenvman.2022.115022; Hérivaux, C. & Coent, P. Le (2021), « Introducing nature into cities or preserving existing peri-urban ecosystems? Analysis of preferences in a rapidly urbanizing catchment », Sustainability (Switzerland), vol. 13, n°2, pp. 1-36. https://doi.org/10.3390/su13020587; Hérivaux, C. & Grémont, M. (2019), « Valuing a diversity of ecosystem services: The way forward to protect strategic groundwater resources for the future? », Ecosystem Services, vol. 35. https://doi.org/10.1016/j.ecoser.2018.12.011; Hérivaux, C. & Rinaudo, J.D. (2016), Integrated assessment of economic benefits of groundwater improvement with contingent valuation. https://doi.org/10.1007/978-3-319-23576-9_21

them has led to the search for transferable reference values. But whether for a CEA or the evaluation of benefits, the results of an economic analysis have little (no) meaning when taken out of context.

The second challenge is an ethical one, it raises the question of the meaning/role of economic analysis in the context of the WFD, which sets the political objective of achieving good status for water bodies. This political objective of restoring and maintaining natural capital over time reflects a strong sustainability perspective. While the CEA theoretically informs the decision on how to achieve this objective at the lowest cost, the role of monetary valuation of benefits and its use in a CBA is less clear. This leaves the door open to a possible substitution of natural capital by other forms of capital, through the use of technological solutions such as water treatment for example, if these are less costly (low sustainability perspective).

These two points set aside, from a purely methodological point of view, two challenges emerged:

- Concerning CEA, when they have been conducted, they do not take into account the functioning (and diversity) of aquifers. The main methodological challenge was therefore to integrate the complexity of aquifer functioning into the CEA (e.g. for water quality restoration programs).

- Concerning the monetary evaluations of benefits, the main challenge is, in my opinion, the fact that they have been carried out in a "narrow"/ “siloed” manner (i.e. focused solely on the benefits directly associated with groundwater): they do not reflect the diversity of the implications (positive and negative) of the action programs (biodiversity, adaptation to climate change, agricultural production for example) (Hérivaux and Rinaudo, 2016; Hérivaux and Grémont, 2019).

Informing decision-making: bottlenecks and opportunities

My feeling is that economic analyses conducted in an "industrial" way have not been used to make decisions and prioritize actions. On the other hand, at the local level, when the demand comes from local actors, I have worked on several projects where economic analysis has made sense.

Cost-effectiveness analysis has proven to be particularly interesting if conducted in a participatory manner, with hydro-modeling coupling, thus at the local scale, with the involvement of local stakeholders. The analysis allowed to objectify the time and costs necessary for the restoration, to target the priority sectors of intervention and to initiate the dialogue on the way to implement the least expensive actions (Neverre et al., 2022).

Benefits assessments can provide interesting insights at the local level, if not conducted with a narrow view focused on groundwater and by considering the overall effects on society of the proposed protection programs. The stakeholders we have involved in these approaches have emphasized that it could help raising awareness on groundwater protection, bring together stakeholders with different interests, bridge the gap between environmental issues and help implementing protection actions (Hérivaux and Grémont, 2019).

Way forward?

Avoid any systematic economic analysis conducted in an industrial way. An economic analysis makes sense in response to a problem formulated at the local level by involving the actors.

In line with the political objectives of the WFD, reposition economic analyses in a strong sustainability perspective, without possible substitution between natural capital and other forms of capital.

CEA can make sense for decision making only if they are conducted in a participatory manner with biophysical modeling.

Benefit valuation can make sense if they are conducted in such a way as to integrate a diversity of effects, by mobilizing a pluralism of values, with the objective of informing, identifying potential synergies with other environmental policies, or analyzing potential levers and oppositions (Hérivaux and Le Coënt, 2021), but not to feed a

cost-benefit analysis (CBA). The quantitative values themselves are of little interest. It is the involvement of stakeholders in the evaluation process that makes sense and can inform the decision.

Key messages, questions or issues to address in workshop discussions.

- Avoid any systematic economic analysis conducted in an industrial way.
- Reposition economic analyses in a strong sustainability perspective.
- Economic analysis of groundwater protection programs makes sense only if conducted at a local scale, in a participative way, by integrating aquifer functioning.
- Economic analysis can help to identify and reinforce the nexus between H_20 and other environmental policies.

ASSESSING DISPROPORTIONATE COSTS IN RELATION WITH ECOLOGICAL FLOW IN HYDROPOWER SECTOR

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Your experience in a nutshell

Twenty-two years of experience in river planning considering an integrated and sustainable approach of hydro-morphological issues related to present and future infrastructure works.

The *Assessing disproportionate costs in relation with ecological flow in hydropower sector* aims the assessment of practical E-flow implementation on Romanian multipurpose river dams, focusing on disproportionate costs and considering economic related impact on the hydropower. It includes both technical and economic information's. An overall status quo of Romanian river dams, E-flow assessment & economic impact expressed in energy loss outlines the overall approach. In this respect, more than 350 river dams of A&B and C&D importance (associated risks) were subject of a comprehensive assessment of the E-flow related technical characteristics (designed flow discharge facilities). The assessment of E-flow considering CIS Guidance 31 has been performed by a research institute. The consultation process with hydropower sector took place over a considerable period, the key factor being the delineation of economic thresholds losses. Still in the ongoing process the results, referring here to practical implementations shows either good result but also technical and economical constrains

Having in view the ongoing character of the above issue

Key methodological challenges encountered

It was not the data itself that was a challenge, but rather the discussions with hydropower sector on the results. Exchanging the data between the Water Authority and Hydropower sector was successfully, even from beginning of the process. Nevertheless, scientific arguing on the eligibility of the E-flow assessments considering the terms of *CIS Guidance 31 - Ecological flows within the implementation of the WFD* could be mentioned here. Considering the importance of hydropower sector in frame of the national energy production, identifying the financial disproportionality thresholds complete the challenges.

Informing decision-making: bottlenecks and opportunities

The entire process (E-flow assessment, Energy loss thresholds, regulation procedure) was finalized through a Government Decision. It must be emphasized here, the particularities of the hydropower dams (build before the 70'es, the technical status of the discharges outlets – subject of the providing E-flow. Exchange of experience, way of doing in similar cases could for sure represent a way forward.

Way forward?

Referring here exclusively on the above topic it is more or less obviously a significant heterogeneity between approaches, Therefore exchange of experience could represent a useful way forward to respond to disproportionate costs issues. Possible dedicated workshop, considering different thematic area (transport, flood protection, hydropower) could be a way.

Key messages, questions, or issues to address in workshop discussions.

- The CIS GUIDANCE No.1 refers in the disproportionate costs' context that *Ultimately, disproportionality is a political judgement informed by economic information*. How this aspect influence the practical of different measures (E-Flow is just a case) in your country?

GAP ANALYSIS FOR UPDATING THE NATIONAL PROGRAM OF MEASURES

Dirk Osiek, Federal Environmental Agency Germany, & Katharina Raupach, Lower Saxony Ministry for the Environment, Energy, Climate Protection - Senior researchers for many years on economic issues in context of WFD and MSFD

Your experience in a nutshell

The EU Marine Strategy Framework Directive (MSFD) requires that Member States establish a program of measures and update it every six years. The program is to identify the measures necessary to achieve or maintain good environmental status in the marine waters of the Member State in each Marine Region. The CIS Guidance Document No. 10 on program of measures describes the procedure for preparing and updating the program of measures. According to this, a gap analysis is to be carried out to review and update the program. The experience gained so far with deficit analyses, both nationally (Sweden and Germany) and internationally (HELCOM SOM (sufficiency of measures)) is the starting point of our contribution.

The deficit analysis can help us prioritize measures, target discussions more effectively, and identify weaknesses in the program. However, the process of deficit analysis has to be started early enough before updating the program of measures.

Experiences on deficit analysis from the current program of measures are presented by Sweden and Germany in the following and an outlook on the next program of measures in 2027 is given.

Methodological approach and key challenges encountered

The German Business as usual (BAU) scenario was developed exemplarily for marine litter (micro litter excluded) in the North Sea with the target year period 2030-2035. It uses HELCOM SOM-analysis for inspiration and the DPSIR approach (Drivers-Pressures-State-Impact-Responses) as a foundation. The identification and prognosis of human activities as main drivers of marine litter is mainly based on literature review (and expert consultation). The first step was the prognosis of the development of human activity and German GDP (as a proxy indicator). Result was an expectation of 14% increase of marine litter. Relevant regulations under other policies (e.g. EU Single-Use Plastics Directive) and their impact on the development of the pressures were included in this consideration. The expectation is that they will reduce amounts of beach litter of around 22.5%. Starting point for the analysis are 389 pieces of litter/100m of beach based on status assessment 2018 (2009-2014). The BAU Scenario is based on an effectiveness analysis of measures of the first program of measures (2016-2021). These MSFD measures against litter are expected to lead to a significant additional reduction (scenarios 50% or 30% effectivity). Depending on the two scenarios a gap about 130 to about 200 pieces of litter/100m of beach will remain between the state reached in the period 2030-2035 and “Good Environmental Status” (GES) (20 pieces of litter/100m of beach). The conclusion of the scenario is that there is high probability that the existing legislation and additional MSFD measures will lead to significant reductions in the amount of litter in the marine environment and in moving towards GES, but that the measures in place may not be sufficient to ultimately achieve GES. Main challenges of the analyses were the lack of expertise nationally in performing this type of analyses in marine management, high uncertainties due to lack of data and knowledge and the dependency on expert judgement and dependency on data from many other processes and existing measures from other policies.

Informing decision-making: bottlenecks and opportunities

The approaches used by Sweden and Germany fall behind the level of sophistication and ambition of the HELCOM SOM-analysis. It seems however, that the main messages / results of the national analyses and those of the SOM analysis are comparable.

The Swedish approach described gaps in orders of magnitude per activity /source and per target. The analysis included an estimation of the effectiveness of existing measures, and potential implementation gaps. The results were felt to be a good way to support discussion with experts and managers on priorities in the need for new measures, and reasons for existing shortcomings.

Way forward?

What to improve for the next gap analysis in the run up to the 2028 update of program of measures:

- Ensure GAP analysis is at hand before starting discussion on new measures

- Plan data collection/methodology development within the timeline for the GAP analysis in areas where there is a potential for improvement.

Key messages, questions or issues to address in workshop discussions.

- Often the journey is the destination. Just dealing with a BAU / Gap scenario at the right time helps enormously. However, detailed and complex reporting does not necessarily help.
- We need regulation that advances and strengthens environmental protection and does not enlarge excessive reporting requirements which bind capacities needed for enforcement.
- How do we get lean but effective regulation?
- How do we conduct a lean Gap analysis over many topics with robust and useful results?

Cost-benefit analysis and biodiversity points[14]

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Your experience in a nutshell

The way biodiversity has been incorporated in Dutch CBAs has changed drastically over time: from CBAs in which major impacts on biodiversity were not even mentioned to CBAs in which the impact on ecosystem services are valued as much as possible. For a decade effects on the non-use value of biodiversity are measured by biodiversity points.

Biodiversity points are quite similar to the quality-adjusted life years (QALY) used for cost-effectiveness analysis of health care treatments. Biodiversity points provide a quality-adjusted measure of the changes in the quantity of biodiversity. It is not based on the preferences and information of consumers or citizens but is based in a standardized way on the expert-opinion of ecologists. The unit of measurement is not dollars or euros but is the number of biodiversity points.

KEY METHODOLOGICAL CHALLENGES ENCOUNTERED

Biodiversity points are calculated by multiplying three components: The area of natural or semi-natural ecosystems affected (in hectares or square kilometers); The ecological quality of each area (0-100%); A weight factor per type of ecosystem, reflecting the contribution of the ecosystem to species richness at national, European or global level, which depends on the species present in the ecosystem and their threat level.

Informing decision-making: bottlenecks and opportunities

The method has been applied to demonstrate the cost-effectiveness of various nature-friendly alternatives for the Enclosuredam (e.g. fish sluice, marshes, trees), the impact on biodiversity on raising the water level in the IJssellake and the impact on biodiversity of the Sandmotor (depositing 20 mln cubic metres of sand to reinforce the coastline). This information played a major role in the public decision-making process.

Way forward?

Biodiversity points should be applied in other countries and in other contexts, e.g. for the ecological importance of marine protected areas and coral reefs in oceans. Such application clarifies the merits and limitations of this method. Also a comparison should be made with the ecosystem services approach (TEEB).

Key messages, questions or issues to address in workshop discussions

- How to best measure the non-use value of biodiversity? Contingent valuation, biodiversity points or other?

[14] F. Bos and A. Ruijs, 2021, Quantifying the non-use value of biodiversity: the Dutch biodiversity points, Journal of Benefit-Cost Analysis.

ASSESSING THE COSTS AND BENEFITS OF NAUTRE-BASED SOLUTIONS

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Your experience in a nutshell

Under a Framework contract with DG ENV, an overview document is being developed on the use of cost-benefit analysis for nature-based solutions for flood risk management. The aim of this work is to better assess, and consequently use, the analysis of costs and benefits in the planning of NBS for flood risk management. The overview report is directed mainly to WG Floods, but is also discussed at the Ad-hoc Technical group on water scarcity and droughts (ATG WSD) and WG Economics. The aim of this session is to gather inputs from experts. A first version of the overview document is expected March 2023.

Key methodological challenges encountered

The forthcoming overview report for DG ENV and CIS working groups will show illustrative examples of:

- Methods and tools to assess costs and benefits, including examples of their application for NBS;

- NBS case studies and case study portals complemented with an illustration of the contained cost and benefit infor-mation;

- Available cost and benefit data from EU and other research and implementation projects, and highlighting of good practices; and

- Policy recommendations on using and/or developing cost and benefits data on NBS for practical flood risk man-age-ment.

Currently, **interviews** are being conducted with EU experts. The aim of the interviews is:

1) To provide more specific information on potential good practices on the use of economic assessments for NBS;

2) To identify implementation barriers, knowledge gaps and recommendations on using and/or developing cost and benefit data for practical flood risk management.

The **main challenge** is currently to identify good practices on the use of costs and benefits for NBS on flood risk management.

Informing decision-making: bottlenecks and opportunities

The main objectives of the overview document for DG ENV are to provide an overview of bottlenecks and opportunities, and consequently to provide policy recommendations on using and/or developing cost and benefits data on NBS for practical flood risk management. Preliminary conclusions will be presented and discussed at the workshop.

Way forward?

By March 2023, the first draft of the overview report will be presented at WG Floods, which includes the findings of interviews, and this workshop, and a first selection of good practices.

Key messages, questions or issues to address in workshop discussions.

- Discuss set barriers, opportunities, and recommendations on using and/or developing cost and benefits data on NBS for practical flood risk management.
- Suggestions for good practices.
- Call for interviewees … which could potentially be conducted during the workshop.

THE USE OF COST/EFFICIENCY METHODS TO PRIORITIZE OR DECIDE ON CHOICES FOR THE MANAGEMENT OF CHEMICAL POLLUTION

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Key methodological challenges encountered

We will report on attempts and ongoing developments to use decision support tools and economic tools to help define priorities and strategies for managing surface water chemical pollution in France. We will briefly introduce for discussion at the workshop the possible reasons for the quite limited uptake of these methods by both national and local stakeholders that we see from our point of view in France.

The Water Framework Directive (WFD) imposes, when necessary, the control, limitation or prohibition of the release of certain substances into the environment, and the achievement of "good ecological status" with a chemical dimension.

Also, a French technical instruction requests local authorities to carry out reduction action plans, with the objective of upstream diagnostics is to identify and reduce emissions to sewer networks and from WWTPs.

In a first study, we have classified around 150 micropollutants of the aquatic environment in order to identify those that are priorities for action to reduce emissions. In order to have more robust results, we have used two prioritization methods, one building on an existing method used to prioritize chemicals for monitoring, and the second one based on Cost-Effectiveness. Results and ongoing further development on building more integrated CEA indicators to assess action on a large set of chemicals will be presented.

In a second study, we used Cost-Effectiveness Analysis (CEA) to help local authorities draw up their action plans on reducing chemical discharges from WWTPs. This report is intended to be didactive and presents the step-by-step approach to carry out CEA.

As stated above, there seems to be a limited uptake of these methods by both national and local stakeholders in France, despite being well known and used at some international level (EEA for instance) and by some researchers. We will discuss some possible reasons and ways forward to improve uptake or better adapt methods to the needs : difficulty to access local stakeholders, persistent lack of knowledge of economic methods among stakeholders, perceived or real lack of actual interest of these methods due : e.g. lack of data, unability to integrate local concerns, great divide between "water people" and "chemicals people" impeding integrated assessment and integrated approach and understanding of issues at stake.

Huge data gaps on economic and non-economic data on chemicals: Risk indicators and CEA look useful in this context in which benefits are difficult to monetize, but:

- Many assumptions

- Are tools applicable? Are the results credible?

Informing decision-making: bottlenecks and opportunities

Low uptake by National decision makers / No use in PoM /Difficulty to reach to local decision makers despite high public sensitivity. Basic environmental economics concepts knowledge / perception.

Public policy assessment culture is lacking: first problem / added value of economics? (Offshore windfarms planification/ cumulated impacts – MSFD)

Way forward?

More motivation for knowledge (monitoring) than action : work on value of information?

SUCCESS STORIES OF AGROECOLOGICAL SYSTEMS

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Your experience in a nutshell

Agriculture consumes 80% of water in the Júcar river basin.

A third of the groundwater bodies in the Júcar hydrographic demarcation are in poor condition due to contamination by nitrates from agricultural sources.

One of the solutions to nitrate pollution is the promotion of organic farming.

Key methodological challenges encountered

The main problem of agroecology is the lack of knowledge of agroecological techniques on the part of farmers, as well as the benefits of agroecology on the part of society.

Informing decision-making: bottlenecks and opportunities

Bottleneck: Free trade policies have impoverished people in many aspects (economically, socially, culturally), which makes it difficult to introduce alternatives that are more respectful of people and the environment.

Opportunities: More and more people care about others and the environment, which helps the implementation of agroecological techniques.

Way forward?

Agroecology supposes a change of economic, even biological paradigm. It is about organizing an economy for the benefit of people and not for the benefit of capital. It is about recognizing the vital force of cooperation and not of competition.

Key messages, questions or issues to address in workshop discussions.

- Questioning the policies of free trade
- Develop an economic system "as if people matter".
- Promote the containment of the demand for resources.
- Disseminate the problems caused by industrial agriculture (green revolution) and the social and environmental benefits of agroecology.

Economic evaluation of nature-based solutions aiming at reducing of water risks[15]

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Your experience in a nutshell

Economic narratives are largely put forward as an argument for the promotion of Nature Based Solutions (NBS) aiming at reducing water risks. However, integrated economic evidence is still needed to support this argument and inform decision makers about the opportunity to promote these solutions. To address this gap, the project H2020 NAIAD developed guidelines for the economic assessment of NBS for water related risks, taking into account direct and opportunity costs, avoided damages from the reduction of water risks and the multiplicity of co-benefits generated by NBS. This method was implemented in three case studies with different types of NBS, water risks, and scales: a neighbourhood scale with pluvial flooding issues in urban context (Rotterdam, Netherlands), a watershed scale with pluvial flooding issues in an urban context (Lez catchment, France) and a watershed scale with a river flooding issue in an urban-rural context (Brague River catchment, France). Overall, we found that the cost of implementation and maintenance is lower for NBS than for grey solutions for the same level of risk reduction, thereby confirming the generally claimed cost-effectiveness advantage of these solutions. We however find that benefits in terms of avoided damages are not sufficient to cover these costs. Other co-benefits such as the regulation of air temperature or the reduction of air pollution represent the major share of the monetary value generated by NBS. Finally, the results of the cost-benefit analysis reveal context-specific results on the overall economic efficiency of NBS.

Key methodological challenges encountered

The implementation of the full economic assessment of NBS required a diversity of skills: hydraulic modellers to evaluate the impact of NBS on hazards, risk economics to evaluate the resulting reduction of damages and environmental economics to estimate co-benefits. As an example, this skill mix was only available in 3 out of 9 NAIAD case studies. Tools and simplified approaches therefore still need to be developed for use as a routine for project evaluation.

The partnership with insurance or reinsurance partners is key to evaluate the impact of hazard reduction on insured damages. Data however remains non-transparent, which limits potential for use of this data.

Informing decision-making: bottlenecks and opportunities

The ultimate use of this economic assessment method depends on the stage of the project cycle and the integration of the project in actual NBS development plans. In the Lez case study, the project was largely perceived as a research project bringing new knowledge to decision makers, without concrete subsequent implementation plans. In the case of Brague and Rotterdam, the evaluation was more directly related to a project cycle. In the case of

[15] Le Coent, P., Graveline, N., Altamirano, M. A., Arfaoui, N., Benitez-Avila, C., Biffin, T., Calatrava, J., Dartee, K., Douai, A., Gnonlonfin, A., Hérivaux, C., Marchal, R., Moncoulon, D., & Piton, G. (2021). Is-it worth investing in NBS aiming at reducing water risks? Insights from the economic assessment of three European case studies. Nature-Based Solutions, 1(August), 100002. https://doi.org/10.1016/j.nbsj.2021.100002
NAIAD assessment webpage with guidelines for ecosystem assessment: http://naiad2020.eu/about-the-e-guide/so1-methodological-assessment/

Brague, the cost-effectiveness of NBS compared to grey solutions modified perceptions of decision makers on the potential use of these solutions. In Rotterdam, the negative cost-benefit analysis results urged decision makers to modify scenarios in order to maximize co-benefits in addition to water risk reduction.

Way forward?

The implementation of this project raised new research questions currently under exploration. We especially currently investigate 1) the benefits of NBS in cities in terms of groundwater protection, 2) the spatial distribution of NBS benefits and costs in cities, and how this distribution could be used to identify priority areas of development of NBS. This new research is implemented in the city of Bordeaux.

Key messages, questions or issues to address in workshop discussions

- NBS appear to be economically efficient only when all the benefits they generate are considered. Implications for project set up and financing are significant. Rules applying for the public funding of NBS should therefore be adapted in order to take into account cross-sectoral benefits of NBS. This requires modifications of the sectoral approach currently still prevailing in the funding of projects for water risk reduction.
- Considering the significance of co-benefits in NBS economic value, it is important to ensure that the co-benefits are maximized during NBS design and implementation, and not focused on a single benefit.
- The economic assessment of NBS requires a high level of skills in a diversity of disciplines due to the multiplicity of benefits generated by NBS. How these methods can be simplified to be more directly used to support NBS implementation?
- At what stage is the economic assessment the most relevant: to design a strategy at the city scale and/or for the implementation of concrete projects?

AN OVERVIEW OF 10 YEARS OF EXPERIENCE WITH SOCIO-ECONOMIC ANALYSES FOR THE NORTHEAST ATLANTIC REGION: WHAT DID WE ACHIEVE?

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Your experience in a nutshell

Ten years ago, OSPAR did not do much with economic analyses. Starting with a first modest contribution in the Intermediate Assessment 2017[16], by presenting socio-economic data and a very brief description of trends and developments in various economic activities that are active on and around the Northeast Atlantic, over the years the working group made itself known within the OSPAR family, and has now prepared significant contributions to the upcoming OSPAR Quality Status Report 2023[17]. An important element in this report is the application of the Drivers-Activities-State-Impact-Response framework[18]. The economics working group has prepared a study on scenarios (Bekhuis, 2021)[19], that was used as input to describe developments in the Drivers and Activities. Another report, by Pachernegg (2021)[20] on the size and trends in recreation and tourism in the OSPAR area a study described one of the activities that are usually difficult to present statistical information on, because it is not an economic sector according to Eurostat definitions. The fact that the contributions by economics working group were noticed resulted in the explicit request to develop and apply a method to analyze the impacts of changes in pressures on ecosystem services (the PS-I part of the DAPSIR framework). This was done in the study by Cornacchia (2022)[21].

In addition, the OSPAR economics group has been investigating the potential role of ecosystem services and natural capital accounting in supporting decision making at the OSPAR level. This resulted in a first overview by Veretennikov (2020)[22], an analysis of ecosystem services related to off shore wind farms by Noordergraaf (2021)[23], but also, a first version of natural capital accounts for the OSPAR area by Alarcon Blazquez (2021)[24], followed by a second version by Stofmeel (in prep), and a study on the potential policy uses of natural capital accounts by Van Veggel (in prep). These studies form a major contribution towards OSPARs Objective S7.03 in the Northeast Atlantic Environmental Strategy[25] that 'By 2025 OSPAR will start accounting for ecosystem services and natural capital by making maximum use of existing frameworks in order to recognize, assess and consistently account for human activities and their consequences in the implementation of ecosystem-based management'. OSPAR has also become member of the Global Oceans Account Partnership[26].

[16] Socio-Economics of the OSPAR Maritime Area - OSPAR-OAP (Prod)
[17] https://www.ospar.org/work-areas/cross-cutting-issues/qsr2023
[18] https://www.ospar.org/news/ospar-special-session-on-the-dapsir-framework
[19] https://www.noordzeeloket.nl/publish/pages/189058/exploring-the-future-together-a-scenario-analysis-for-the-ospar-region.pdf
[20] https://oap-cloudfront.ospar.org/media/filer_public/0f/f7/0ff77204-dc69-4f3f-9b91-e043e844840f/p00831_recreation_tourism_feeder_report_2021.pdf
[21] https://puc.overheid.nl/rijkswaterstaat/doc/PUC_709990_31/1/
[22] https://www.noordzeeloket.nl/publish/pages/172938/possibilities_of_application_of_ecosystem_services_and_natural_capital_approaches_in_ospar_activitie.pdf
[23] https://www.noordzeeloket.nl/publish/pages/182023/application_of_es_to_support_decision-making_within_ospar_final.pdf
[24] https://www.noordzeeloket.nl/publish/pages/193624/natural-capital-accounting-for-the-nort-east-atlantic-area.pdf
[25] https://www.ospar.org/documents?v=46337
[26] https://www.oceanaccounts.org/

Key methodological challenges encountered

One of the measures that is implemented by many OSPAR countries is the assignment of marine protected areas (MPAs). Therefore, the economics working group of OSPAR asked Spaans (2020)[27] to perform an assessment of the current status of MPAs and the representation of their benefits in socioeconomic analyses in order to support decision-making. However, as is often the case in economic analyses for the marine environment, it appeared to be very difficult to quantify and monetarize the benefits of measures. Partly because of the inherent dynamics of ecosystems, but also because there is no clear reference situation to compare with, and a lack of monitoring data (and because almost each MPA has its own management regime).

The availability of monitoring data at the relevant scale is also an issue when developing natural capital accounts, as shown in the report by Blazquez (2021). For example, often data on the ecological or chemical status are available for a particular OSPAR region, but not for individual ecosystems. This makes it difficult to say something on the development in the state of individual ecosystems and their capability to provide ecosystem services. In addition, there is a lack of primary data on the monetary value of ecosystem services.

Up until now the various studies on socio-economic analyses have been largely based on data and information provided by other OSPAR work streams. Ideally, these studies (e.g., the natural capital accounts) would be prepared together with the various OSPAR expert and working groups, to make the data and information more fit for purpose, and to make these projects really a product by all OSPAR groups, and thus stimulate shared ownership, instead of an economic project. However, in order to be able to be an integral part of all OSPAR work streams for a couple of years requires much more economic capacity than currently available.

Informing decision-making: bottlenecks and opportunities

Ten years ago, OSPAR did not do much with economic analyses. Starting with a first modest contribution in the Intermediate Assessment 2017[28], over the years the working group made itself known within the OSPAR family, and has now prepared significant contributions to the upcoming OSPAR Quality Status Report 2023[29] by helping to operationalize the DAPSIR framework, and initiated work on natural capital accounting. One can therefore say that economic analyses has now been accepted as an important part of the OSPAR work streams. However, the available capacity is limited, which may be a challenge for the future; to continue working on natural capital accounting and make it really an integral part of OSPAR analyses, but also helping out with various work streams where economic analyses could play a role.

For example, in 2022, OSPAR agreed on a new Regional Action Plan on Marine Litter. Whereas the first Regional Action Plan on Marine Litter was describing the measures at a very high and abstract level, this second action plan provides already somewhat more details on the potential measures. Based on some ball park figures and guestimates on the order of magnitude on the costs and effects of measures, economic analyses could support decision making at a more strategic level, to distinguish between potentially interesting – cost-effective, efficient – measures, and measures that may have less impacts at higher costs. These analyses could become more detailed in course of time, as more detailed decisions are needed and more detailed information becomes available. This could be an area where economic analyses could be used to support decision making at OSPAR level, provided that capacity is available.

[27] https://www.noordzeeloket.nl/publish/pages/184490/status_and_benefits_of_marine_protected_areas_in_europe_final.pdf
[28] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/socio-economics/
[29] https://www.ospar.org/work-areas/cross-cutting-issues/qsr2023

Way forward?

In its North East Atlantic Strategy, OSPAR has agreed to work on natural capital accounting. This work will continue in the coming years. Another issue that was raised in a recent meeting of the economics working group was that various countries might be interested to do something (more) with social analyses, although it was not clear yet what exactly. In addition, now that the economic working group has shown the potential contribution of economic analyses for the various OSPAR work streams, it has become more likely that other work streams will ask the economics working group to work with them. Therefore, whereas over the past 10 years the economics working group has mainly been working supply driven, working on topics that the economics working group could be useful for OSPAR, the expectation is that in the coming years the work by economists at the OSPAR level may become more demand driven. Therefore, at the moment, it is not possible to say what questions the other groups will come up with. However, since in 2022, OSPAR agreed on a new Regional Action Plan on Marine Litter, it is likely that the OSPAR economists will be asked to contribute to that in one way or another.

Key messages, questions or issues to address in workshop discussions.

- It took ten years for economic analyses to become (an important) part of the OSPAR work streams. This was realized by supplying OSPAR with (potentially) relevant analyses and information on own initiative. Now the economists are found by the various OSPAR work streams, there is a serious risk of not having enough capacity to deliver all that is asked for. This may be a serious challenge for the coming years. Do you have suggestions on how to deal with this?
- …

Using ecosystem service valuation in CBA of nature-based solutions[30]

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Your experience in a nutshell

In the past 7 years I have worked on economic assessment, institutional analysis and financing of (nature-based) climate adaptation in urban, coastal and freshwater in the Netherlands, Europe and globally. Often in the context of national (Dutch) or international knowledge development projects and exchanges, mostly with public but also the private sector. Additionally, I have worked on developing economic analyses and impact models related to land subsidence (in turn linked to ground – and surface water policy and climate change). In the context of climate adaptation, I have worked on demonstration cases, guideline development for embedding ecosystem service analyses in project CBA for economics and relating these benefits to cost recovery and co-financing mechanisms. At present I am doing my PhD on economics and financing, aiming to develop an integrated assessment of floodplain management scenarios for the Dutch Rhine and Porguese Sorraia, reviewing trade-offs in ecosystem services, combining results and approaches from natural capital into CBA and linking CBA to develop at-scale funding and financing strategies. Expected (hoped for) results include a substantiated new economic narrative of more integrated and nature-based river management – while such arguments are often used by propagators of NBS/ ecosystem restoration, actual economic studies supporting this narrative in the context of freshwater management are still limited.

Key methodological challenges encountered

Data availability and accessibility: within Europe, local data may be available but retrieving it is often very time-intensive relative to the scope of the work, however, using generic (not-local) data decreases relevance of results to policy makers.

Integration between disciplines: to assess ecosystem services in freshwater context, connection between hydraulic modelling, (geophysical) impact assessment – dose-effect relations are not always available, and integration can be both time-intensive and very complex. Consequentially, organizing a CBA can be quite specialist and time-intensive, not always feasible. Combination of CBA with MCA is a go-to solution in this context but may complicate communication of results.

Informing decision-making: bottlenecks and opportunities

After the Dutch 'Room for the River' programme, economic analysis was used inform a nation-wide preferred flood mitigation strategy, focusing on dike re-enforcement versus floodplain reconnection: the latter did not have a positive rationele. More integrated river management strategies (this shift is currently ongoing) + integrated assessment (in CBA) in which the co-benefits of NBS are more comprehensively addressed may lead to another outcome.

The municipality of Gouda used a CBA to inform a decision on surface water and groundwater management in relation to subsidence and adaptation issues in the inner city – with possibly significant impact on homeowners via health issues and structural damage. Bottleneck faced: a lot of discussion on validity of results based on

[30] https://link.springer.com/article/10.1007/s11069-021-04520-3 https://www.semanticscholar.org/paper/The-potential-of-nature-based-flood-defences-to-in-Kok-Bisaro/976476e0fc6aaed1333eb87b591a5c2e4c0285eb

imperfect model outcomes and assumptions on dose-effect relations. Opportunity: I would be interested in more analysis comparing uncertainties along the entire chain from input data to physical model results to pricing assumptions, to better communicate results and target efforts to reduce uncertainties. Similar issues related to NBS, where little experience with application can lead to high uncertainty in outcomes.

Way forward?

- Review (and improve) applicability of (physical and monetary) natural capital accounts to provide a basis for integrating ecosystem services in CBA in water policy context.

- Develop and publish more examples and cases of integrated assessment of NBS versus conventional solutions in support of paradigm shift/ scaling up investments in such strategies: such examples and studies are also needed if the potential of private sector investment/ financing – required to bridge the ecosystem restoration gap – is to be tapped.

Key messages, questions or issues to address in workshop discussions.

- Issue to address: if we agree more ES analysis is needed in everyday CBA in water policy context, how do we best help this happen in practice? Guidelines are increasingly out there, application in practice lags behind.
- (How to) put effort in making natural capital accounts most valuable for local decision making (including suitable for scenario analysis; modular set-up to enable use of local data; accessibility of models/ approach)

The role of hydro-economic models to support water management decisions[31]

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Your experience in a nutshell

Global water withdrawals have increased significantly throughout the twentieth century and during the first decades of this century. As a result, many basins around the world have experienced pervasive water scarcity conditions and related management challenges. These challenges are expected to become more critical in the coming decades, driven by impending socioeconomic developments. At the same time, the supply of freshwater resources to meet the ensuing increase in water demand is subject to large uncertainties due to the impacts of changing climatic conditions, water quality degradation, and increasing demand for environmental flow protection. As such, policymakers in vulnerable basins need to adapt management practices for securing reliable future water supply that can meet the demands of different sectors. However, the choice of water management options is often associated with tradeoffs across multiple societal objective such as agricultural production, energy supply, and ecosystem health, as well as across space and time.

In recent decades, hydro-economic models (HEMs) have emerged as an important tool for informing basin-scale water resources planning because they include an integrated biophysical-technological-economic representation of the water resources systems. These features are usually represented using a set of physical and technology choice equations (or core model). Numerical optimization algorithms are then applied to the core model to back calculate a set of primary decisions that collectively result in the best feasible outcome from the perspective of specific objectives important to decision-making. For example, an economic objective that focuses on minimizing costs or maximizing benefits is typical in HEMs because it facilitates valuation of resource and policy constraints. Similarly, simulation algorithms can be used in HEMs to more realistically represent complex water systems with nonlinear physical or institutional processes. Traditionally, HEMs models have been used to evaluate the efficiency of alternative water allocation mechanisms under existing infrastructure and to identify bottlenecks in the water system, where investments in new infrastructure would be most beneficial. Recently, HEMs have also been used to assess how effectively the water system can adapt to future climatic and socioeconomic changes and explore the value of various options for doing this.

Key methodological challenges encountered

The main methodological challenges encountered when developing and applying HEMs are as follows:

- HEMs require a lot of input data including crop areas, crop yields, crop prices, water use by sector, river flows, infrastructure capacity, operational rules, economic benefits, etc. These data are often not available at the model spatial (subbasin units) and temporal resolutions (multiple years, monthly) and thus require considerable efforts to be harmonized.

- Developing a HEM requires a minimum level of understanding of processes in different disciplines including optimization.

- The dimension of HEMs can increase exponentially, which makes solving the model difficult and requiring high computational capacity.

[31] Kahil, T. et al. (2018). A continental-scale hydro-economic model for integrating water-energy- land nexus solutions. Water Resources Research, 54, 7511–7533. https://doi.org/10.1029/2017WR022478

Informing decision-making: bottlenecks and opportunities

HEMs have been used to inform decision making in many countries around the world, for example the CALVIN model in California has been used in climate assessments to provide insight on promising water management alternatives or the AQUATOOL model in Spain has been used by all river basin authorities to inform water planning and management. However, the full adoption of HEMs faces several obstacles related to the high model complexity, user-unfriendly interface, and extensive data requirements. To encourage the use of HEMs for informing decision making, HEMs will require greater accessibility such that they may be more widely deployed by practitioners, as well as harmonization of modeling approaches and input data.

Way forward?

The recent applications of HEMs showed the need to shift towards a system-of-systems modeling approach that represents the water system together with other systems such as food and energy within a one more complex system, including a more realistic representation of complex social behaviors and of indirect effects of interventions beyond the modeled system. Moreover, HEMs should allow more interactive participation of practitioners and stakeholders to incorporate their needs and interests and for co-identifying implementable solutions. HEMs should also consider the increasing uncertainty related to climatic and socio-economic conditions and thus allow for sensitivity analysis of performance rather than search for a single definitive solution.

Key messages, questions or issues to address in workshop discussions

- HEMs help identifying opportunities to improve water management systems from a watershed perspective.
- In water economic assessment tools, it is important to properly account for biophysical, technological and institutional constraints in a spatially-explicit way (considering the upstream-downstream linkage) to be able to provide better-informed results for decision making in the complex environment in which water management operates.
- It is important to consider uncertainties related to climatic and socio-economic conditions and therefore seek robust solutions.
- Stakeholders' preferences and needs will need to be integrated into modeling to ensure the acceptability of solutions and the stability of agreements.

UNCERTAINTY, SHOCK AND RESILIENCE

Building water resilience to face the economic challenge of climate change in Spain[32]

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Your experience in a nutshell

Water security has always been the critical factor for sustaining income and employment opportunities in semiarid Mediterranean regions. Climate change, with the prospective reduction of water resources and the more frequent and more severe water extremes, is an emerging problem that adds to two pre-existing structural problems: the increased water scarcity and drought exposure on one side and the narrowing of options to reconstruct water security on the other. Water in increasingly scarce in the place and in the areas connected through water transfers, groundwater tables are decreasing, and the quality of groundwater diminish because of lower quantities and the use of fertilizers and agrochemicals. These problems translate into social conflicts between agricultural development and sectors that rely on the services provided by better preserved ecosystems such as tourism, biodiversity and natural conservation, energy production, urban uses, etc.

History shows that options to reduce scarcity and increase water security have been taken (such as water transfers, improvements in water efficiency, alternative water sources from reused and desalinated water) but this have not resulted in any demonstrable outcome in terms of reducing scarcity. New opportunities do exist to rebalance water uses across sectors and transform production models. But taking these options, as experience makes evident, does not guarantee any advance in water or economic resilience.

The main lesson we should take from past decisions is that all these options can only be seen as the means that should be articulated to the end of rebuilding water security.

Key methodological challenges encountered

The main methodological challenge consists in developing concepts and methods able to make the economic importance of water security visible. That implies:

- Identifying and measuring the opportunity cost of water insecurity (translating the cascade of uncertainties associated to water and climate change), into economic risks in terms of output, job and income loses, local development opportunities, etc.
- Developing new concepts and metrics to assess the economic and social benefits of water security advances.
- Develop assessment frameworks to show existing opportunities (from the energy transition, digitalization, conservation and low carbon agriculture, etc.) as means to the end of improving economic resilience while improving the status of water related ecosystems.

Informing decision-making: bottlenecks and opportunities

Water security is essentially a public good. The key political challenge in water stressed areas consists in aligning public interest (of advancing towards a water secure economy) and individuals interests in making the most of existing business opportunities. Making the individuals' benefits visible (for agriculture, tourism, energy, cities, etc.) is an integral part of any decision making process intended to create alliances to enhance the water security (supported by cooperation agreements to share the benefits) through implementing nature based management solutions to water scarcity, optimize the water portfolio, improve the urban and rural water cycle, agree on

[32] See the Water Resilience for Economic Resilience WR4ER initiative "to inform the principles, theories, tools, and practices for ensuring that financial and economic institutions can manage and invest in building resilient economies that will endure and thrive amid a shifting climate". See, for instance, the Spanish case study

financial schemes to pay for alternative water sources and put into practice all other means to improve water and economic security.

Way forward?

Improving knowledge for better understanding the importance of water resilience for economic resilience.

Reaching out to economic actors and decision makers to better understand the way water related risks are considered in their decision making and the tools they use.

Reviewing existing methods and tools of analysis that can help in making the economic case for water resilience.

Exploring the economic costs of water insecurity driven by scarcity trends and climate change in southern Mediterranean EU river basins. Developing the notion of water resilience as a strategic objective to give consistency to water policy across territories and economic sectors while accomplishing the objectives of water management.

Key messages, questions or issues to address in workshop discussions.

- Alternatives to restore water security do exists but they should be designed and implemented to respond to social and collective economic problems instead of individual needs. These alternatives should be seen as the means and not as the ends of water policy.
- Climate change escalates economic risks in water scarce and drone prone areas and add tensions to existing water conflicts.
- Without cooperation, responses to impacts of climate change on water insecurity will be spontaneous, uncoordinated, competitive, unplanned, reactive, and short term. The objective of recovering water security seems to be critical to developed political responses that are anticipated, coordinated, cooperative, planned proactive and oriented to improve the economic resilience through improving water security in the face of climate change.

Uncertainties in the adaptation of water management strategies to climate change, application of the DAPP methodology to a pilot case study[33]

Philippe Le Coent, BRGM, p.lecoent@brgm.fr

Your experience in a nutshell

Decision makers face deep uncertainties in the design of water management strategies (e.g, climate change, market dynamics …). In this context, traditional economic assessment methods based on optimization are no longer valid to support decision-making. One possible approach to deal with deep uncertainty is the use of adaptive management strategies in which a set of adaptation measure are identified and implemented according to changing conditions over time. The Dynamic Adaptative Policy Pathways (DAPP) method[34] proposes a stepwise method to evaluate alternative adaptation measures and design pathways to cope with different scenarios of uncertain future. This method has been applied to a diversity of contexts but presents limited application to the context of quantitative water management. We took the opportunity of the development of a modelling chain of water resource and water use (hydropower) in the Neste system, South West France (PIRAGUA project, INRAE) to pilot test the method in a context of quantitative water management with a multi-purpose system of reservoirs. This activity was implemented in a small project and therefore did not allow the full implementation of the method. We were nevertheless able to design a first map of adaptation measures and determine the attainment of Adaptation Tipping Points (ATP) in two climate change scenarios.

Key methodological challenges encountered

Although this method has been applied in many contexts, its application to the domain of water management design remains a challenge. Indeed, the central concept of ATP[35] which is straightforward in risk management policies becomes more challenging when there are multiple objectives with multiple views on their relative importance. Our main challenge was therefore to try to identify the nature of the ATP through a participatory process (individual interviews and workshops) carried out with a limited set of key stakeholders. A compromise was finally defined as a certain level of the main high altitude reservoirs at the end of the agriculture season, considered able to maintain the minimum public water supply and environmental needs. We consider a water management strategy to have reached its tipping point when this level is passed more than once in 10 years.

Another key challenge was the adaptation of the modeling chain to evaluate the attainment of the ATP. In particular, a simple irrigation model had to be specially developed, in addition to the hydraulic and hydroelectric management model, to account both for the impact of climate change on water demand and to estimate the impact of irrigation adaptation measures (such as the reduction of maize cultivation on water demand). The limited size

[33] Eric Sauquet, Philippe Le Coent, Clotaire Catalogne, Peng Huang, Jean-Philippe Vidal. Formulation de stratégies d'adaptation au changement climatique sur les territoires connectés au système Neste - Une étude pilote croisant trajectoires dynamiques d'adaptation et vulnérabilités. Inrae; Brgm; icare2. 2023. https://hal.inrae.fr/hal-03929971

[34] Haasnoot, M., Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. Global Environmental Change, 23(2), 485–498. https://doi.org/10.1016/j.gloenvcha.2012.12.006

[35] Kwadijk, J. C. J., Haasnoot, M., Mulder, J. P. M., Hoogvliet, M. M. C., Jeuken, A. B. M., van der Krogt, R. A. A., van Oostrom, N. G. C., Schelfhout, H. A., van Velzen, E. H., van Waveren, H., & de Wit, M. J. M. (2010). Using adaptation tipping points to prepare for climate change and sea level rise: A case study in the Netherlands. Wiley Interdisciplinary Reviews: Climate Change, 1(5), 729–740. https://doi.org/10.1002/wcc.64

of the project did allow neither the evaluation of the diversity of adaptation measures nor the evaluation of the other set of evaluation criteria, identified during the participatory process. Although the method is said to accommodate qualitative approaches, we found that its application and especially the identification of the impact of climate change on the attainment of ATP requires a sophisticated chain of modelling.

Informing decision-making: bottlenecks and opportunities

The DAPP method was only partially applied to our case study and therefore could not be directly used for decision-making. The method nevertheless generated at least two interesting outcomes:

- Despite its difficult application to the context of quantitative water management, we consider that the use of the concept of ATP is fruitful to raise awareness among stakeholders on the need to adapt to climate change.

- Key stakeholders participated in the process, including the organization in charge of formulating the new water management and development plan for the Neste region. Some elements of the method, data and conclusions will therefore be incorporated in this plan.

Way forward?

- Despite the interest of the DAPP method to manage uncertainties, we had difficulty taking into account the uncertainty between climate models to evaluate adaptation measures. Presenting the results of the set of climate models did not appear doable. We therefore used the median year of attainment of the tipping point. We need to further investigate how to account for the uncertainty of climate models in defining the attainment of ATPs.

- We used an ad-hoc participatory process to identify ATPs. The concept and the process to define them could however be clarified: What standard process could be used to identify ATPs? What are the possible indicators in the domain of water management? How to choose among candidate indicators of tipping points in a participatory process? Should multi-dimensional ATPs be preferred in the context of water management?

- More economics is needed in the choice of preferred pathways in the DAPP methodology.

Key messages, questions or issues to address in workshop discussions.

- DAPP appears to be a powerful tool to identify the vulnerability to climate change of water management systems and evaluate potential adaptation strategies.
- Further investigations are needed to tailor the concept of adaptation tipping points to the evaluation of water management strategies.

SUPPORTING POLICY MAKING WITH A NATURAL CAPITAL PERSPECTIVE

Natural capital & life cycle thinking for holistic asset management[36]

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Your experience in a nutshell

The research was conducted in the period 2013-2017 in the context of a PhD project at the University of Bath (UK). The work was conducted in the context of the UK water sector, whose regulators formally encourage the industry to become more resilient by adopting whole systems'/integrated approaches in their asset management strategies. Responding to this policy-driven demand, the research delineates the catchment as the scale for the design and implementation of holistic asset management. It introduces the Catchment Metabolism (CM) concept and modelling schema: a structured, transdisciplinary approach for modelling catchments as asset systems and gathering and synthesizing data for integrated asset management purposes. The whole-system approach developed is based on the principles of integrated catchment management (ICM), water accounting and environmental regional input-output analysis (E-RIO). The research outputs have been utilised in the formulation of the asset management strategy of a regional water company in South-West England.

Key methodological challenges encountered

Data challenges emerged for constructing the water accounts. Data sources and types were combined. Nonetheless, the data were mostly aggregated and not local- or case- specific. Therefore, they were -at times- not aligned in terms of temporal or geographical scales. Therefore, assumptions and simplifications had to be made regarding the hydrological parameters and local conditions of the case study catchment and its actors (e.g. agriculture). Working in the interface of multiple disciplines results in an elaborate, lengthy research process in order to build a robust framework that enables to make use of the strengths of multiple approaches and tools. The lack of transparency of existing methodologies either did not allow for their in-depth analysis or was discouraging from use altogether. The transdisciplinary nature of the work also challenged the communication/engagement with the research's industrial partner. For example, the work couldn't be 'categorised' and therefore 'assigned' directly to one of the company's departments. Rather, it became clear from an early stage in the research project, that collaboration and data/information/policy synthesis across different parts of the organisation was necessary. A lack of relevant experience resulted at times in miscommunication, questioning about the value of the research conducted, as well as delays in data sharing and compilation.

Informing decision-making: bottlenecks and opportunities

The outputs of the research have been used by the project's industrial partner to demonstrate in their asset management strategy that they are meeting the national (UK) policy demands for integrated and resilient asset management. More specifically, the modelling schema created informed the formulation of the strategic asset management plan by the relevant teams of the collaborating water company and informed the discussions with the regulators (executive level). An opportunity for further integration within the water sector would have been to be in direct dialogue with the regulatory bodies, to have the chance to plan a seed for the practical application of sustainability and systems thinking principles in the water industry.

[36] https://www.sciencedirect.com/science/article/pii/S0959652616319291

Way forward?

Despite its structured and comprehensive design, the methodology introduced is arather sophisticated and data intensive which requires collaboration among experts and the automatisation of processes in a later stage. The application of the schema in diverse typologies of catchments is required to evaluate its flexibility and highlight areas for future improvement. More case study applications may provide further practical insights and facilitate the integration of the approach in every day practice.

Key messages, questions or issues to address in workshop discussions.

- The research undertaken introduces a transdisciplinary modelling schema and a modelling inventory, based on the robust synthesis of disciplines, methods and tools.
- The methodology introduced enables water companies to include natural capital – in the forms of input and output- in their asset management strategy.
- The work has achieved impact at a company/regional scale. How could this be scaled-up, therefore; how would an effective direct interface between science and policy look like?

THE FRENCH EVALUATION OF MARINE AND COASTAL ECOSYSTEMS AND ECOSYSTEM SERVICES

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Your experience in a nutshell

Context

The French Evaluation of Ecosystems and Ecosystem Services (EFESE) was launched in 2013 as part of the 2011-2020 national strategy for biodiversity. Inspired by the Millenium Assessment, EU MAES programme and IPBES start, the evaluation has been conducted between 2015 and 2018. AMURE has been responsible to produce the evaluation for marine and coastal ecosystems.

Approaches

Literature review, expert workshops, expert survey and stakeholder consultations to:
- Describe the state of marine ecosystems accounting for incompleteness of knowledge and priorities in management arrangements;
- Reveal stakeholders' perceptions of the state of the ecosystems and the levels of services provided;
- Estimate the benefits of each service separately with available physical and monetary indicators, consider bundle of services,
- Characterize the diversity of ecosystem service demands and possibly their antagonisms and complementarities, to help inform trade-offs; and
- Assessment of the level of consensus or dissent by stakeholders, comments published with the evaluation.

Key methodological challenges encountered

The main methodological challenges encountered in the French Evaluation of Ecosystems and Ecosystem Services

- The sea is a vast 3D domain (France has second EEZ in the world) with a great diversity of ecological entities (temperate, tropical, polar).
- The level of knowledge rapidly decreases when we move offshore and deep in the ocean.
- Scale of services and supporting ecological functions many be significantly different (fisheries, carbon sequestration,).
- Except for commercial provision of seafood, both the physical and monetary evaluation of ES is very fuzzy (part of coastal tourism or carbon sequestration depending on ecological status?), so more work is needed on indicators.
- Account for the financial and regulatory effort that goes to protect natural heritage but doesn't fit in ES framework.
- A large share of information is an opportunistic production (research programmes) so lack of consistency in method and continuity.

Informing decision-making: bottlenecks and opportunities

- Sympathy for creating a data collection framework to document an accounting approach (MSFD ESA context) but no move since 2018.
- Availability of experts and stakeholders to develop and share any kind of regular assessment.
- Demand for establishing maritime economy observatories (regional and national) and national statistical service.

Way forward?

- Research to develop indicators and methodologies to document physical and monetary accounts in cooperation with statistical services.
- Prioritize the marine ecosystems with a significant contribution to society or critical for conservation.
- Design under the regulatory framework a program to collect data on activities and policy targets on a regular basis.

Key messages, questions or issues to address in workshop discussions.

- A “complete” versus an “informative” account for policy design and public debate (how to prioritize).
- Partnership research/statistical services to develop operational tools.

BRINGING ECOSYSTEM SERVICES AND NATURAL CAPITAL FRAMEWORKS INTO OPTION APPRAISALS (CEA/CBA): WATER INDUSTRY EXPERIENCE

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Your experience in a nutshell

The UK government's 25 Year Environment Plan sets out an ambition to improve the environment in a generation, including achieving the aim of clean and plentiful water and water industry plays a crucial role in protecting and enhancing the environment. The Environment Act 2021[37] challenges water industry to ensure resilience, support for nature recovery, use of natural capital and a catchment approach in decision-making, and delivery of net gain for the environment. There are also challenges around restoring good ecological health to chalk streams and reducing the impact of storm overflows on the natural environment. The water industry national environment programme (WINEP) ensures that water companies are meeting their statutory and non-statutory environmental obligations while maximising wider environmental outcomes in relation to natural environment, net zero, catchment resilience and access, amenity, and engagement. The WINEP is closely linked to other frameworks, plans and strategies including River basin management plans, Water resource management plans (WRMPs) (that enable sustainable abstraction and ensure non-deterioration), Drainage and wastewater management plans (DWMPs) and Drinking water safety plans among others. Water companies need to identify best value set of options while taking into account costs and benefits for customers, environment and society (both monetary and non-monetary), natural capital and net gain for the environment and specifically biodiversity net gain (if applicable). Current guidance[38] suggests that the appraisal needs to consider natural capital and ecosystem services that natural capital assets provide and consider as a minimum the following ecosystem services: 1) water purification; 2) water regulation; 3) natural hazard management; 4) climate regulation; 5) biodiversity.

WSP studies over the last three cycles of water resources and river basin management planning aimed to support water industry in completing individual and in-combination assessments of options to inform the selection of a best value set of options. The studies commenced with unconstrained lists of possible options that were screened to develop a constrained, feasible list of options for detailed appraisal. The studies used a range of approaches including Multi-Criteria Analysis, Cost-Benefit Analysis, Cost-Effectiveness Analysis and environmental and social cost assessments while considering changes in natural capital assets and associated ecosystem services flows. The appraisals identified the preferred, best value (combinations of) options to be included in water companies' business plans (e.g. based on Cost-Benefit Ratios).

Key methodological challenges encountered

Despite encouraging the use of Natural Capital and ESS frameworks in water industry there is currently no single, standardised protocol on water industry approaches to NC/ESS appraisals. This has led to an uneven development and application of natural capital approaches across industry, lack of consistency and comparability of results across different water company regions.

Water quality improvements as a result of water industry interventions (including catchment management approaches) to ensure compliance with water body environmental objectives are valued using current water benefit

[37] Environment Act 2021 (https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted)
[38] Water resources planning guidance (2020) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/903694/Water_resources_planning_guideline.pdf

unit values (NWEBS)[39] - despite the crucial role NWEBS benefit values have played to date in river basin management planning, there are several notable limitations: NWEBS values only cover surface water bodies; do not capture effects of changes in ecological and chemical water body status on human health[40] (physical and mental), and more generally on a number of regulating and supporting_ecosystem services (e.g. climate regulation, biodiversity); NWEBS values do not cover emerging issues and pollutants (e.g. microplastics, AMR) and benefits of non-deterioration. There are also challenges in assessing intraclass and marginal improvements as NWEBS benefit values capture the value of change in the overall water body status from one status class to another (e.g. from moderate to good).

Another key methodological challenge include:

- Ability and limitations of the current scientific knowledge to identify and quantify marginal changes in surface and groundwater quality and quantity and resulting impacts on ecosystem services (regulating, supporting). The issue of scientific uncertainty is also of a particular relevance to emerging pollutants (e.g. pharmaceuticals, microplastics, chemicals) as there is little scientific understanding of the potential impacts of these substances on aquatic environment and human health;

-Quantifying and monetising impacts of options on biodiversity including from marginal changes in NC asset condition;

-Coherent use of non-monetary value metrics in ESS/NC appraisals (where practicable) in conjunction with monetary values.

Informing decision-making: bottlenecks and opportunities

The water industry national environment programme has delivered significant benefits since its inception. The investment since 1989 totalled 25 billion GBP and more than 5 billion GBP between 2020 to 2025[41] financing catchment-based measures, water industry asset improvements and other interventions. These investments have been crucial to ensure that water companies are meeting their statutory (S) environmental obligations (mandatory legislative requirements in relation to water quality, quantity and biodiversity), statutory plus (S+) obligations (subject to disproportionality assessment) and non-statutory (NS) environmental requirements that go beyond the minimum legal requirements. Water industry needs to meet their statutory and non-statutory requirements while maximising wider environmental outcomes in relation to i) natural environment (restoration and enhancement of the environment, biodiversity, and habitats), ii) net zero (embedded and operational GHG emissions), iii) catchment resilience (e.g. flood/ drought resilience, better surface and groundwater management, restoring or increasing environmental capacity) and iv) access, amenity, and engagement (amenity, recreation, wellbeing).

The option appraisal studies enabled water companies to identify best value set of options taking into account costs of options (TOTEX) while maximising net benefits to environment, society and customers.

Way forward?

The lack of a standardised protocol on water industry approaches to natural capital and ESS appraisals has led to an uneven development and application of natural capital approaches across industry and improving consistency

[39] In 2007, a **National Water Environment Benefit Survey (NWEBS)** was conducted to derive people's Willingness-To-Pay for improvements in the aquatic environment. Benefit values reflected status change in surface water bodies and covered six parameters: fish, invertebrates and other animals, plants, condition of flow and channel and safety for recreational contact.
[40] Beyond the safety of recreational contact with surface water
[41] WINEP: https://www.gov.uk/government/publications/developing-the-environmental-resilience-and-flood-risk-actions-for-the-price-review-2024/

in *approach* and *application* will be of crucial importance in the future. Other important areas of further research include:

- Assessing (quantifying, monetising) impacts of options on biodiversity including from marginal changes in NC asset condition.

- Closing the gaps in monetary values of benefits from natural capital (where practicable) in conjunction with development and coherent use of non-monetary value metrics in ESS/NC appraisals.

Key messages, questions or issues to address in workshop discussions.

- Setting the boundary of option appraisal – focusing on key natural capital assets and ecosystem services flows vs aiming to value all costs and benefits to society and environment.
- Ability to translate and quantify changes in natural capital stocks and their condition into ecosystem services flows incl. dealing with lack of scientific knowledge and/or uncertainty when valuing impacts of emerging pollutants (e.g. priority substances, microplastics) on aquatic environment.
- Development and use of non-monetary value metrics in conjunction with monetary estimates.

NATURAL CAPITAL ACCOUNTING IN FINLAND

Liisa Saikkonen, SYKE/Finnish Environment Institute

Your experience in a nutshell

Testing and developing methods to compile ecosystem accounts for freshwater and marine ecosystems in Finland. Valuation of aquatic ecosystem services and ecosystem assets for NCA. Identification of data gaps with respect to aquatic ecosystem accounting. Assessing the connections between aquatic natural capital accounts and other policies such as MSFD, BD strategy and WFD. Evaluation of the institutional context (ownership, stewardship, laws and policies) affecting markets of ecosystem services. Taking part in the revision of the EU regulation of environmental economic accounts (with other Finnish experts).

Key methodological challenges encountered

I think the accuracy/resolution and availability of all data (biophysical, economic and institutional) are the main challenges. Also "raising the awareness" on accounting is a major challenge, meaning that accounting is not just "something to do with economics" but a framework of standardized methods that allows the measurement and monitoring of ecosystem assets and services in biophysical and monetary terms that comply with the system of national accounts. There are countless ways that NCA can support policy making, and there are synergies between ecological and economic monitoring required by other policies, and data collection required by ecosystem accounting. There are still major challenges to communicate these aspects to the policy makers.

Informing decision-making: bottlenecks and opportunities

In Finland NCA has not been officially used to inform decision making, however ecosystem accounting approach has been applied for example on the use of marine waters analysis for MFSD already in 2018, but this was more of an ex-post analysis to see how current activities and previous decisions affect the value of ecosystem services. NCA could be used more for ex-ante type of analyses. However, spatial data on ecosystems and their use has been used to support policies, but these data have not been called ecosystem or natural capital accounts.

Visual tools and portals to illustrate ecosystem accounts spatially to support decision making have been developed, but unless we have accurate and reliable data with sufficient resolution to illustrate, these tools provide very little added value to policy making.

Again, we need to get the message through to scientific community and decision makers, that we should compile ecosystem accounts, not just to meet the regulations set by EU or another institute, but to support other policies. This would mean that the data used to compile the accounts should be reliable and of adequate resolution to support policy making on subnational level even if the accounts are mandated to be compiled for national level.

Way forward?

- Getting message through to scientific community and policy-makers on the synergies, usability of accounting to support policies, and on the data requirements.

- Personal interests and projects: understanding the institutional settings affecting ES markets and the value of ecosystem assets; developing policy applications of aquatic NCA: especially with respect to MPAs, ecosystem restoration, and decisions on the use of marine and freshwater areas; NCA to support investments and other actions of citizens and companies; integrating NCA to I-O modelling.

Key messages, questions or issues to address in workshop discussions.

- NCA should be seen as a tool to support policies, and not just as something that is expected to be required from EU states.
- It is all about data. There are no tools or methods that can compensate for the lack of reliable and accurate data of sufficient spatial resolution. This does not apply only on ecological data but also on the data on the demand of ecosystem services and other factors affecting the value and market of services.

COMPILING NATURAL CAPITAL ACCOUNTS FOR THE NORTH EAST ATLANTIC

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Your experience in a nutshell

I am working on creating the second version of the natural capital accounts for the North East Atlantic. For the creation of these accounts, I am following the System of environmental-economic accounting – ecosystem accounting framework. This framework uses five different accounts, some of which are already created in the first version, and I am updating and some of which I am creating. The extent account is updated using a more recent EUNIS classification. The condition account is created using indicator assessments from OSPAR. The ecosystem service accounts are updated where possible and some new ecosystem services will be added. For example, coastal protection will be added as a new ecosystem service. And lastly the asset account will be updated, and the value can then be compared to the value in the first version.

Key methodological challenges encountered

One of the main challenges in creating the natural capital accounts for the North East Atlantic is the data availability. It can be quite difficult to get complete data for creating natural capital accounts and this is especially difficult regarding the marine environment. Some data is only available for national seas or only small parts of the North East Atlantic, which is then not representative for the whole area. Data is also not collected using the same method for every OSPAR country. Another challenge is that most data for the ecosystem services cannot be linked to the ecosystem extent account as OSPAR mostly collects data that is based on their five different regions. This means that the accounts can, in most cases, not be linked to each other.

In the SEEA EA framework that is used, only natural capital is included but it would of course be interesting to not only look at natural capital but also at social capital to get a more complete overview of the value of the marine environment. Social capital is added in Ocean Accounting so it might be interesting to look at this in the future.

Informing decision-making: bottlenecks and opportunities

Right now, the natural capital accounts are not really integrated in any other framework but it would be a good opportunity for OSPAR to try and integrate the natural capital approach within the DAPSIR framework. The creation of natural capital accounts for OSPAR could also be included in the next OSPAR Quality Status Report. This would be an opportunity for OSPAR to keep track of their natural capital and to see how it is developing. Keeping track of natural capital and especially the ecosystem service accounts and the ecosystem asset account could also be used to inform decision-making, as it is easier to see whether the natural capital is declining over the years.

The natural capital accounts created for the North East Atlantic will probably be mostly used by OSPAR but can also be used by the individual countries that are part of the OSPAR area.

Work is still needed on how natural capital accounts can inform decision-making as the accounts can be quite difficult to understand and use for policy makers and others who are not involved in the creation of the accounts. Looking at how terrestrial accounts are used in decision-making and using case studies could support the use of marine accounts in decision-making.

Way forward?

Some ideas for further research would be to keep updating and adding on to the accounts, especially after the OSPAR Quality Status Report is published, to keep track of the natural capital and to try to connect the account to each other more. It would also be interesting to look at the idea of adding a pressure account. Another idea for further research is to look at Ocean accounting as this includes social capital and can give a more complete valuation.

Key messages, questions or issues to address in workshop discussions.

- Even though data can be limited this should not be the reason to refrain from creating and working with natural capital accounts.
- How could the framework be made clearer for accounting within the marine environment?
- Would it be relevant to also include a pressure account in the natural capital accounting framework?

POTENTIAL POLICY APPLICATIONS OF NATURAL CAPITAL ACCOUNTING IN THE MARINE ENVIRONMENT

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Your experience in a nutshell

Marine policy faces issues that provide integrated social, economic and environmental challenges. The complex integrated policy context requires an integrated information stream to support evidence-based decision-making. The System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA-EA) framework which was accepted as international accounting standard during the 52nd session of the UN statistical division in March, 2021, provides measurements and reports on the stocks and flows of the natural capital of the marine environment. On 11th of July 2022 a proposal was made for mandatory provision of natural capital accounts by EU member states. Various institutions have expressed their interest in setting up natural capital accounts, but they are mainly supply driven.

Key methodological challenges encountered

Objective: Examine potential policy applications for natural capital accounting for marine policy (specifically the Dutch part of the North Sea & OSPAR):

- Analysis of up-to-date case studies and interviews on natural capital accounting (NCA)
- Discussion during OSPAR workshop 13th (North Sea) and 14th (North East Atlantic) of December 2022
- Establishing policy context, policy applications & knowledge gaps

Key challenges:

- Hard to directly couple evidence and a policy decision
- Especially with relatively new and incomplete framework such as NCA
- Many accounts are currently being developed (supply driven), what is the benefit of placing existing information in a different framework?
- Go from abstract policy applications/context to concrete examples and link it to existing policy goals

Possible policy application of natural capital accounting for marine policy

- Issue identification and monitoring the state of the marine environment.
- Establish insights on trade-offs and interactions between marine ecosystems and economy.
- Provide communication tool for policy makers to establish the importance of the marine environment and blue economy.

– Support multidisciplinary communication and cooperation between various stakeholders within (and outside) the government.

- Combine with other methods such as scenario analysis or cost benefit analysis to provide integrated insight into assessment of future policy decisions in a spatial setting.

Way forward?

- Data.
- Applicability of NCA strongly varies per EU member state
- How to keep policy makers engaged while accounts are being improved?
- Need for more case study examples to show the possibilities of NCA
- Think about how to visualize relatively complex data for various types of stakeholders
- Make the accounts more demand driven

Key messages, questions or issues to address in workshop discussions

- What are the main challenges to be able to use NCA for marine policy?
- How do we keep policy-makers engaged while the accounts are being developed?
- How can natural capital accounts contribute to specific elements and areas of MSFD. What is need-ed to make it applicable?

SOCIAL CHALLENGES AND CHANGE OF BEHAVIOR

INTEGRATING ENVIRONMENTAL JUSTICE DIMENSION IN WATER POLICY DESIGN AND EVALUATION[42]

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Your experience in a nutshell

With Master's degrees in Agricultural Development Economics and in Environmental and Natural Resources Economics from AgroParisTech (France) and a PhD in Economics from Montpellier Supagro (France), I have 18 years of experience as an environmental economist applied to geosciences, contributing to and coordinating the economic component of applied research projects at the local, national and European levels. I am particularly involved in the development of methods to design and assess groundwater protection programs using nature-based solutions (e.g. agroecology, forest conservation, urban green infrastructures, wetland restoration). My current research activities contribute to the four principles of sustainability economics applied to groundwater protection: (i) a systemic approach integrating human activities and aquifers; (ii) long term consideration; (iii) cost-effectiveness approaches applied to groundwater quality restoration; and (iv) analysis of different dimensions of social and environmental justice in groundwater protection programs

My experience in analyzing environmental justice in groundwater protection programs is quite recent. I started with an analysis of population preferences for different NBS strategies at the scale of a Mediterranean watershed (France), where we showed (with a choice experiment survey) marked differences in preferences along an urban-rural gradient (Hérivaux and Le Coënt, 2021). We showed that these differences were related to three types of environmental inequalities: inequalities in access to nature, inequalities in exposure to heat islands during heat waves, and distributional inequalities in terms of the impact on the place dedicated to the car (Hérivaux and Le Coënt, submitted).

I still work on this issue with the co-supervision of a PhD thesis in progress, which focuses on the economic analysis of NBS aiming at improving groundwater recharge in urban context. A CE survey has just been carried out in the Bordeaux metropolitan area (France) and highlights again the existence and influence of environmental inequalities on the preferences of the population for different NBS strategies.

Key methodological challenges encountered

Inequalities are often central in economics to evaluate the justice of a situation, but studies focus mainly on the analysis of three forms of inequalities; economic inequalities, educational inequalities, and health inequalities, the environment being often relegated to the background. This field of research is still little investigated. Methodological approaches using economic and social sciences still need to be developed to support the design of cost-effective groundwater protection programs, supporting just conservation rather than generating negative effects and creating or exacerbating existing environmental inequalities.

[42] Hérivaux, C. & Le Coënt, P. (submitted), « Inégalités environnementales et hétérogénéité des préférences pour les solutions fondées sur la nature », Développement Durable et Territoires; Hérivaux, C. & Coent, P. Le (2021), « Introducing nature into cities or preserving existing peri-urban ecosystems? Analysis of preferences in a rapidly urbanizing catchment », Sustainability (Switzerland), vol. 13, n°2, pp. 1-36. https://doi.org/10.3390/su13020587, BIODIVERSA+ 2021-2022 Joint Call funded projects: https://www.biodiversa.eu/2022/10/07/2021-2022-joint-call/

Informing decision-making: bottlenecks and opportunities

The time frame is not sufficient to analyze the contribution of these results to decision making. Nevertheless, we anticipate that taking environmental inequalities into account will make it possible to anticipate potential inequalities and to think about compensation mechanisms in order to design just conservation programs.

Way forward?

The recently funded BIO-JUST project (Biodiversity and ecosystem protection driven by Environmental Justice) coordinated by Jean-Carlo Rodriguez (German Development Institute) will address these challenges by BIO-JUST investigating the environmental justice implications (i.e. questions of equity in relation to the distribution of benefits and costs from environmental policies and practices, to the inclusion and exclusion of stakeholders and perspectives in processes of decision-making, and to the recognition of different worldviews, use rights and knowledges) in the design, implementation and evaluation of NbS for watershed provisioning ecosystem services across seven different case studies in Europe and Latin America. My contribution to this project will focus on highlighting and analyzing the different forms of environmental inequalities associated with groundwater protection programs as well as the trade-offs that may exist between them, but also with other forms of inequalities and other forms of justice.

Key messages, questions or issues to address in workshop discussions.

- Environmental inequalities associated with groundwater protection programs have been under-investigated in the past.
- Their consideration by social and economic sciences is necessary to design just groundwater protection programs.

Bringing a social issue perspective to EU marine water policy[43]

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Your experience in a nutshell

As part of the Marine Strategy Framework Directive (MSFD) implementation and its forthcoming revision and in support of the Programme of Measures and Socio-Economic Analysis working group (POMESA WG), we (ACTeon) are conducting a study on social aspects in relation to the MSFD and marine policies in general. The analysis shows that the social dimension is not much taken into account in maritime policies in general, but the issue is gaining interest lately. The study aims at providing an overview of how various countries have been dealing with social issues, offering a source of inspiration for others.

The study provides definitions for the main social concepts studied, a state of play of the consideration of these aspects in the MSFD (and to a lesser extent in other marine policies) and case studies building on literature review and interviews. The case studies provide in-depth assessments of social issues in the marine field, analysing how these issues are considered in practice under diverse contexts and scales. Lessons drawn from the case studies will contribute to provide operational guidance to better consider social issues in the MSFD context (in terms of "social impact" assessment and supporting measures).

Some key messages emerge from the study:

- The principles of fairness, inclusiveness and social acceptance are major social issues. The respect of these principles is of particular interest when looking at the social impacts of policies (e.g. are all social groups impacted equally?) or at the governance processes related to policy implementation (e.g. are all social groups consulted and involved in the decision-making process?).

- Social issues can be found at each stage of a policy cycle, from the setting of objectives of marine policies (defining social objectives) to the setting of social indicators aiming at assessing the social impacts of marine policies after a full implementation cycle.

- For the time being and for the Programmes of Measures (PoM) analysed, the "social measures" implemented in the framework of the MSFD are mainly related to information, capacity building, awareness raising and consultation.

- The case studies provide sources of inspiration for better taking into account the social dimension in the MSFD, with examples of accompanying measures addressing social concerns (e.g. aid in developing complementary activities, training, facilitation of community working groups, targeted communication and surveys) and stressing

[43] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). EUR-Lex - 32008L0056 - EN - EUR-Lex (europa.eu)

GURNEY G. G., MANGUBHAI S., FOX M., KIATKOSKI KIM M. and AGRAWAL A., 2021. Equity in environmental governance: perceived fairness of distributional justice principles in marine co-management. Environmental Science & Policy, 124, 23-32. doi:10.1016/j.envsci.2021.05.022

BENNETT, N.J., 2018. Navigating a just and inclusive path towards sustainable oceans. Marine Policy. https://doi.org/10.1016/j.marpol.2018.06.001

JOHRI S., CARNEVALE M., PORTER L., ZIVIAN A., KOURANTIDOU M., MEYER E. L., SEEVERS J. and SKUBEL R. A., 2021. Pathways to Justice, Equity, Diversity, and Inclusion in Marine Science and Conservation. Frontiers in Marine Science. Volume 8, Article 696180. doi: 10.3389/fmars.2021.696180

SOMA, K., HAGGETT, C., 2015. Enhancing social acceptance in marine governance in Europe. Ocean & Coastal Management, 117, 61–69. doi:10.1016/j.ocecoaman.2015.11.001

the need to better include vulnerable groups in the MSFD implementation (e.g. having really inclusive participatory processes).

Key methodological challenges encountered

Main methodological challenges encountered carrying out the study are:

- Defining what lays behind "social" and the social concepts (and finding the right sources to do so) with relevance to the marine context. Social issues seem more difficult to define and measure than purely economic and environmental factors, with mainly qualitative indicators. It is also difficult to find examples of measures with social aims in marine environmental policies, as "social actions" are usually limited to education, awareness raising and consultation. The social issue is also very often seen from a socio-economic perspective, with indicators mostly related to employment and working conditions;

- Figuring out how social initiatives implemented at local levels in particular can be applicable and adapted to the European policy context;

- The availability of the documents produced as part of the implementation process (e.g. Programmes of Measures for the second cycle of the MSFD) and the large amount of information to be reviewed.

More generally, challenges related to the implementation of social assessment and measures in marine policies include the involvement of vulnerable groups (which may be harder to reach out) and the need to provide them with the appropriate means to engage; administrative barriers (social initiatives often requiring flexible and innovative approaches that can be difficult to align with restrictive funding rules); the insufficient awareness on social issues (their consideration may actually be perceived as "obvious", thus leading to less effort to address social issues in practice); the need to tailor social strategies to the local context and challenges; the limited citizens' limited knowledge about the marine environment; the difficulty of identifying the social impacts of measures due to cumulative effects…

Informing decision-making: bottlenecks and opportunities

The results of the study will be presented to and hopefully used by the members of the POMESA WG. The results and recommendations provided by the study could be used to elaborate new guidance for the Economic and Social Analysis (ESA) developed under the MSFD and come up with a methodology to assess the social impacts of the MSFD. The results could also be the opportunity to think of new accompanying measures to be implemented under the next cycle of the MSFD and to be reported on by EU Member States.

Way forward?

Such a study could also be replicated for other marine policies (in more detail than ours, which focuses mainly on the MSFD) and for freshwater policies (if this has not already been done). Sources of inspiration could also be found in "land-based" examples that demonstrate a successful reconciliation of the three pillars of sustainable development. Hopefully, these studies will allow for a better consideration of the social dimension in fresh and marine water policies, without focusing only on the environmental and economic dimensions in the future.

Key messages, questions or issues to address in workshop discussions.

- Social issues are currently given relatively little attention in marine policies but are gaining momentum.
- What do we mean by "social"? A difficult-to-define object.
- Any examples or ideas about levers for the creation of sustainable social conditions?
- Any examples of social analyses/assessments or (successful) supporting measures?

Social vulnerability in CBA for flood risk management[44]

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Your experience in a nutshell

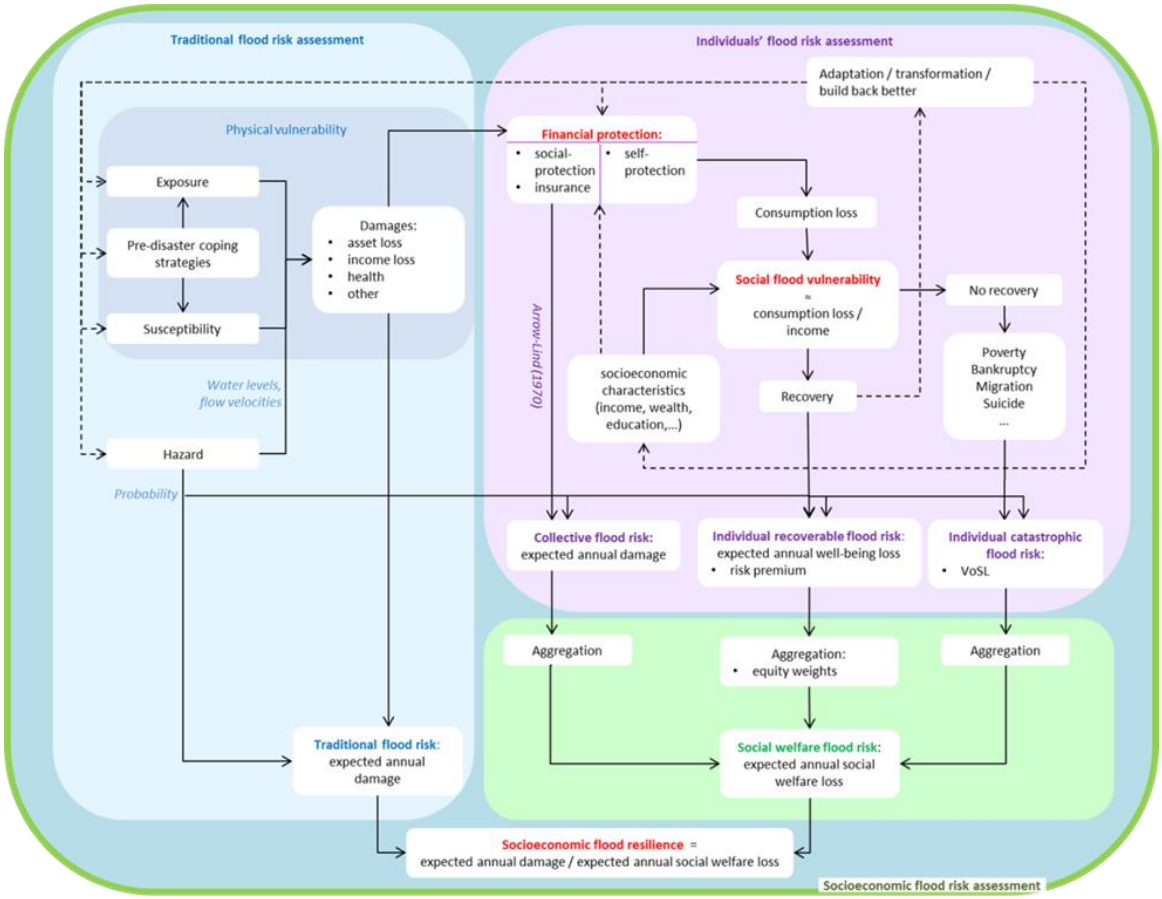
Most traditional 'flood' CBAs focus narrowly on avoided asset damages, and do not adequately account for the interests of the (relatively) poor, who own few assets. Poor people compose a relatively large share of the population exposed to floods and are often more vulnerable. Focusing on avoiding asset damages will steer investments in flood risk reduction to areas with people who are already relatively better off, leaving the poor exposed. Those CBAs lead to dissatisfaction and questions about fairness and social justice of flood risk management (FRM) policies and programs. They do not pay much – if any – attention to other types of flood damages for humans (e.g., income loss and health impacts), which may be substantial. Nor do they consider how flood damage is distributed over people with different incomes, and the capacities of those people to cope with, and recover from, floods. These CBAs do not consider 'social vulnerability' and 'socioeconomic resilience' of individuals, communities or societies. They also are at odds with the ambition of many governments to mainstream policies for disaster risk reduction and climate change adaptation, with social policies aiming at the provision of safety nets, income distribution and poverty reduction. Those CBAs are inconsistent with social welfare economics, which is the scientific and ethical foundation of CBAs supporting public investments decisions, such as those in FRM.

Key methodological challenges encountered

The CBA approach to assess flood risk management projects needs to be improved. A novel framework towards flood risk assessments and CBA was developed based on social welfare economics. This framework integrates social vulnerability, socioeconomic resilience and financial protection measures. The framework distinguishes between collective flood risk, individual recoverable flood risk, and individual catastrophic flood risk, each of which needs a different approach towards economic valuation. Application of this framework is likely to lead to different recommendations on what to do and whom to target, compared to traditional flood CBAs.

One of the main challenges for implementing the approach is the limited availability of microeconomic data which is needed for its implementation (especially data relating flood damage to income to financial protection on the level of individuals or households). This can be partly overcome through Monte Carlo simulations creating synthetic flood affected populations. Other challenges include the uncertainty about the response of humans, governments, and the international community, both before, during and after floods; incomplete knowledge about when floods become catastrophic for individuals, and others.

[44] Kind, J., W.J.W. Botzen and J.C.J.H. Aerts (2017), Accounting for risk aversion, income distribution and social welfare in cost-benefit analysis for flood risk management. WIREs Climate Change, 8(2). https://doi.org/10.1002/wcc.446
Kind, J, (2019). Drowning by Number. Social Welfare, Cost-Benefit Analysis and Flood Risk Management http://dx.doi.org/10.13140/RG.2.2.35717.01769
Kind, J., Botzen, W., & Aerts, J. (2020). Social vulnerability in cost-benefit analysis for flood risk management. Environment and Development Economics, 25(2), 115-134. https://doi.org/10.1017/S1355770X19000275



Informing decision-making: bottlenecks and opportunities

In the climate debate, there is a growing interest in social inclusion, social justice, equity, inclusive wealth and related concepts and issues. The social welfare framework toward risk assessment and CBA presented in Figure 1 is (partly or fully) compliant with many CBA handbooks and guidelines from different organizations, including the EU. Nevertheless, a social welfare flood CBA has never been conducted in practice to support flood risk management policy. Possible explanations include but are not limited to:

- Misconception about the purpose of a CBA and its use of money as numeraire to measure individuals preferences;
- Complexity of applying basic economic principles in CBAs (like utility functions);
- Relative high level of do-it-yourself-economists conducting CBAs;
- Controversy on the application of equity weights in relation to government policies on income (re-)distribution;
- Failure to distinguish 'risk aversion' from 'inequality aversion';
- Failure to distinguish 'baseline uncertainty' from 'effectiveness uncertainty' in combination with the default recommendation that governments should act risk-neutral; and
- Challenging micro-economic data needs.

The opportunity lies in improving CBA guidelines and handbooks on the application of social welfare principles, including its application in data scarce environments, as well as training of both staff and consultants.

Way forward?

Better implementation of social welfare CBAs is just one of the possible ways to better address the needs and interest of poorer and vulnerable population groups in relation to flood and other (climate related) risks, and towards the implementation of inclusive wealth in general. There are other ways to safeguard the interest of those groups during project preparation and appraisal which may be less data-demanding. A way forward is a guidance document on the incorporation of social / socioeconomic vulnerability and inclusion in project appraisal.

Key messages, questions or issues to address in workshop discussions.

- Traditional flood CBAs are often biased against poor and vulnerable populations.
- CBA guidance and practice need to be improved.
- Inequality aversion (equity weights) AND risk aversion (social vulnerability) need to be considered.
- Micro-economic data is needed.
- Alternative ways to safeguard the interests and needs of poor and vulnerable groups?
- How to proceed in data scarce environments?

Can biodiversity and ecosystem protection be driven by environmental justice?

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Your experience in a nutshell

Nature-based solutions (NBS) promise to deliver environmental, social and economic benefits. As win-win-win solutions, they are becoming increasingly prominent in climate adaptation and mitigation policies, biodiversity frameworks and related efforts.

However, the extent to which they are able to deliver ecosystem services and biodiversity conservation, while also supporting socially just conservation rather than creating or exacerbating existing inequalities is a topic of contestation.

BIO-JUST therefore investigates the environmental justice implications in the design, implementation and evaluation of NBS for watershed provisioning ecosystem services across seven different case studies in Europe and Latin America. It understands environmental justice as comprising i. the distribution of benefits and costs from environmental policies and practices, ii. the inclusion and exclusion of stakeholders and perspectives in processes of decision-making, and iii. the recognition of different worldviews, use rights and knowledges

Key methodological challenges encountered

Ecosystem services compartmentalization.

Positionality issues.

Data availability/access.

Transdisciplinary requires time, but decision-makers needs or project funding is short term.

Informing decision-making: bottlenecks and opportunities

- Research uptake by decision-makers.

- Contexts are full of complexities, and decision-makers require simple solutions that tend to be reworked in policy as blueprints that do not recognize contextual diversity.

- Research unraveling political drivers of environmental change are different to tackle by development policies.

- Focus on how to secure/improve provision of ES but no focus on the distribution of ES, whose views matter and ES are governed by IPs and LCs.

Way forward?

- Unraveling historical struggles for natural resource control (how is water distributed) and injustices around ES.

- Understanding how ES are locally governed before implementing novel policies.

- Rights-based conservation and the difficulties of implementing it (water re-distribution)

Key messages, questions or issues to address in workshop discussions

- Nature-water as co-produced by human and non-human nature.
- NBS is a new concept made out of old tools.
- Power in NBS needs to be addressed, and it materializes in laws, infrastructure.
- Nature's concept of IPLCs starkly contrasts with the nature of NBS.
- Rights-based conservation as an avenue for just and effective conservation, politics of recognition to be considered.

Transforming controversy around river restoration into collective co-construction of a project: approaches to building a shared river culture among stakeholders

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Your experience in a nutshell

River restoration projects often raise controversies and generate conflicts involving various stakeholders. In some cases, this can even prevent projects from being implemented. Our hypothesis is that opening a space for discussion very early in the process may allow us to avoid suffering from controversies. On the contrary, it may be helpful to use them as a starting point for initiating a dialogue around restoration and co-constructing projects that are shared and expected. We elaborated interdisciplinary participative workshops to promote the definition of desired future states of the river Auzon (France). We tested several tools: image and video screening, direct experimentation and sensory model building to accompany stakeholders in the elaboration of their scenarios. The involvement of researchers from several disciplines contributed to building up a common river culture and care for the river at stake.

Key methodological challenges encountered

- Mobilizing stakeholders of diversified profiles for participation in workshops
- Avoiding domination of the discussions by certain personalities
- Adjusting the researchers' position in relation to public authorities in the discussions
- Gaining local stakeholders' trust

An exploratory sociological survey conducted before our workshops was crucial for understanding the case study and the relations between stakeholders. Furthermore, it proved to be particularly useful for motivating them to take part in the workshops. Taking sufficient time (6 participative workshops) was another important prerequisite for building up an atmosphere of trust with the stakeholders. Moving from a time of free speech to moments of fair speech distribution allowed us to give voice to different personalities (including women). We also used practical workshops and sensory mediation to balance the relationship between experts and local residents and open space for sharing different types of knowledge (even the less articulated ones).

Informing decision-making: bottlenecks and opportunities

The support and participation (as observers) of the river management authorities (*syndicats de rivière*) throughout the process has been crucial for the integration of our results into decision-making. River management authorities officially engaged from the very beginning to take into account the workshop outputs in their contract with the engineering office in charge of the elaboration of technical scenarios and the implementation of the selected one.

The return of our results (once analyzed) to the municipal authorities helped integrate the restoration project in the general urban development project of the concerned town (in the framework of the program "*Petite ville de demain*").

Way forward?

A documentary film with both scientific and sensory / poetic aspects was produced in the framework of our project. We would like to test its use for launching discussions on river restoration and allowing stakeholders to share a common river culture from the very beginning of their exchanges around a potential project.

Key messages, questions or issues to address in workshop discussions

- The possible roles of researchers in the participatory processes.
- The place of the emotional, sensory elements compared to technical knowledge in the discussions around environmental issues such as restoration.

Ocean and health: how coastal environments benefit our mental well-being[45]

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Your experience in a nutshell

I am currently doing a PhD on "blue psychology", i.e. the impact of coastal environments on mental well-being and underlying psychological mechanisms. My research is set within the framework of "Ocean and Human Health", which is an interdisciplinary field investigating the interactions between the marine environment and humans in the aim of protecting and promoting the sustainable use of the ocean and the benefits for human health. I have conducted both qualitative and quantitative research to assess the emotional experience of the North Sea and how it can influence the well-being of coastal and inland residents. Results show that the coast represents a safe place to experience positive emotions and to cope with daily stressors. I also take a look at whether exposure to coastal landscapes can help increase pro-environmental behavior and the role of citizen science regarding plastic pollution on participants' ocean literacy and well-being.

Key methodological challenges encountered

Although there is an increasing amount of research on the impact of nature (green and blue spaces) on health, specific focus on coastal environments and mental well-being remains largely unexplored. Current evidence strongly suggests that the ocean is beneficial for our mental well-being, however it is unclear why and how. Due to the novelty of the field, effort is needed to make the methodological standards more robust and to strengthen the impact and communication of the field's implications. Furthermore, the integration of psychology into the marine sciences presents several challenges[2] (e.g. lack of knowledge of its methodology, being the "only one in the room"). Finally, the dependency on human participants in psychological research is challenging in terms of recruitment efforts and equal representation from different socio-economic groups.

Informing decision-making: bottlenecks and opportunities

Results have not yet been considered in decision-making, however the topic of Ocean and Human Health (OHH) has been presented to policy-makers via the Seas, Oceans and Public Health in Europe project (SOPHIE). One of the outputs of this project is a policy brief[3] displaying the policy challenges when addressing ocean and human health together and giving recommendations on how to integrate OHH within the current policy framework (e.g. promoting the "Health and Environment in All Policies" approach). Regarding the specific focus on how coastal environments benefit mental well-being, certain bottlenecks when informing decision-making can be identified. First, results regarding mental well-being are not always quantifiable and are often subjective, making it difficult to estimate their value. Second, interactions between the coast and humans can not be interpreted with a "one size fits all" approach. Individual differences based on socio-demographic characteristics, past experience,

[45] Severin, et al. (2021). Influence of the Belgian coast on well-being during the COVID-19 pandemic. *Psychologica Belgica*, *61*(1), 284–295. http://doi.org/10.5334/pb.1050
Severin, et al. (2022). A qualitative study on emotions experienced at the coast and their influence on well-being. *Frontiers in Psychology*, *13*, 902122. https://doi.org/10.3389/fpsyg.2022.902122

[2] Cvitanovic, et al. (2022). Normalizing failure: when things go wrong in participatory marine social science fieldwork. *ICES Journal of Marine Science*, *79*(8), 2184–2195. https://doi.org/10.1093/icesjms/fsac153

[3] European Marine Board (2020). *Policy Needs for Oceans and Human Health*. EMB Policy Brief N°. 8. DOI: 10.5281/zenodo.3822099Do

personality...etc. should be taken into account. Finally, perceptions and knowledge from marginalized groups are often left out from the discussion. Possible solutions to overcome these bottlenecks include utilizing tools such as the Life Satisfaction Approach or QALYs (Quality-Adjusted Life Year) that enable to convert the value of certain health-promoting factors (e.g. exposure to the coast) into economic terms; implementing tailored measures/interventions appropriate to different population groups; and including perceptions from all communities on a local and global scale.

Way forward?

In the context of Ocean and Human Health, there is still much to be explored. In addition to the positive effects of coastal environments on human health, further research is needed on how to foster ocean literacy, including ocean stewardship, and how to motivate people to act sustainably towards the ocean, in the aim of optimizing the impact of humans on ocean health. The understanding of how plastic pollution can impact physical health and mental well-being should also be improved. In essence, the cultural ecosystem services of the coast (i.e. "**the non-material outputs of ecosystems that affect physical and mental well-being**") should be better integrated within marine policy.

Key messages, questions or issues to address in workshop discussions

- What challenges do policy-makers foresee if health were to be more integrated within marine policy?
- How can we promote ocean literacy on a European scale, within education, research, and policy?
- How can we further optimize the interactions between ocean health and human health ?
- How can we put forward the importance of marine social science and the solutions it may provide to present issues?

VALUING WATER: DESIGNING NORMS AND BEHAVIOURS FOR WATER POSITIVE LIVES AT HOME

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Your experience in a nutshell

Within the framework of The Bridge, a partnership between Linnaeus University and IKEA, a research project was proposed with the intention of studying the value of water at home. The guiding questions were addressed by the phases of the overall design process.:

- Which values can we share and celebrate to achieve access to clean and healthy water for all? (exploring and specifying)

- Which stories about life at home can lead to less water use? (develpment and implementation)

- How can design enable positive water use in the home? (testing and refining)

The first phase consisted of *exploring* and *specifying*. Here the social context of water access was explored, and the most relevant norms and behaviours were specified. This was done through citizen interviews and mapping activities with representatives of a municipality of in southern Sweden, IKEA, Space10 and design teachers. The main findings of this stage were: (a) 20 concepts limiting motivation, education, information, and social sharing; (b) a gap between intention and action in water care; and (c) little evidence of working on behaviour and creativity in relation to water care.

The second phase consisted of *development* and *implementation*. Here a water meter for taps was developed that provides real-time information on water use using economic, political, social, environmental, and emotional values. This device converts water flow into visual and audio information that allows users of multiple cultures and ages to understand how much a litre of water is.

Finally, the third phase consisted of *testing* and *refining*. Here a new interface has been produced to be applied at the city level and not only at the household level. This new idea is reflected in the interaction that citizens can have with an interactive house that provides real-time information on the water use of a city's households, teaches about the quantity and distribution of water in the household at a local-global level, and compares water use with historical data. The house will be in Borgholm, Ötland - Sweden.

Key methodological challenges encountered

Regarding availability and access to data, domestic water consumption is more complex to track than electricity consumption. Factors such as leakage from the pumping plant to the treatment plant and in old water systems are determining factors. In this respect, locating data can take longer than expected.

Another complicating factor is the political/economic willingness to share data. On the one hand, government agencies and private companies have no defined framework to indicate when data are reserved and when they are in the public domain or can be paid for. On the other hand, university research plays more of a competitive than a developmental role between municipalities and companies.

In terms of operational challenges, at least from this research, the need for a multidisciplinary team to carry the research through from start to finish is evident. While there is the excellent opportunity provided by The Bridge, between industry and academia, there is still a need for the involvement of government partners and community representatives to promote, implement and test strategies.

Finally, research through design, although innovative and recognised, is not common, which undermines its credibility in approaching the actors involved in domestic water management. The context of water management in

general terms (industry, agriculture, and consumption) resembles a more technified and engineered plane than innovation related to human behaviour. In fact, talking about behaviour may lead one to think of psychological or sociological strategies rather than innovative ones. The scientific validation of the proposals of this research and development project is still to be carried out (statistical studies, feasibility, effectiveness, etc.); however, the guiding questions were addressed to satisfaction.

Informing decision-making: bottlenecks and opportunities

To stimulate the value of water at home through bridging the gap between intention and action, was identified as necessary to affect the current behavioural system (collective action) through the *(re)*design and implementation of a system composed of at least four central nodes: (1) increasing motivation, (2) stimulating education, (3) providing information and (4) reinforcing collective sharing behaviour.

In motivation, the concepts of sensation, anticipation and belonging developed in B. J. Fogg's model were considered.

In the stimulation of education, converting the technical data into data that could be associated by a general audience (a child and his grandfather from another culture) helped the initial understanding of water flow and the (personal) relationship of the amount of water that can pass through his hands in one second.

To provide information, it was necessary to tap into the water flow to find real-time information. A bottleneck is that the invoices are time-dependent (some are monthly) and most of them are addressed not to the tenants but to the owners of the properties.

And finally, for social sharing, the best opportunity lies in making consumption visible. To avoid protocols that delay the sharing of information, the idea is not to share personal data or single consumption but at community level (i.e., city, region, country, etc.).

Way forward?

Strategies that apply integrated knowledge as well as those that include as many stakeholders as possible are definitely an ideal way forward for further research and design.

Understanding human behaviour at the collective level is crucial to tackle complex global problems (access to water as one of them) especially why there is a gap between intention and action, as well as the value paradox (belief of importance as opposed to value outcomes/facts).

Key messages, questions or issues to address in workshop discussions

- How to articulate interdisciplinary and intersectoral knowledge to address complex problems that require short- and medium-term solutions?
- What needs to change in the current models that organisations have for dealing with complex problems?

Social factors influencing fishers' behaviour[46]

Marloes Kraan (co-authors: Amanda Schadeberg, Katell Hamon and social science colleagues Nathalie Steins and Xanthe Verschuur), WUR, marloes.kraan@wur.nl

Your experience in a nutshell

Fisheries management aims to influence the behaviour of fishers in such a way that (more) sustainable outcomes are achieved. Yet the science underlying the policy is heavily dominated by ecologists, biologists and economists. Understanding behaviour is a prerequisite for influencing it and also requires social science. In our case study of Dutch demersal fishers we used mixed methods to capture fishing activity and its motivations, resulting in a more social understanding of fisher behaviour. A métier analysis of logbook data describes five dominant fishing practices in the Dutch demersal fleet. Twenty-five in-depth interviews with fishers along with focus groups including other experts identify three social factors that influence fisher behaviour in this group: business structure (skipper as employee or family-owned), working rhythm (Monday-Friday or week-on-week-off), and polyvalence (specialist or switcher). The results show that motivations for fisher behaviour are more complex than complying with regulations or seeking profit: social factors also influence fishing activity. Furthermore, these social factors have real implications for the impacts of management measures on both the fishing communities and the environment, especially in times of change. These results are useful for management strategy development or evaluation because they could be added in existing data collection protocols.

Key methodological challenges encountered

Our method requires working in a transdisciplinary way, making use of the strengths of all scientific methods, both quantitative (métier analyses) as qualitative (semi-structured interviews, focused groups), and of the expert knowledge of practitioners (most notably fishers but also policy officers and fisher representatives). Access to fishers data (e.g. vessel monitoring system) is required. The method takes time, especially when done for the first time or benchmarked. However once the indicators of interest are identified, they could be taken up in standard data collection, making such data more easily available for future analyses and allowing to follow the development of those indicators. Working in a transdisciplinary way also requires that enough time is taken to explain each other's methods and that the right formats are found to work with non-scientific experts.

Informing decision-making: bottlenecks and opportunities

First, care was taken to make the management implications of the work explicit in the journal article (see table 5; reference to article in footnote). Second, this study is part of a whole cluster of academic work aimed at informing policy makers and transforming scientific approaches and practices to gain a better understanding of fisher behaviour. The work is communicated in journals, sectoral news outlets (Visserijnieuws) and via social media (using visual abstracts), presented to policy officers at different occasions and integrated in research projects aiming to evaluate the impact of management measures. Dedicated workshops with policy officers were also held that focused on fisher behaviour and ways to influence behaviour by making use of insights of behavioural economics. Several major issues have caused a crisis situation for some (Dutch) fisheries, with many losing trust in the government. These issues include changes in marine spatial planning policy severely impacting available space for fisheries, the stark rise of oil prices, and poor communication from the government towards the industry. At the

[46] Schadeberg, Kraan and Hamon (2021) Beyond métiers: social factors influence fisher behaviour. ICES JMS. DOI: 10.1093/icesjms/fsab050 Link: https://academic.oup.com/icesjms/article/78/4/1530/6207634

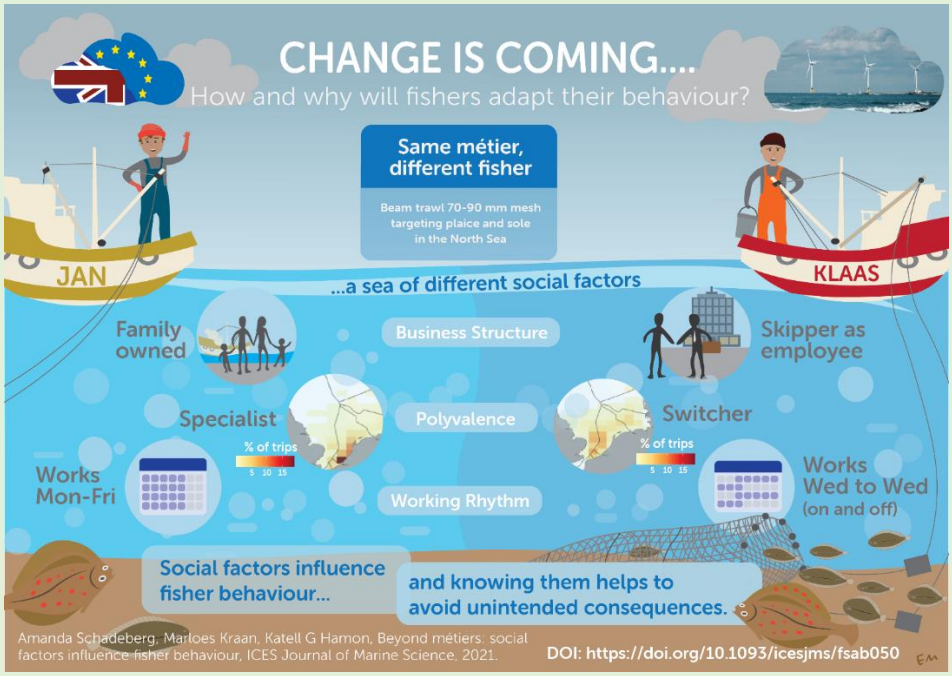
same time, the clear need for change presents an opportunity to re-arrange standard approaches. The insights about fisher communities and priorities gained in this research could also be used to inform (new) policy.

Way forward?

This case study was done with the Dutch demersal fleet, yet more fleets can be studied in this way (in the Netherlands as well as internationally). The results of this project and other studies inform the EU-funded SEAWISE project[47]. Certain social factors can be identified by new analyses on existing logbook data (e.g. polyvalence) while others can be taken up as variables expanding social data collection (e.g. work rhythm and ownership). This work is an example of the importance of a more 'social' understanding of fisheries, for which attention is slowly growing at the EU (e.g. the social dimension of the CFP) and within ICES (e.g. the Strategic Initiative on the Human Dimension)[48]. Finally the interviews held with fishers contain an enormous amount of information, pointing to many more social factors that are not so easily standardized, but which nevertheless can help other projects to better understand fisher perceptions about fishing, policy and their lives.

Key messages, questions or issues to address in workshop discussions

- Fisheries management has been too focused on better understanding (impacts on) the biology of the system, while there is still much to be understood about the socio-economic side of fisheries, including behaviour
- Fishers will adapt to the rapid changes that take place in the marine context, and we need to understand how
- Social factors influence fisher behaviour and knowing them helps to avoid unintended consequences



[47] https://seawiseproject.org

[48] https://www.ices.dk/community/groups/Pages/SIHD.aspx#:~:text=The%20Strategic%20Initiative%20on%20the,vision%20and%20mission%20of%20ICES.

HOW TO BRING WATER SCARCITY TO THE FOREFRONT OF USERS' ATTENTION AND PRACTICE/USE

Oliver Loebel, EurEau, oliver.loebel@eureau.org

Your experience in a nutshell

Water is a precious natural resource all over the world. Water scarcity affects Europe's citizens differently depending on where they live. The Mediterranean basin has been facing declining annual precipitation and increased evaporation accompanied by regular severe droughts for many years. People are therefore quite aware of the situation. Major parts of Central and Eastern Europe are increasingly experiencing more intense and prolonged drought periods that may result in seasonal water scarcity. On the other hand, Northern European is less affected by this phenomenon. Measures and communication strategies must be adapted to these specific circumstances.

Key methodological challenges encountered

Several tools exist to change the behaviour of private households.

Communication: Many suppliers conduct awareness-raising campaigns to encourage efficient water use. They can use different media and address urgent calls to react to acute drought situations or long-term behavioural changes. Children are an important target group.

Price signals: As a starting point, consumers should pay for their consumption water metres thanks to the installation of water meters. Flexible tariffs during peak hours or acute drought situations could also be considered.

Restrictions: Authorities sometimes impose water use restrictions accompanied by sanctions for non-essential water uses (garden watering, pool filling). However, such measures are often insufficiently enforced, limiting their possible effectiveness.

Measures targeting industrial and agricultural water users often take a regulatory nature and are beyond the control of water operators. Priority schemes or limitations in water abstraction rights will decrease water demand. Water use disclosure or water use limitations as proposed under the draft revised Industrial Emissions Directive can also have positive impacts. Last but not least, regulators can encourage or impose the use of reclaimed water in the sectors concerned.

Informing decision-making: bottlenecks and opportunities

EurEau members promote a holistic approach to climate change. Changing consumer behaviour is only one part of long-term water scarcity management. It must include regulatory measures (for example granting priority to public water supply over other uses) and utility measures (alternative water sources, water storage, leakage reduction etc.).

Very importantly, it requires close cooperation between water suppliers, public authorities and other relevant actors. This includes regulatory measures, the financing of utility adaption measures and the use of the above tools (communication, price, restrictions) to make consumers aware of water scarcity. Agreed measures must be implemented rigorously based on clear responsibilities and guaranteed funding.

Way forward?

Climate models need refining to allow for regional predictions. Authorities should develop long-term water use plans based on climate models and predicted population developments as well as industrial and agricultural water

needs. Water suppliers should include water scarcity in the risk assessment and management measures related to the Drinking Water Directive.

Raising consumer awareness on water scarcity through the above-mentioned tools should be part of the risk management measures and should be implemented in close cooperation with public authorities.

Key messages, questions or issues to address in workshop discussions.

- Raising the awareness of consumers on water scarcity is part of a wider effort to adapt to climate change.
- Success factors include close cooperation between water operators and public authorities and the use of different tools.
- The extent to which communication, price signals and restrictions are used depends on local circumstances.
- Which tools are most effective? What about the impact on access to W&SS?

POLICY PROCESSES AND GOVERNANCE

WHY CONCRETE ALWAYS (?) WINS: CAN SOCIO-ECONOMIC ASSESSMENT SHED LIGHTS ON FLOOD-DEFENCE INVESTMENTS? THE EXAMPLE OF THE SKYROS ISLAND (GREECE)

Eduard Interwies, InterSus (+ Citizens for the protection of the Kiffisos River), interwies@intersus.eu

Your experience in a nutshell

Personal background: working since 23 years on the implementation of socio-economic assessment in the field of water management

Context: NOT a research/consultancy project! Personal experience from a specific "flood protection" project – "reality check"

Specific situation:

Skyros island: 200 km^2; 3.000 inhabitants, of which 2.500 in the only village (cultural protected settlement)

Kiffisos river:

- Right at the village, approx. 17km^2 catchment (NOT defined as a WFD-water body); affected length (below an irrigation dam being constructed since many years, EU-cofinanced): 3 km. Of these: approx. 1.5 km downstream degraded due to "often illegal" human activities; 1.5 km upstream/up to the dam in pristine condition with no human activity (PS: NBS protecting the lower part!)

- Main reason of existence of village (and traditions) since centuries: main spring of the island (providing most of the drinking water for the island); low-intensity farming, traditional irrigation system, 8 water mills (most destroyed due to negligence), old cloth washing area; chapels etc.

- Delta: protected "small Aegean wetland " based on Greek law (FEK 229/2012)

- Flood protection project – EIA approved (9/22): contains (for the whole of the 3 km: creation of a river bed of 8 meters width):

  1 800m: excavations (and destruction of vegetation) partly concrete riverbanks;

  400m: gabions and concrete riverbed;

  450m: concrete channel;

  200m: closed concrete channel;

  No walking path etc. planned;

  Meaning: excavations of 19000 m^3; concrete of 6000 m^3.

- Financing (project costs: 6 million Euro): "top-up" of the dam construction project budget (EU-cofinanced): lead Ministry of Agriculture, EIA commissioned by the contractor of the dam (that will also implement the flood protection project)

- No consultation with the municipality/the public (EIA "officially" uploaded for consultation at a www-site requiring registration, no information in the (local) media: zero comments…).

- Local opposition – but construction works have started.

Key methodological challenges encountered

Required EIA for the "flood protection project": heavily flawed:

- Flood risks exaggerated (no historically significant flood events; problematic maximum flows return period 50 year; no proof in the EIA that the floods are significant, this is just stated as such);

- No consideration of the actual vegetation/biodiversity ("no significant vegetation existing": in reality, approx. 300 century-old trees will be cut down);

- No consideration of the flood protection potential of the dam (with 1 Mio m^3 of reservoir capacity) or of the natural, upstream river section without human activity (NBS);

- No consideration of the importance of the river for biodiversity and socio-economics (recreation, sustainable tourism potential).

Alternatives considered in EIA:

- Zero solution: no implementation of project as designed: rejected, since "not sufficient flood protection";

- Medium solution: partly implemented project: as above,

- Only viable solution: project as designed.

No further consideration/specification of socio-economic effects in any way.

→Nevertheless: EIA approved by province (and related authorities): construction/destruction has begun, local opposition

Informing decision-making: bottlenecks and opportunities

Problematic decision making process in practice: various flaws in the process but also in the EIA itself: lead to a clearly wrong solution being implemented…while laws an regulations are in place.

Socio-economics don´t really play a role – and will not play a role as long as the decision-making "realities" are as they are.

Way forward? Issues for discussion

- This is only one (small and not "so important") example of hundreds of similar projects being promoted/implemented re flood protection: "old school" flood management approach (excavations – cannels – concrete banks – gabions (PS: considered environmentally friendly)) is reality, even in cases where floods do not threaten human activities (e.g. pristine NATURA2000-sites being bulldozed where no human activity takes place in the name of flood protection – e.g. Erasinos river, Attica).

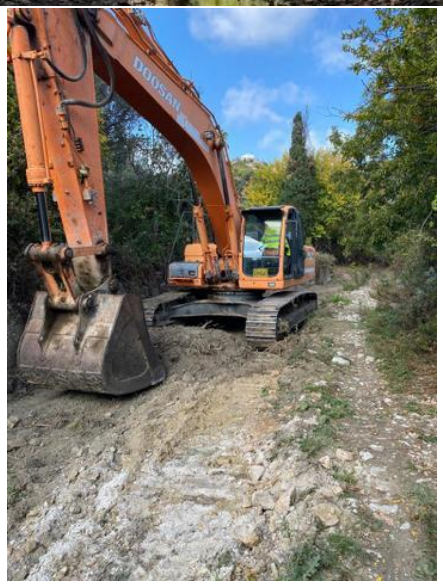
- Talking about NBS, river renaturation, Floods Directive implementation/compliance, public participation at a strategic level: often no effect "on the ground".

- Need to go one step back: how are "in practice" decisions for specific projects taken? Only if correct institutional interplay, valid studies and real public participation: then, socio-economic assessment can play a role.

- EIA: how to ensure "modern thinking there?

- Dreaming on: what can the role be of the European Union? Compliance checking (WFD, FD) at the current "high" level does not ensure correct project design…"Stick" to be used esp. in cases of (co-)financing from European Union? So far: complaints at EU-level only possible if all national legal actions have been taken. Cumbersome/difficult to "push" for better decisions. Thus: does the COM have to check use of EU-funding at the micro-level (subsidiarity is good, but….)?

What will soon not exist anymore: The project has started:



EXPERIENCE WITH INTEGRATED ASSESSMENT TOOLS IN THE DUTCH DELTA PROGRAM FRESHWATER AND THE BANGLADESH DELTA PLAN

Femke Schasfoort, Deltares, femke.schasfoort@deltares.nl

Your experience in a nutshell

The Dutch Delta Program Fresh Water aims to secure sufficient supplies of freshwater now and in the future. Every six years the lower house of parliament establishes the Delta decision Fresh Water including an investment program. This decision and investment program is prepared by the national government, regional governments, and civil society, with the support of consultancies and knowledge institutes such as Deltares. An integrated drought risk assessment method has been developed to support this process. This entails the quantification of drought risks, integrating drought probability and socio-economic consequences for sectors that are potentially affected by drought. Drought risk provides information on major drought and water supply-related bottlenecks and can support the assessment of the benefits of freshwater interventions by assessing the reduction of drought risks. The propagation of droughts and water shortages have been simulated using the National Water Model (NWM), making use of historic meteorological time series of 100 years. The output of the NWM is used in so-called impact modules, which quantify the impact on agriculture, nature, inland water transport, drinking water supply, and industry in the current situation and under future scenarios. The results of the impact modules are used in a societal cost-benefit analysis of freshwater policy and provide insight into the distribution of drought costs and benefits over different water users and regions.

The Bangladesh Delta Plan 2100 aims to achieve a safe, climate-resilient, and prosperous Delta by the year 2100. The investment plan includes 80 investment projects, which should contribute to this goal. To get more insight into current and future challenges, and evaluate the impacts of proposed and alternative projects, an integrated assessment (meta) model has been developed, which was a joint effort of Dutch and Bangladesh's knowledge institutes. The metamodel shows hydrological impacts as well as socio-economic impacts, such as the impact on food security. Quantification of current and future risks and impacts of projects provides advisory support to the General Economics Division of Bangladesh, which could support finding the necessary funds.

Key methodological challenges encountered

The approach used in the Delta Program Fresh Water acknowledges the complexity of drought propagation to societal impact, but it is also data-and computation intensive and sometimes complex to explain. Furthermore, the approach does not allow quick assessment of impacts and is not flexible when new or alternative measures arise. Another challenge is the integration of the impact of droughts and freshwater measures on nature, which is politically an important argument to invest in measures. Literature suggests applying the ecosystem service method, but there is not sufficient information and agreement among experts to quantify, let alone monetize, the impact of drought and freshwater measures on the full range of ecosystem services and biodiversity on a national scale. Another challenge is the current and the future resilience of the different sectors to droughts, which preferably should be included in the analysis.

The methodological challenges related to the Bangladesh Delta Plan are related to the formulation of the investments in the investment plan, which leaves room for interpretation. This makes it also complicated to assess the investments quantitatively with the metamodel. Furthermore, there is not sufficient data available to include impacts on sediment dynamics, nature, biodiversity, fish production, and the livelihood of people.

Informing decision-making: bottlenecks and opportunities

The results of the drought risk approach have been used in the evaluation of bottlenecks, and societal cost-benefit analysis for the investments part of the Delta Program Fresh Water. The results could play a more important role if a larger range of potential strategies could be assessed as part of the SCBA. This was not possible due to the long run times of the models behind the method. The development of more rapid and less detailed models could improve the applicability.

The metamodel is operational since 2022. In the coming years, we will find out whether it can play the role as foreseen. There is a capacity to run and adjust the metamodel in Bangladesh, and decision-makers have (sufficient) confidence in the results. The challenge is formulating well-defined investment projects and analyses of the results. For example, the results depend on the geographical and temporal scale, which is sometimes difficult to understand for decision-makers. Furthermore, in Bangladesh, the implementation of projects highly depends on the contribution of donors, who frequently have their preferences and impact assessment procedure.

Way forward?

-Towards rapid assessment tools, which creates more flexibility in the analysis of drought risk of investments.

-Assess the impact of interventions early in the process, even when the details of the interventions are not known yet (be clear about the assumptions)

-Add assessment of impacts on livelihood, nature, biodiversity, and sediment dynamics.

-Inclusion of resilience and adaptive behavior of different groups in the impact assessment

-Better communication about the methods (explaining the methods more easily), which might support the uptake of results by policy-makers and donors.

Key messages, questions or issues to address in workshop discussions

- How to include impacts on nature and biodiversity in a national-scale impact analysis?
- How to determine the right balance between the level of detail and speed of the assessment methods/models?
- How to include resilience and adaptive behaviour in national scale analysis?
- How to explore the impacts of investment strategies that are vaguely formulated?
- How to improve communication about integrated assessment methods and tools (to decision-makers, civil society etc)?

PRACTICAL EXPERIENCE WITH ECONOMIC APPRAISAL FOR WATER MANAGEMENT IN ENGLAND: LESSONS FROM PAST/PRESENT AND FUTURE CHALLENGES

Dr Jonathan Fisher, Jonathan Fisher Environmental Economics. jonathanfisheren-vecon@virginmedia.com

Your experience in a nutshell

- Qualitative
- Multi-criteria Analysis
- Benefits transfer of values for specific benefits
- Strategic analysis of Costs and benefits of implementing WFD
- Valuation of overall water benefits: Survey with focus group deliberation and consultations
- Good incremental evolution up to 2015

Key methodological challenges encountered

- Heavy workload to appraise many (300+) cases in v. short time.
- Economic appraisal considered too late. Takes big effort and time to deliver good evidence and relevant analyses.
- Appraisals need to be done by non-economist technical manager practitioners.
- Clear presentation and communication of each linked step in appraisal process – comprehensible to all.

Informing decision-making: Opportunities and challenges: 2015 to now

- Appraisal very important due to big increasing water problems and high control costs => Affordability constraints
- Risk return to silo based specific targets and mgt
- Risk of resort to single “solution” approaches
- Risk repeat and not learn lessons from past (mistakes)
- 2015: Big cuts in budgets and internal capabilities esp at catchment level. Outsourcing to NGOs not worked well.
- Now major austerity constraints

Way forward?

- Protect core internal capabilities and sound technical base.
- Re-envigorate process for integrated water mgt for catchments to secure lower cost most efficient and sustainable options (eg SUDS, catchment mgt).
- Prioritization by cost-effectiveness analysis to focus on contentious cases for CBA appraisal with consultation.
- Need new stated preference benefit valuation survey with: Preceding deliberative focus group discussions.
- Consultation on selection of contentious cases for detailed environmental and economic appraisal prioritized based on cost-effectiveness analysis and then review findings to aid decisions on agreed measures.

- Explore how do each step-in process by virtual study => identify priority research needs: As for Ribble for Wateco for RBMP.

Key messages, questions or issues *(and key points)* to address in workshop discussions

- How complete economic appraisals and consultations for many (300+) cases in short time/deadlines.
- How provide sound technical and economic evidence base? *Can Take 2 years. So start early.*
- How secure internal capability for this – *Key.*
- How overcome resourcing and affordability constraints due to financial austerity?
- *By prioritised focus:* How?
- How combine technical and economic analyses with due consultation at catchments at each stage? *Need complementary process covering all elements and approaches - not just one.*

STRATEGIES FOR WATER ALLOCATION REFORM IN THE CONTEXT OF WFD IMPLEMENTATION

Josselin Rouillard, Ecologic Institute, Josselin.rouillard@ecologic.eu

Your experience in a nutshell

Water allocation: an under-examined issue in the implementation of the WFD.

Increasing scarcity and droughts => major stress on the legitimacy of current allocation patterns, on permitting arrangements and regulatory compliance.

Key question: how to align water use rights with environmental needs, temporally and spatially, balancing environmental, social and economic outcomes.

Experience: compilation of experiences on (ground)water allocation.

- ATG Water Scarcity and Droughts: ongoing exchange on good practice relating to environmental flows, water balances and allocation strategies.

- Survey of water allocation strategies (specifically with regards to agriculture) in EU and outside EU.

Key methodological challenges that can be encountered

- Developing a registry of water users and strengthening permitting regime: opposition, difficulty to map all (ground) abstraction points.

- Establishing the scientific evidence for a sustainable abstraction cap: variability of water resources, interactions between surface water and groundwater, impact on ecosystems.

- Gathering evidence on benefits of disrupting current practices and norms on allocations: impacts of changes in use priorities.

- Designing the adequate legal and regulatory arrangements, how to bring new actors in decisions.

Informing decision-making: bottlenecks and opportunities

Key challenges in the steps for water allocation reform:

- Establishing a supportive legal and policy framework that facilitate collective decision-making and increases flexibility in allocations.

- Matching allocations to the allocable pool, considering both long term and short-term availability of water resources (temporal variability), the various types of resources, their spatial characteristics and interconnectedness.

- Facilitating reallocation between uses, including the transfer of allocations between uses and mitigating the impacts of these reallocations on water users.

- Ensuring compliance with allocations, in particular regarding compliance monitoring and enforcement of penalties.

For good practice under each of these steps, see questionnaire on eflows, water balance and allocation part of the ATG WSD activities: https://circabc.europa.eu/ui/group/9ab5926d-bed4-4322-9aa7-9964bbe8312d/library/87733fea-35cf-47aa-bca8-d55170d6de84

Way forward?

Need for trusted, transparent water availability and use data.

Careful attention to authority over allocation decisions – local, user based vs central, public control.

Tackling issues of fairness and social justice upfront (procedural and distributive).

Not a rigid and fixed process – need to build acceptability, respond to variability, allow for flexible allocations.

Coordination across water and sectoral policies.

Key messages, questions or issues to address in workshop discussions

- Any successful experience of water allocation reform process leading to more alignment of water use rights with environmental needs?
- What type of socio-economic assessments, evidence and justifications help build the case for reform?

CO-CREATION OF RIVER BASIN PLANNING THROUGH PARTICIPATORY DEVELOPMENT OF INTERACTIVE DASH-BOARDS (EU STARS4WATER)[49]

Judith ter Maat, Deltares, judith.termaat@deltares.nl

Your experience in a nutshell

Worldwide freshwater resources are under increasing pressure from rapidly intensifying climate change effects, putting the availability and quality of water resources and socio-economic developments at risk. River basin organizations need to be prepared.

To support the river basin organizations and others, the EU funds the STARS4Water (acronym for 'Supporting Stakeholders for Adaptive, Resilient and Sustainable Water Management') project. The four-year project started in October 2022 and brings expertise in data science, software development, water resources management, river basin hydrology, ecological flows and water use by economic sectors together. The team involves research organizations, small and medium enterprises, and river basin organizations – 21 partners overall – and is led by Deltares.

STARS4Water is a project in which improved stakeholders' data-driven services, models and tools for an integrated risk assessment of climate change will be delivered in the context of river basin planning. This is done with respect to water resources availability including hydrological extreme events and socio-eco--hydrological developments. One of the deliverables within the project are policy dashboards, made for river basin hubs, which are co-designed and co-developed with the river basin stakeholders.

Aim of the dashboards is to improve the understanding and use of existing and newly generated data and information in the river hubs by stakeholders and end-users which will help policy analysts, decision-makers and stakeholders to visualize and communicate on system's understanding and related risk information, such as impacts of scenarios, impacts of interventions and the progress of interventions in a structured way.

In the project the consortium will build on existing new generation policy dashboard approaches such as WaterLOUPE[50] . These tools present the required information in a coherent and intelligible manner. Therefore, they help to identify and make the most appropriate decisions. The dashboards are tailored to the needs of stakeholders in the river basin hubs, and while tailoring it, capacity building ensures that river basin organizations are empowered to easily use their specific hub-dashboard during and beyond the duration of the project.

The STARS4Water project has received funding from the European Union's Horizon Europe research and innovation program under the Grant Agreement No 101059372

Key methodological challenges encountered

The dashboards will be co-designed with stakeholders to meet their needs on data and information and to enable stakeholders to define actions towards sustainable water management and climate resilience of their basins:

- Co-create participatory understanding of the integrated water resources system (socio-eco-hydrology, including interaction).

- Identify indicators that have stakeholders' interest.

[49] https://www.deltares.nl/en/news/deltares-led-horizon-europe-stars4water-proposal-selected-for-funding/
[50] https://waterloupe.deltares.nl/en/

- Benefit from reliable global to local datasets.
- Perform integrated modelling and create transparent workflow.
- Present meaningful decision support information on scenario and strategy assessment.
- Discuss output and outcome with stakeholders

Informing decision-making: bottlenecks and opportunities

Progress in the incorporation of climate change and its socio-hydrological impacts in river basin plans differs between river basins. In river basins where climate change is (being) included in the plans, adequate quantification of its many and diverse impacts on socio-hydrology is often hampered by a lack of data, data services and models. When data services and models are in place, they insufficiently meet the needs of stakeholders. STARS4Water will address these challenges with respect to improving data sets, data services and models and will provide projections for risk assessments. Co-designed dashboards will support decision making on actions towards sustainable water management and climate resilience in the river basins.

Way forward?

The STARS4Water project has just started. The project runs from October 2022 till September 2026.

Key messages, questions or issues to address in workshop discussions

- EU STARS4Water wants to link with other projects and initiatives working on the same themes and is glad to discuss cooperation.

Streamlining coherence between public policy objectives[51]

Manuel Lago, Ecologic institute, manuel.lago@ecologic.eu

Your experience in a nutshell

The communication hopes to contribute to debates on the role of the economic analysis of water use for the practical implementation of the WFD in Europe. My experience is based on the economic analysis of water policy choices at different levels (academic, policy and consultancy). Fundamentally and despite legislative requirements, the economic analysis of water use under the WFD seems to be dead in the water! Let´s look at the issue of disproportionate costs as an example.

Article 4 of the WFD on exemptions when costs are found to be disproportionate brings up some very interesting "economic" questions. One for example relates with the need to justify WFD implementation costs, as ultimately exemptions are a difficult decision which is based on political judgement. Other aspects that disproportionate costs bring into the analytical demand mix for WFD implementation is the need to consider distribution of costs: equitable distribution versus burden on specific group or activity. It also aims to clarify who pays for the appropriate application of the polluter pays principle. And finally, disproportionality analysis also brings up issues of affordability and ability to pay to comply with environmental regulation.

Economic analysis can help to answer these questions as decisions ideally, should be based on structured evidence. But the WFD is not prescriptive as to those models and tools to be used to assess disproportionality. This opens an interesting debate about appropriate tools and methods to inform decisions.

Key methodological challenges encountered

Only a handful of disproportionate cost analysis (DCA) frameworks have been developed and tested in the academic literature, see reference below. Specifically, Lago (2008) reviewed the practical definition of disproportionality with a view to convey a consistent interpretation that is fully compliant with the economic requirements of the Directive, whilst also being mindful of the principles of pollution control and welfare economics theory. On this basis, the author concluded that standard-setting derogations should aim to reach socially optimal decisions and be judged with reference to a combination of explicit cost and benefit curves – an application of Cost-Benefits Analysis - and financial affordability tests. Focusing the analysis on the socio-economic impacts of achieving water diffuse pollution targets for the Scottish agricultural sector, a series of independent tests were proposed to assess disproportionality. These are: i) development of abatement cost curves for agricultural Phosphorus (P) mitigation

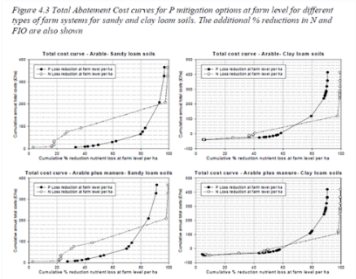
[51] Scotland: Lago, M (2009) An Investigation of regulatory efficiency with reference to the EU Water Framework Directive: an application to Scottish Agriculture. PhD. Thesis, The University of Edinburg.
Denmark: A practical CBA-based screening procedure for identification of river basins where the costs of fulfilling the WFD requirements may be disproportionate – applied to the case of Denmark. / Jensen, Carsten Lynge; Jacobsen, Brian H.; Olsen, Søren Bøye; Dubgaard, Alex; Hasler, Berit. Journal of Environmental Economics and Policy , Vol. 2, No. 2, (2013), p. 164-200.
Italy: Galioto, marconi, raggi, viaggi (2013) Assessment of Disproportionate costs in WFD: the experience of Emilia Romagna. July 2013
Germany: Klauer, B., Schiller, J. & Sigel, K. (2017). Is the achievement of 'Good Status' for German surface waters disproportionately expensive? Comparing two approaches to assess disproportionately high costs in the context of the European Water Framework Directive. Water 9, 554.
Czech Republic: MACHÁČ, J.; BRABEC, J. 2018. Assessment of Disproportionate Costs According to the WFD: Comparison of Applications of two Approaches in the Catchment of the Stanovice Reservoir (Czech Republic). Water Resource Management. Vol. 32(4), pp. 1453-1466

options for different farm systems; ii) a financial characterisation of farming in Scotland and impact on profits of achieving different P loads reductions at farm level to explore issues on "affordability" and "ability to pay" by the sector; and iii) an investigation of benefits assessment using discrete choice modelling to explore public preferences for pollution control and measure non-market benefits of WFD water quality improvements in Scotland. Results from these tests provide benchmarks for the definition of disproportionate costs and are relevant to other aspects of the economic analysis of water use in Scotland.

Some interesting results

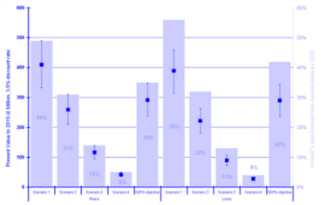
Cost-Effective Selection of Measures

- *Development of Cost Functions for Agricultural Best Management Practices*



Benefits Functions for Water Quality Improvements

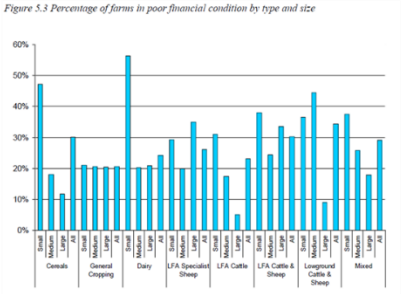
- *Market and non-market types of benefits*
- *Benefits Transfer versus original valuation (Choice Experiments for the Estimation of the Non-Market Benefits of the WFD)*
- *Aggregate welfare estimates of WFD benefits (£ Million) for different policy scenarios to achieve certain percentage levels of improvement in water quality by 2015 (axis on the right) for rivers (left half) and lochs (right half)*



Financial Viability Assessment & Definitions of Affordability (I)

- *Farm Viability Assessment: Application of Multidimensional Financial Indicators*

Figure 5.3 Percentage of farms in poor financial condition by type and size



Further issues:

Technical Efficiency

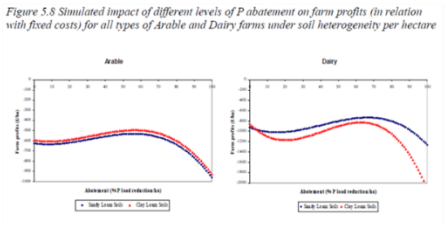
Off-farm income

Role of subsidies

Financial Viability Assessment & Definitions of Affordability (II)

- *Impact on Farm Profits as a Measure of Affordability*

Figure 5.8 Simulated impact of different levels of P abatement on farm profits (in relation with fixed costs) for all types of Arable and Dairy farms under soil heterogeneity per hectare



Source: Lago, 2008

Informing decision-making: bottlenecks and opportunities

The (CBA/CEA) tests/processes are arguably more valuable as the results that are generated. The application of these tools ultimately force the analyst to think through, in a rigorous, consistent fashion, what the economic impacts of a project /policy/regulation will be, who will be affected and when, and the relative magnitude of any gains or losses. Available DCA economic studies ultimately help to clarify the nature of sectoral water use and how it leads to social tradeoffs with other water users. This perspective adds to the debate of how and where water is best employed to maximize its value to society.

However and despite the clear theoretical benefits of application, limited progress has been made in applying the economic elements of the WFD throughout Europe (England and Wales is probably an exemption). This limited uptake of economic methods to explore the topic of WFD exemptions can be found both at an academic level (there are still many conceptual questions to be resolved and probably little research interest) and at the political level (marked by path dependency in decision-making throughout Europe). Arguably, another potential limitation is the lack of researchers/consultants working in the topic.

The lack of application has also affected the entire economic analysis cycle under the WFD, not just the investigation of disproportionate costs. These has now resulted in limited evidence to answer other potentially relevant implementation questions that water policy is currently facing in Europe, such as (and not exhaustive) investigations on the financing of measures to reach GES, accounting for ecosystem services or increased coherence in

management (coordination with protected areas for the protection of biodiversity) and/or integration of various political objectives (CAP with WFD).

Way forward?

An opportunity for the "economics" of the WFD arises from the next cycle of implementation of the WFD. There will be an urgent need to inform decisions about exemptions for the next RBMP cycle. According to the COM's WFD implementation reports, exemptions have been applied in all Member States. In the first RBMPs, timeframe derogations were rarely used for surface water bodies, comprising less than 5% of all exemptions applied at that time. However, in the second RBMPs plans most exemptions were granted in terms of time frame derogations. This meaning that most countries have chosen to delay important decisions and actions to future revisions of the plans. With the stated deadline of 2027 for the realization of WFD objectives, the question is if Member States will keep postponing implementation.

Key messages, questions or issues to address in workshop discussions

- Why is water policy different than other areas of public policy? When it comes to the WFD, why are we not pursuing economic efficiency as the objective of our assessments to advice policy choices?… This is not the case in other "difficult" public policy areas such as climate, housing, health, transport.
- What are the potential pros and cons of not following traditional public policy evaluation procedures?

COHERENT & CROSS-COMPLIANT OCEAN GOVERNANCE FOR DELIVERING THE EU GREEN DEAL FOR EUROPEAN SEAS

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Your experience in a nutshell

Interdisciplinary researcher in ocean- and nature-human relations (environmental engineering, qualitative research methods, policy and legal analysis). Main research interests include stakeholder involvement, policy development and policy implementation processes, primarily focusing on European Union's nature and marine policies (i.e. Water Framework Directive, Natura2000, Marine Strategy Framework Directive, Maritime Spatial Planning) and understanding how they are implemented especially from an institutional and governance perspective

Key methodological challenges encountered

How to achieve multiple goals, derived from different policies, in a coordinated way?

The current landscape of marine-related policies at EU and regional sea level, which has evolved over decades, contain overlaps, gaps, and weaknesses. This multi-level, multi-sector governance system, combined with the numerous societal dynamics such as sectoral path dependencies, socio-economic power inequalities, and political and cultural inertia influence the ability to reach the objectives set as part of the European Green Deal.

The three-years (2022-2025) funded HE CrossGov project aims to address this key overarching question, and search for new and existing initiatives which could assist in closing the current implementation gaps.

Informing decision-making: bottlenecks and opportunities

One of the key objectives of the project is to provide policy makers with a methodological toolbox that will foster more systematic and effective studies of coherence and cross-compliance. Analysis as well as recommendations and roadmaps for better integration of policies will also be provided

Way forward?

An iterative process between desk studies, case study research, and evaluation of results by key stakeholders is currently ongoing for the creation of the toolboxes and roadmaps.

Key messages, questions or issues to address in workshop discussions

- What is understood by "coherence and cross-compliance" of policies?
- Are such analysis of coherence and cross-compliance currently taken place? Who carries them out and how frequent?
- Would civil officials in charge of implementing policies at local scale be interested in carrying out such analysis?