2017 Water JPI Exploratory Workshop Report

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Disclaimer

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Contents

List of Abbreviations

AB:	Advisory Board
CSA:	Coordination & Support Action
EAP:	Environmental Action Programme
EC:	European Commission
EIP:	European Innovation Partnership
EIFAAC:	European Inland Fisheries and Aquaculture Advisory Commission
ETP:	European Technology Platform
ESS:	Ecosystem Services
EU:	European Union
FACCE JPI:	Agriculture, Food Security and Climate Change
FP7:	Seventh Framework Programme
GB:	Governing Board
H2020:	Horizon 2020
ISO:	International Organization for Standardisation
JPI:	Joint Programming Initiative
NBS:	Nature Based Solutions
RBMP:	River Basin Management Plan
RDI:	Research, Development and Innovation
SAG:	Stakeholders Advisory Group
SME:	Small Medium Enterprise
SRIA:	Strategic Research and Innovation Agenda
STB:	Scientific and Technological Board
TRL:	Technology Readiness Level
UN-Water:	United Nations Water
WFD:	Water Framework Directive
WP:	Work Package
WssTP:	Water supply and sanitation Technology Platform

Executive Summary

The Water Joint Programming Initiative (JPI) (www.waterjpi.eu), entitled "Water Challenges for a Changing World", was launched in 2010 and later formally approved by the European Council in December 2011. The Water JPI membership comprises a total of 22 Member States and three observer countries, which collectively represent a large proportion of the European public Research, Development and Innovation (RDI) investment in water resources. The Water JPI is dedicated to tackling the ambitious grand challenge of achieving "sustainable water systems for a sustainable economy in Europe and abroad".

This report contains the proceedings of the second Exploratory Workshop of the Water JPI. The Exploratory Workshop took place in Dublin on the 2nd – 3rd November 2017. Members of the Governing Board, Water JPI partners and national experts, numbering 45 people, participated in this workshop. This workshop provided the occasion for participants to discuss and identify knowledge gaps and RDI needs, with respect to Theme 1 of the Strategic Research and Innovation Agenda (SRIA) entitled Improving Ecosystem Sustainability and Human Well-being.

The workshop was held over two half-days, involving plenary sessions with contributions from the United Nations Water (UN-Water), BiodivERsA, the Scientific Advisory Board and the Stakeholders Advisory Group, and representatives from the Water supply and sanitation Technology Platform (WssTP). The breakout sessions facilitated discussion on the three subthemes of the Water JPI SRIA Theme 1, namely:

- **Subtheme 1.1.** Developing Approaches for Assessing and Optimising the Value of Ecosystem Services.
- **Subtheme 1.2.** Developing and Applying Ecological Engineering and Eco-hydrology.
- **Subtheme 1.3.** Managing the Effects of Hydro-climatic Extreme Events.

The objectives of the 2017 Water JPI Exploratory Workshop were:

⇒ Gathering relevant experts in the topic, who will present and discuss their findings to other experts and stakeholders (end-users, policy makers and industry).

⇒ Identifying Knowledge Gaps and RDI Needs in that area (emerging needs).

⇒ Further elaborating the SRIA RDI Needs.

1. Introduction

1. 1. Water Joint Programming Initiative

The Water Joint Programming Initiative (JPI) (www.waterjpi.eu), entitled "Water Challenges for a Changing World", was launched in 2010 and later formally approved by the European Council in December 2011. The Water JPI membership comprises a total of 22 Member States (17 European Member States and 5 Beyond Europe countries) and three observer countries, which collectively represent a large proportion of the European public Research, Development and Innovation (RDI) investment in water resources. The Water JPI is dedicated to tackling the ambitious grand challenge of achieving "sustainable water systems for a sustainable economy in Europe and abroad".

The Water JPI provides an opportunity for broader cross-border cooperation, greater collaboration and a more unified focus on water RDI across Europe. It must be remembered that the European water economic sector has a broad diversity of stakeholders and is highly fragmented, mainly due to the fact that water resources, water supply and wastewater treatment were often locally managed.

Among the RDI benefits of the Water JPI, five of these have a clear European dimension through:

- Aligning the national RDI agendas, optimising their scope and the resulting funding efficiency; effectively covering the wide variety of European water environments.
- Increasing cooperation among European professionals.
- Designing, building and sharing large research and development facilities (e.g. experimental treatment plants).
- Creating, maintaining and co-operatively exploiting networks of open-field experiments and scientific observatory systems (e.g. experimental watersheds).
- Multiplying the scientific impact of European research, increasing its relevance and scientific leadership.

The Water JPI is strengthening its global dimension through international cooperation, first explored in a mapping report in seven targeted countries conducted by the Water JPI in 2014. This was progressed further by the new Coordination and Support Action (CSA), IC4Water, launched in January 2017, dedicated to the development of international cooperation in the water area. International cooperation on water research and innovation often results in benefits reaching well beyond the water sector. Common to most country development agendas, are goals to provide for sustainable development and healthy water systems for all citizens.

The Water JPI has three specific objectives for international cooperation:

- Strengthening the international dimension of European water RDI.
- Developing durable global partnerships for water RDI.
- Broadening the impacts of the Water JPI common activities.

The Water JPI will produce science-based knowledge leading to the support of European policies; comprising the identification of problems, their quantification, and the development of feasible technical and managerial solutions. It will coordinate water RDI in the participating countries and provide a powerful tool for international cooperation in the water area.

For more information, please refer to the Water JPI Implementation Plan document.

1. 2. Exploratory Workshops under WaterWorks2014

WaterWorks2014 is an EC-funded ERAnet COFUND, supporting the implementation of the Water JPI. Under WaterWorks2014, the three planned Exploratory Workshops are activities contributing to the implementation of the Water JPI during the five-year period of the ERA-NET COFUND. Emerging scientific and technological developments are the target of exploratory workshops.

This workshop gathered relevant experts in the topic, for an opportunity to present and discuss their research with other experts and stakeholders (end-users, policy makers and economic sector representatives). The Exploratory Workshops are critical to the development of the JPI SRIA. These workshops also allowed for the alignment with future Horizon 2020 Work Programmes to ensure synergies and avoid duplications. The outputs from the Exploratory Workshops will be used as a source of information to further focus and identify the RDI needs under the Water JPI SRIA, to adapt the SRIA to reflect changes in RDI needs, and to prepare for future Water JPI Joint Calls.

The objectives of the 2017 Exploratory Workshop were to:

- Gather relevant experts in the topic, who will present and discuss their findings to other experts and stakeholders;
- Identify Knowledge Gaps and RDI Needs in that area;
- Further elaborate the SRIA RDI Needs; and
- Explore cooperation with BiodivERsA, a network of funders operating on biodiversity and ecosystems.

1. 3. Aims of this Report

This document contains the proceedings of the 2017 Water JPI Exploratory Workshop, which took place in Dublin on the 2nd and 3rd of November 2017. All presentations and the workshop documentation, are available on the Water JPI website on the page for the 2017 Exploratory Workshop.

This report is organised as follows:

- Section 2 provides an overview of the methodology in planning the workshop;
- Section 3 provides the proceedings of the workshop; and
- Section 4 provides the key conclusions arising from the workshop.

This report was prepared based on the presentations and notes provided by the rapporteurs, as well as the feedback received from the attendees on the draft version of the document. A follow-up survey was filled out by attendees at the end of the workshop and the survey outputs are included in Section 4.

2. Methodology

The 2017 Water JPI Exploratory Workshop was organised by the Environmental Protection Agency (Ireland), with the support of the WaterWorks2014 partners, and the WaterWorks2014 and Water JPI Secretariats.

2. 1. Workshop Theme

The theme of the 2017 Water JPI Workshop was the Water JPI SRIA Theme 1: Improving Ecosystem Sustainability and Human Well-being. This theme was selected based on consultation with the Water JPI Community.

The aim of the RDI actions under this theme is to maintain the essential functions, processes and services of water bodies and associated ecosystems over the long-term through integrated and interdisciplinary RDI actions. The key to sustainable development is to achieve a balance between the exploitation of natural resources for socio-economic development and conserving ecosystem services (benefits people obtain from ecosystems). Further water management efforts and RDI actions are currently needed to ensure the protection and/or restoration of water bodies and ecosystems whilst meeting the socio-economic, political and cultural needs of current and future generations. Research on ecosystem sustainability will also support a relatively wide range of national, European and international policy initiatives including: the 7th Environment Action Programme (EAP); the EU Biodiversity Strategy; the Water Framework Directive (WFD); the Habitats and Flood Directives; and the United Nations Sustainable Development Goals (UN SDGs).

It is expected that a better understanding of the role of biodiversity in the strength and sustainability of aquatic ecosystems will be realised. From an operational point of view, functional indicators will be developed to better understand the condition and ecological dynamics, and to act in terms of conservation and rehabilitation. As such innovative applications of ecological engineering (design of ecosystems for the mutual benefit of humans and nature) can help restore water resources, biodiversity and aquatic environments (wetland restoration or hydromorphological/sediment management, restoration of ecological continuity, reintroduction of key species).

The Water JPI strives to create and maintain partnerships with relevant networks whose work overlaps into the water sector. SRIA Theme 1 is primarily focused on the essential functions, processes and services of water bodies and associated ecosystems, a focus that was aligned to certain objectives of the BiodivERsA network which made BiodivERsA an attractive and relevant partner to work with. BiodivERsA is a European network of 32 research-funding agencies across 19 European countries. Created in 2005, BiodivERsA has received funding from the European Commission (EC) under the 6th and 7th European Framework Programme for Research and since 2015 under the Horizon 2020 Framework Programme for Research and Innovation. BiodivERsA works to coordinate national research programmes on biodiversity across Europe and to organise international funding for research projects in this field, on a competitive basis. Over the years, BiodivERsA partners have joined forces to develop a wide range of activities ranging from the mapping of the research landscape on biodiversity and ecosystem services in Europe to research programming and funding. Besides, the network supports stakeholder engagement all along the research process and contributes to the dissemination of research outputs and knowledge brokerage. In the planning for the 2017 Exploratory Workshop, the Water JPI seized this opportunity to join forces with BiodivERsA in exploring the Water JPI SRIA Theme 1.

Theme 1 (see **Annex 1**) is composed of:

- **Subtheme 1.1.** Developing Approaches for Assessing and Optimising the Value of Ecosystem Services;
- **Subtheme 1.2.** Developing and Applying Ecological Engineering and Eco-hydrology; and
- **Subtheme 1.3.** Managing the Effects of Hydro-climatic Extreme Events.

To view the full description of Theme 1, please consult the **Water JPI SRIA 2.0[1].**

[1] http://www.waterjpi.eu/images/documents/SRIA%202.0.pdf

2. 2. Workshop Attendees

One of the aims of the workshop was to gather relevant experts in specific areas relevant to Theme 1 of the Water JPI SRIA, who would present and discuss their findings with other experts and stakeholders. The workshop was attended by researchers, policy makers and other stakeholders, along with the Water JPI community. The attendees numbered 45 in total, representing thirteen countries as illustrated in **Figure 1**, and could be categorised as follows:

- Invited speakers: Invited experts to present their research in a specific area under Theme 1.
- Panel Discussion: Invited panellists representing initiatives including the Water JPI, UN-Water, BiodivERsA & WssTP.
- Nominated national experts: Invited experts to attend the workshop and contribute to discussions.
- Water JPI Community: Dominique Darmendrail (Water JPI Coordinator), Maurice Heral (Water JPI Chair), Padraic Larkin (Water JPI Co-Chair), as well as members of the Water JPI Governing Board, Advisory Boards and WaterWorks2014.

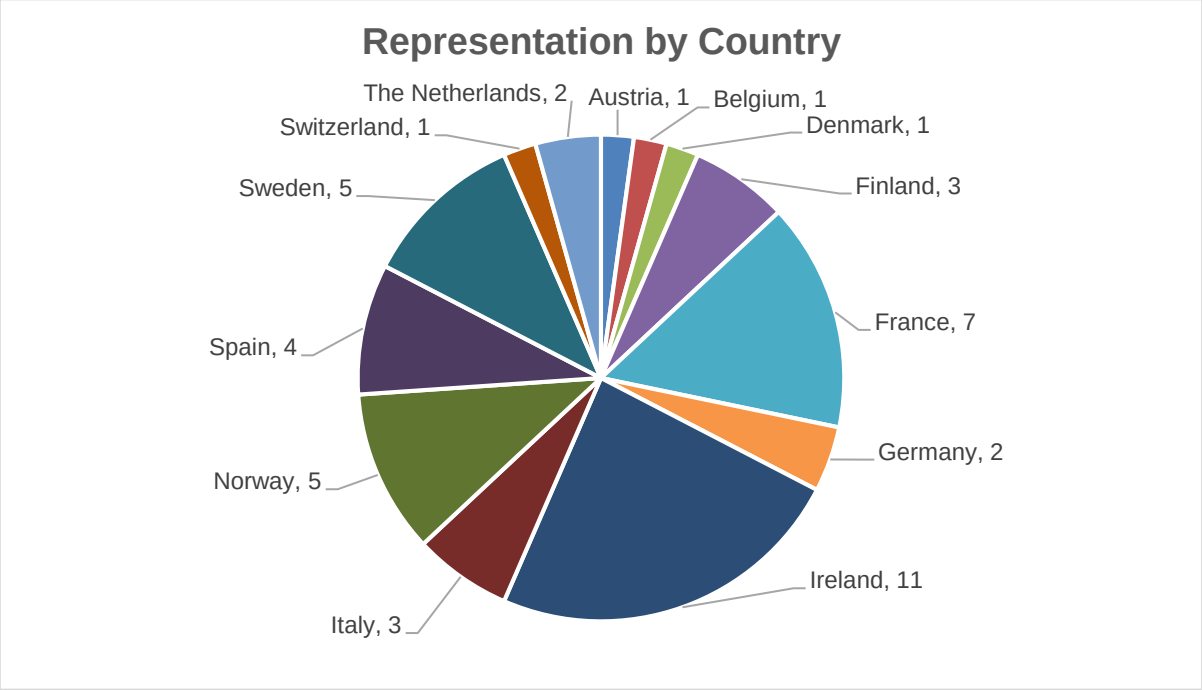

Figure 1: Pie chart illustrating the diverse representation from European countries that participated in the workshop.

The list of all attendees is provided in **Annex 2**.

2. 3. Workshop Programme

The workshop included three plenary sessions, as well as two breakout sessions composed of three discussion groups, running in parallel on each day. The WaterWorks2014 partners identified the theme of the workshop, as well as the preparation of questions for the panel discussions. The Water JPI Community selected the experts to be invited as speakers and nominated experts, based on a review of relevant EU projects and initiatives. The Programme and short Biographies from the speakers are available in **Annexes 3 and 4**.

2.3.a. Plenary Session-1

The first plenary session provided a general introduction to the Water JPI objectives, synergies with BiodivERsA and the expected outcomes of the workshop. This introduction was followed by presentations on the scientific, policy and end–users / economic perspectives for Theme 1 and BiodivERsA's view of the synergies between the initiatives. Presentations during the first plenary session were made by:

Dominique Darmendrail
(Water JPI Coordinator, France)

Seppo Rekolainen
(Ministry of Agriculture and Forestry, Finland)

Daniella Bostrom-Couffe
(UN-Water, Switzerland)

Henrik Lange
(BiodivERsA, Sweden)

Teppo Vehanen
(European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), Finland)

2.3.b. *Breakout Sessions-1*

The three breakout sessions were targeted at specific RDI needs within Theme 1 organised per subtheme as outlined in **Table 1**. Each breakout session had one chair to manage the time during presentations and facilitate the group discussion. A rapporteur recorded the discussion.

Table 1: Chairs and rapporteurs assigned to the Breakout Sessions.

No.	Breakout Session Title	Chair	Rapporteur
1	Developing Approaches for Assessing and Optimising the Value of Ecosystem Services	Natacha Amorsi (EURO-INBO, France)	Alice Wemaere (EPA, Ireland)
2	Developing and Applying Ecological Engineering and Eco-hydrology	Andrea Rubini (WssTP, Belgium)	Margaret Keegan (EPA, Ireland)
3	Managing the Effects of Hydro-climatic Extreme Events	Jens Christian Refsgaard (The Geological Survey of Denmark and Greenland, Denmark)	Áine Murphy (EPA, Ireland)

The breakout sessions contained two 15-minute presentations from relevant European projects. These presentations were followed by a group discussion moderated by the Chair, which aimed to:

- Identify the key knowledge gaps in the specific subtheme of the session; and
- Identify any new RDI gaps not in the SRIA.

2.3.c. *Plenary Session-2*

Plenary session-2 was an informal networking discussion which brought together the participants to critically review the outputs of the breakout sessions. The output consisted of a list of RDI needs on flipcharts for each subtheme, including needs which were not present in the current SRIA subtheme. Each participant was given three stickers per subtheme flipchart, to indicate their top three RDI needs under each subtheme.

2.3.d. *Breakout Sessions-2*

The second round of breakout sessions, involved the breakout session group reviewing the prioritisation exercise from plenary session-2, agreeing the top three RDI needs by adjusting or combining needs from the RDI list, and elaborating on these using the template provided. The RDI needs template required information about the RDI need under the following headings:

- Title of the RDI need.
- The Challenge and the Scope.
- Top 3 Objectives.
- Top 3 Expected Impacts.
- End-Users needs.
- Policy Relevance.
- Type of Instrument.
- Technology Readiness Levels (TRL).
- RDI Needs for Theme 1.
- Related UN SDGs.

2.3.e. Plenary Session-3

Plenary session-3 was split into three parts, firstly the rapporteur's summary was presented followed by the panel discussion between the initiatives and lastly the next steps for the workshop outputs. Each rapporteur presented on how the RDI list of the previous day was narrowed down using the prioritisation exercise in Plenary Session-2 and the discussion in Breakout Sessions-2. The top three RDI needs for each subtheme were elaborated upon by providing detailed information as outlined in the RDI needs template. The discussion was opened to the floor by the moderator David Murphy (AquaTT), for attendees to provide views on the top three outputs, the interlinkages between them and how the global dimension could be assimilated into these needs.

The aim of the panel discussion was to discuss how best to implement the Water JPI identified RDI needs for Theme 1 Improving Ecosystem Sustainability and Human Well-being. The Panellist representatives were Henrik Lange BiodivERsA, Daniella Bostrom-Couffe UN-Water, Lena Goldkuhl WssTP and Dominique Darmendrail Water JPI. The moderator facilitated the discussion asking each panellist to share their perspective on the following key questions:

- Should there be a two-step panel evaluation process, one of which carries out a scientific review and the other a review by stakeholders?
- How can we address local / regional dimension within our activities?
- How can we increase the involvement of the economic sector?
- How to strengthen the global dimension of the Water JPI activities, link with other on-going initiatives and involve the economic sector?

Discussion and questions for the panellists were welcomed from the audience throughout.

2.3.f. Workshop Materials

Each attendee was provided with a range of materials on the day and via email prior to the workshop. These items included:

A. *Workshop Information:* Workshop Objectives, Workshop Programme, Short Speaker Biographies and a Workshop Feedback Form
B. *Water JPI Information:* Water JPI Implementation Plan, 'How to engage with the Water JPI' Leaflet & Water JPI Information Factsheets.

Speakers were provided with template slides to be used to prepare the presentations. The breakout session speakers had to describe the project, the project's objectives and expected outputs, the RDI gaps for the future and the links to the SRIA. Panellists were provided with the list of planned questions. An excerpt of Theme 1 of the SRIA version 2.0 and the key knowledge gap template was provided in each breakout session. Participants were asked to consider these documents during their discussion.

All presentations are available on the Water JPI website via a dedicated webpage available at: 2017 - Improving Ecosystem Sustainability and Human Well-being

3. Workshop Proceedings

3.1. Plenary Session-1

The Exploratory Workshop was opened by ***Matt Crowe*** of the Irish Environmental Protection Agency. Matt highlighted the importance of the SRIA and the purpose of the workshop, in particular to work together to identify RDI knowledge gaps in the SRIA.

The Water JPI Coordinator, ***Dominique Darmendrail***, provided a general introduction to the Water JPI and its SRIA. She highlighted, in particular that:

- The SRIA is updated by the consideration of outputs from the thematic activities including the Exploratory and Networking Workshops, Joint Calls, monitoring and impact assessment of funded projects, among other sources.
- The Water JPI encourages the coordination between researchers by providing opportunities to network in Knowledge Hubs and Thematic Annual Programming (TAP), yielding policy outputs specific to the targeted end-users.
- The focus of the day was on SRIA Theme 1, and would involve cross-cutting horizontal issues that overlap between themes.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/General%20Introduction%20on%20Water%20JPI%20%20SRIA.pdf

Seppo Rekolainen, member of the Water JPI Scientific and Technological Advisory Board, prepared a presentation on the scientific perspective on the key RDI challenges in Water JPI SRIA Theme 1 but due to unforeseen circumstances was unable to attend. His presentation highlighted:

- The links between water, food and energy security were illustrated in a diagram which considered the climate land, water and socio-economic drivers.
- The level of transboundary coordination required to protect and sustain water bodies across the globe was considerable.
- The relationship between the likelihood and impact of global risks and their interconnections were presented.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/Scientific%20Insights%20on%20key%20RDI%20challenges%20in%20Water%20JPI%20SRIA%20Theme%201.pdf

Daniella Bostrom Couffe, UN-Water, provided an overview of water policy from the UN's perspective, and linked this with the Water JPI SRIA RDI needs within Theme 1. This included information on:

- The coordination of the United Nation's (UN) work on water and sanitation globally.
- The provision of policy and technical advice to UN Member States.
- Monitoring and reporting on global indicators to meet the SDG 6 'Clean Water and Sanitation' targets.
- Support to the UN inter-agency expert groups that has classified the target methodologies in tier I to III with respect to their maturity.
- Inspiring action by informing and engaging with the public to care about water.
- The issues of fragmentation and decreasing aid; issues of better governance
- The need to put a financial cost on meeting SDG 6.
- Strengthening monitoring systems and national capacity and increase the use of available citizen science data.
- Linking the SRIA to SDG 6, but also SDGs 14 and 16, more specifically for Theme 1 to find out accurately and consistently how to measure ecosystem services.
- The research required in financially costing the protection of ecosystem services for policy makers and the cost of in-action.

Link to the presentation:

http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/Policy%20Perspective%20on%20Water%20JPI%20SRIA%20RDI%20needs%20within%20Theme%201.pdf

Henrik Lange, representing BiodivERsA, presented the Synergies between the Water JPI and BiodivERsA under the SRIA Theme 1, including in particular:

- A description of BiodivERsA as a network and its focus on nature based solutions.
- BiodivERsA's SRIA which contains core and transversal themes, linked to the Science and Policy for People and Nature Conceptual Framework.
- BiodivERsA's themes are synergistic with the Water JPI SRIA themes 1, 4 & 5.
- Within the Water JPI Theme 1, BiodivERsA have themes which align with aspects of each subtheme.
- Next steps to exploit the synergies between BiodivERsA and the Water JPI are
    - Joint CO-FUND call between BiodivERsA and the Water JPI, with a focus on aquatic systems.
    - The Production of Joint Policy briefs from the funded projects.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/BiodivERsA%20Synergies.pdf

Teppo Vehanen, member of the Water JPI Stakeholders Advisory Group, presented the End-users / economic insights on key RDI challenges in SRIA Theme 1, including reference to:

- Achieving a balance between the exploitation of natural resources for socio-economic development and conservation of ecosystem services.
- Map and value ecosystem services and integrate these into policy using the Common Implementation Framework.
- Apply the existing valuation methods for ecosystem services.
- Quantify the adverse effect of Ecological Engineering projects on biodiversity by monitoring the magnitude and breadth of impact.
- Sustainable use of the aquatic environment in terms of food, technology, by-products and leisure activities.
- Ecosystem services can be considered as nature based well-being.
- Sustainable production and sustainable should be at the centre of this.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/End-Users%20Economic%20Insights%20on%20key%20RDI%20challenges%20in%20Water%20JPI%20SRIA%20Theme%201.pdf

Clarifications during Questions and Answers:

- Biodiversity issues concern both BiodivERsA and the Water JPI, as it is important to protect and maintain ecosystem quality in water bodies.
- There is a considerable amount of research in ecosystem valuation for a business case, but an aspect lacking is the method by which the financial cost is framed for Policy Makers.
- Research must be framed in a manner that can be applied by Ministers, for example have the financial figures to meet the research need outlined and the research to back it up.
- The post-implementation assessment of the WFD River Basin Management Plan (RBMP) should be reviewed and the benefits out of it should be quantified. There are many questions relating to integration across water, habitats, and climate change. Knowledge on these areas should be assimilated into the next revision of the WFD.

3.2. Breakout Sessions-1

3.2.a. Session-1: Developing Approaches for Assessing and Optimising the Value of Ecosystem Services

This section is based on the presentations and notes provided on the flipcharts by the rapporteur, Alice Wemaere (EPA, Ireland).

i. Presentations from relevant projects

Daniel Hering presented on the EU Horizon 2020 project MARS, providing a synthesis of results on 'Multiple stressor impacts on European surface waters'. The objectives of the project were to determine:

i. How stressors interact in affecting ecological status and services at the water body, catchment and continental scales?
ii. Despite the multitude of stressors, is there a common ground for restoration activities?

The project outputs include evidence of the:

- Additive effect of temperature and nutrients on phytoplankton, macrophytes, primary production and respiration.
- Antagonistic effects of adding humic substances to cyanobacteria blooms under nutrient stress.
- Multiple stressor synthesis and the relevance and strength of its interactive effects on nutrients in freshwater.
- Predicted future scenarios from a 'techno world', 'consensus world' and a 'fragmented world' perspective on phosphorus and ecological quality ratios.
- Model output of how multiple stressors act in rivers across Europe.

In particular, the identified RDI gaps were:

- Capitalising on the data source on stressor-impact-relationships.
- Capitalising on the Europe-wide data source on various stressors and ecological status.
- Capitalising on the tools produced by MARS.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/DESSIN-Demonstrate%20Ecosystem%20Services%20Enabling%20Innovation%20in%20Water%20Sector.pdf

David Schwesig presented on the EU Horizon 2020 project DESSIN, through his presentation 'Demonstrate that ecosystem services are enabling innovation in the water sector'.
The objectives of the project were to:

i. Demonstrate and promote innovative solutions to water related challenges with a focus on water quality and water scarcity.
ii. Demonstrate a methodology for the valuation of ecosystem services (ESS) as catalyser for innovation in the water sector, and better decision-making.

David outlined how water scarcity and water quality can have positive impacts on ESS of water bodies (quantifiable) and develop new arguments for market uptake and practical implementation.
The identified RDI gaps were:

- Establish a direct link between measure and effect on biodiversity as it is one of the most relevant factors for cultural ecosystem services (e.g. recreation).
- Need approaches to harmonise economic valuation results from using different evaluation methods.
- Choose the valuation method depending on the type of ecosystem service as different methods provide monetary values with different economic meaning. e.g., stated-preferences methods (willingness to pay) vs. market evaluation methods (market price).
- Measure the business value of ecosystem services.
- Integrate the ESS value into the decision-making process.
- Investigate how management of ecosystem services impact on corporate performance.
- Cross-cutting RDI gap: Data
    - Data availability, functional monitoring and functional failure prediction. The data needed for ESS evaluation are not identical with the 'standard environmental data' gathered today.

- Development of new tools in ecological engineering and early warning systems, including sensors, web services, numerical codes and (further) ecological restoration.
- Increased availability and relevance of data and decision making products for extreme weather events.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/Multiple%20stressor%20impacts%20on%20European%20surface%20waters%20A%20synthesis%20resulting%20from%20MARS%20project.pdf

ii. Group Discussion: Identifying key knowledge gaps

The Chair and Rapporteur compiled a list of **potential RDI knowledge gaps** based on the information discussed, as listed in **Table 2**.

Table 2: Key RDI Knowledge Gaps identified in Session-1

Session-1: Key RDI knowledge Gap
1. State of the art of existing research (synthesis) including compiling case studies.
2. Informing choices in policy-making (regarding the environment and human well-being).
3. Linking measures and other interventions to their effects on the ecosystem and ecosystem services, and to their societal impacts 1.1.4, 1.1.1 (f).
4. Quantifying ecological & social resilience of ecosystems.
5. Engagement of stakeholders: Promoting a two-way communication with the stakeholders.
6. Engagement of the stakeholders: Identification of the attributes of the services they value.
7. Standard approaches to quantify ecosystem services (standardised methodology).
8. Framework and methods for assessing well-being gains & losses associated to ecosystem-based responses.
9. Relation between human well-being and ecosystem services.
10. Direct health effect of environmental measures (e.g. health benefits indicators).
11. Issue of scale: spatial, temporal & governance.

3.2.b. Session-2: Developing and Applying Ecological Engineering and Eco-hydrology

This section is based on the presentations and notes provided on the flipcharts by the rapporteur, Margaret Keegan (EPA, Ireland).

i. Presentations from relevant projects

Jörgen Johnsson's presentation, presented by Margaret Keegan, was on the BiodivERsA-project Salmo-Invade 'Insights from SalmoInvade: policy recommendations based on biological and social findings'. The aim of the project was to develop a pan-European approach to integrate the knowledge required for managing invasive salmonids. SalmoInvade did this by integrating novel eco-evolutionary and socio-economic hypotheses to evaluate the impacts and consequences of non-native salmonid invasions. The project outputs were divided into biological studies and social studies. The key results and policy recommendations include:

- The negative ecological effects of non-native salmonid species and populations on native biodiversity across all levels of biological organisation, from individuals to populations, communities and ecosystems.
- Domesticated non-native fish, such as rainbow trout, can to some degree be controlled by intensive fishing given their high vulnerability to angling.
- There are substantial differences in governance and management of salmonid stocking and transfer between and within European countries, in terms of levels of decision-making, and trends and volume of salmonid stocking.
- The public awareness of non-native salmonids and their potential effects on biodiversity is low.

- Decisions by local-level fisheries decision-makers to stock non-native salmonids are influenced by the attitude toward fish stocking which is governed by social and economic contextual factors and social norms, rather than by potential negative biological effects.

In addition, the identified RDI gaps were:

- The biological effects of invasive non-native species and populations appear to be more complex than previously recognised. Research studying the effects at multiple levels of biological organisation, and at longer time scales, is required.
- Biological and social science studies need to be better integrated to understand how knowledge of biodiversity and its values, and the consequences of non-native species/population invasions, can be transferred more effectively to the public and stakeholders.
- Support for multidisciplinary European research programs further examining the links between science, policy and public awareness of biodiversity conservation.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/Insights%20from%20SalmoInvade%20policy%20recommendations%20based%20on%20biological%20and%20social%20findings.pdf

Lena Goldkuhl, as a member of the WssTP working group on ESS, presented on 'Urban Green Infrastructure, Ecosystem Services and Water JPI RDI Gaps' highlighting the areas within ecosystem services research that could be included in future updates to the Water JPI SRIA. Lena identified the RDI gaps for the future including the following:

- Economic and ecologic evaluation of ESS from urban green/blue infrastructure, for example flood protection, water treatment, recreation, biodiversity, and CO_2 retention in stormwater pond sediments.
- Tradeoffs / conflicts between ESS and urban green / blue infrastructure regarding the following:
    - Stormwater ponds are serving as biotopes for different species, while at the same time proving a treatment facility.
    - How species in stormwater ponds get affected by heavy metals.
    - How to perform maintenance without affecting biotope.
    - Aesthetics vs. functionality (stormwater retention).
- The identification of key factors needed in order to increase the use of urban green/blue Infrastructure, including how to provide for a planning process that involves all relevant water actors.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/Urban%20Green%20Infrastructure%20Ecosystem%20Services%20and%20Water%20JPI%20RDI%20Gaps.pdf

ii. Group Discussion: Identifying key knowledge gaps

The group discussion was led by Andrea Rubini. Several points made during the discussions, included:

- The key words: Detect, monitor, sustainability and affordability.
- The need for the continued use of citizen science.
- The need for integration with planners to develop policy/green infrastructure to increase the biodiversity.
- Further research on hydromorphology and ecological flows (eFlow) and how they will impact on the ecosystems such as the intervention biological response.
- Further research into invasive species' impact on ESS, developing early warning and rapid response systems for invasive species, and the need for cross border agreement on standards for invasive aliens.
- Developing an understanding of the connectivity between the aquatic and terrestrial environment.
- Geochemical dynamics are not included in WFD.
- Programme of Measures for WFD which must quantify the economic cost and benefit of the measures.

The Chair and Rapporteur compiled a list of potential RDI knowledge gaps based on the information discussed, as listed in Table 3.

Table 3: Key RDI Knowledge Gaps identified in Session-2

Session-2: Key RDI knowledge Gap
1. Human created infrastructure and associated ecosystems (e.g. Green/Blue Infrastructure).
2. Link to Urban Europe and BiodivERsA .
3. Co-benefits and intrinsic values.
4. Integrated decision support models for adaptive governance (include planning, social science etc.).
5. Integrated approach to rapid response to invasive alien species regulation.
6. Counterbalance between trade and impact of invasive species
7. Intermittent waterbodies – rivers (southern countries) and lakes – ecosystem functions and services.
8. Review of cost benefits of Programme of Measures to input to review of WFD.
9. Measuring the impact on ecosystems of non-native or modified species.
10. Integration with planners to develop blue/green infrastructure to increase biodiversity.
11. How indicators (e.g. WFD) reflect the state of the ecosystem (1.1.1).
12. Hydromorphology / eFlow – supplement WFD indicators for hydromorphology and how it affects ecosystem services and links to cost effectiveness.
13. What extent can the ecological engineering treat water – State of the art/inventory.
14. Integrated Model approach for forecasting for ecosystem services, early warning systems (e.g. algal blooms) – mathematicians need to be included – to support governance / rapid response/ management / marketable outputs.

3.2.c. Session-3: Managing the Effects of Hydro-climatic Extreme Events

This section is based on the Speaker presentations and the notes provided on the flipcharts by the rapporteur Áine Murphy (EPA, Ireland).

i. Presentations from relevant projects

Maria-Helena Ramos presented on the EU Horizon 2020 project IMPREX 'Improving predictions and management of hydrological extremes'. The project focused on research on forecasts/projections and application-oriented research, to guide decisions on weather events in a climate context. The project is made up of a strong transdisciplinary team of forecasters and hydrological modellers, sectoral experts and Small Medium Enterprises (SMEs), and outreach and dissemination experts. The project team strives to embed their research in the actions of users, national and regional water authorities.

The RDI gaps identified for the future included:

- Improving predictability of extreme events.
- Integrate approaches developed for water management and climate change effects.
- EU Adaptation Strategy including improved (sectoral) risk assessments as the basis for adaptation strategies (national, sectoral, local) and the assessment of economic sectors' dependence on water resources outside Europe.
- WFD, Drought Policy and Floods Directive: Climate change and drought events are not sufficiently considered in RBMPs and the links and input on flood risk and hazard maps, damage modelling.

The link between the project and the Water JPI themes were highlighted as:

- Identification of weather- sensitive and climate-sensitive ecosystem services.
- Providing for actionable water services (data and risk outlook) by mapping the complexity of interactions and dependencies in the real world and in decision-making contexts.
- The two-way system of competitiveness and opportunity creation in the water industry, should be exploited for:
    - Water & energy, agriculture, tourism, & ecosystems.
    - Facilitating SMEs to extend their product portfolio (tailoring climate services to local needs and innovation of Nature Based Solutions (NBS)).

- Integrated strategy on how different policies affect each other and a multi-risk governance structure to anticipate the future.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/Overview%20of%20IMPREX-IMproving%20Predictions%20and%20management%20of%20hydrological%20EXtremes.pdf

Martin Kainze presented on the BiodivERsA funded project LIMNOTIP 'Biodiversity dynamics and tipping points in our future freshwater ecosystems'. The research project focuses on how regime shifts in freshwater ecosystems can change drastically as the ecosystem exceeds its tipping point. This causes freshwater ecosystems to change from a biodiverse clear water state, to a state characterised by algal blooms and turbid water, with low provision for biodiversity and ecosystem services. Martin explained how these tipping points can arise as immediate drivers of brownification or act as a slow steady path towards it ecosystem degradation. The application of social-ecological integration of the results was an essential component, to develop a framework for future actions. The reversal of tipping points through restoration was also investigated.

In particular, the identified RDI gaps were:

- Effects of heat waves on lake physics (mixing), carbon cycles (including greenhouse gases) and winter.
- Impact of climate and regional/local human impact on biodiversity, ecosystem services (drinking water), and safe provision of food from lakes and rivers (fish).
- Synergistic effects of climate and other environmental processes (eutrophication, browning) on biodiversity and overall ecosystems response.

Link to the presentation:
http://www.waterjpi.eu/images/documents/Workshops/2017_WaterJPI_Exploratory_Workshop_Dublin/LIMNOTIP-Biodiversity%20dynamics%20and%20tipping%20points%20in%20our%20future%20freshwater%20ecosystems.pdf

ii. Group Discussion: Identifying key knowledge gaps

The group discussion was led by the Chair, Jens-Christian Refsgaard, and all attendees were involved. The discussion highlighted the need to prepare more adequately for extreme events, to analyse post-event, and how to return society and ecosystems to the pre-existing environment. The development of tailored solutions to the impacts of extreme events must be elaborated further to allow for the upscaling of all solutions produced. Benchmark studies to develop tools on early warning systems was aired as a potential need, especially if the benchmark recommendations are integrated into catchment management to preserve biodiversity in receiving waters.

The idea of transformative social learning in the context of policy making for global climate change, was highlighted as significant a need but can be difficult to implement due to the barriers of current public administration systems. The cross-cutting issues raised were global transferability of developed technology, and the need to investigate the nature of generational change and how it impacts on policy making.

The Chair and Rapporteur compiled a list of potential RDI knowledge gaps based on the information discussed, as listed in Table 4.

Table 4: Key RDI Knowledge Gaps identified in Session-3

Session-3: Key RDI knowledge Gap
1. Catchment management bottom-up and top down related to water management of extreme events.
2. Benchmark studies for testing of tools.
3. Data storage and use of extreme event data.
4. Transformative and social learning and governance in water management of extreme events.
5. Study the limits of adaptability and what is good enough – predictive capability.
6. Water management on timescales/spatial scale and transboundary scale of extreme events.

7. Multi-risk approach to dealing with extreme vents and the multi-cascade effects realised.
8. Costs related with occurrence and remediating and valuation of extreme events related to ecosystem services.
9. Tipping points – why some systems are prone to change.
10. Water quality impacted – groundwater, soil and freshwater point of view due to occurrence of extreme events and their interactions.
11. Upscaling from local to national/global scale events.
12. Better understanding as a basis for developing different tools.

3.3. Plenary Session-2

Plenary session-2 was an informal networking discussion which brought together participants of each breakout session into one room, to critically review the output of the breakout sessions. The output consisted of a list of RDI needs on flipcharts for each subtheme, including needs which are not present in the current SRIA subtheme, see **Figure 2, 3** and **4** below. Each participant was given three stickers per subtheme flipchart, to indicate their top three RDI needs under each subtheme, see **Figure 5** and **6**.

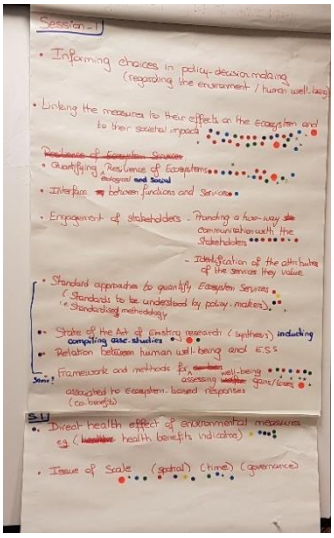

Figure 2: RDI needs list generated for subtheme 1.1.

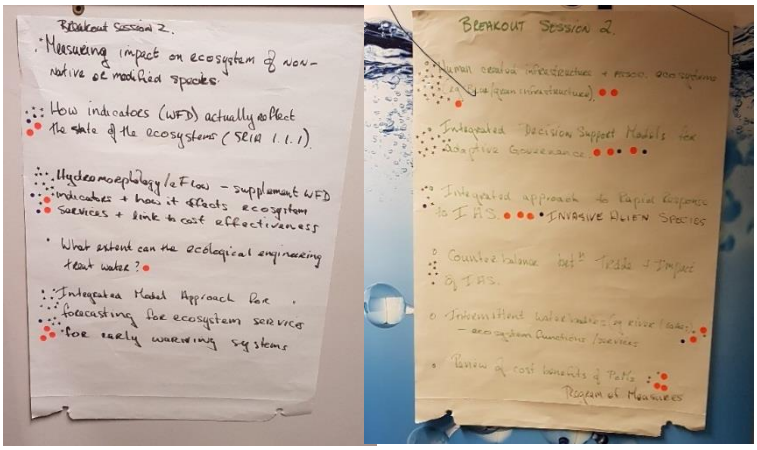

Figure 3: RDI needs list generated for subtheme 1.2.

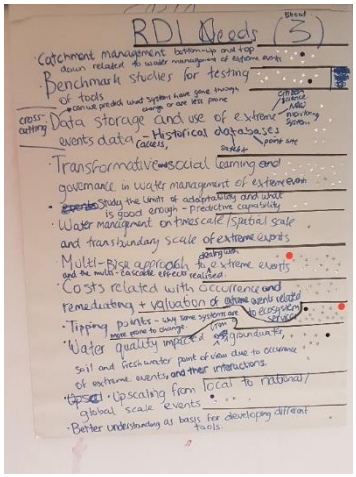

Figure 4: RDI needs list generated for subtheme 1.3.

Figure 5: Workshop participants prioritising the RDI needs list.

Figure 6: Workshop participants prioritising the RDI needs list.

3.4. Breakout Sessions-2

The expected outcomes of the second round of breakout sessions, was to review and agree the top three RDI needs by taking the prioritisation preferences indicated by the sticker count, and elaborating on these using the template provided.

i. Subtheme 1.1.: Developing Approaches for Assessing and Optimising the Value of Ecosystem Services

This discussion yielded a recommendation for the subtheme title to be changed from the above title and be replaced by "Harmonising approaches for assessing and enhancing ecosystem services as a tool to inform policy".
The following three research needs were prioritised:

Key Research Need 1-1	Linking the measures to their effects on the ecosystem and to their societal impacts
Key Research Need 1-2	Quantifying & linking ecological & social resilience of ecosystems
Key Research Need 1-3	Framework and methods for assessing ecosystem services

The detailed elaboration of these needs is included in Annex 5.

ii. Subtheme 1.2.: Developing and Applying Ecological Engineering and Eco-hydrology

The following three research needs were prioritised:

Key Research Need 2-1	Water related urban infrastructure and associated ecosystems
Key Research Need 2-2	Integrated Decision Support Systems for adaptive Governance
Key Research Need 2-3	Hydromorphology / eFlow: Developing suitable indicators for hydromorphology to support cost effectiveness of measures

The detailed elaboration of the first need is included in Annex 6, but the group did not have sufficient time to flesh out the information on the second and third need.

iii. Subtheme 1.3.: Managing the Effects of Hydro-climatic Extreme Events

The following three research needs were prioritised:

Key Research Need 3-1	Extreme hydroclimatic events, governance and catchment management
Key Research Need 3-2	Multi-risk approach to dealing with extreme events
Key Research Need 3-3	Identification of tipping points caused by extreme events

The detailed elaboration of these needs is included in Annex 7.

3.5. Plenary Session-3

The third plenary session was divided into three parts: feedback and discussion on the breakout session outputs, a panel discussion between initiatives and the next steps following the workshop. This session was chaired by the Water JPI Co-Chair, Padraic Larkin, and moderated by David Murphy (AQUATT).

3.3.a. Feedback from the Breakout Sessions

Feedback on each of the three breakout sessions were provided by the Rapporteurs using the RDI needs template to flesh out the research need and how it should be implemented. The summaries were followed by a group discussion. The views raised regarding how the top three RDI needs could overlap included:

- Research needs 1-1 and 3-3 on ecosystem resilience and tipping points could tie in well together.
- The RTD networking aspects should be combined across the theme and addressed together.
- Benchmarking studies could be useful to identify the baseline before addressing research gaps. A clear overview of the different case studies could be created in the area by collating the existing information and sharing this. A framework of good practice guidance should include benchmarking on tools, methods and approaches.
- The common denominator between some needs is policy. These could be implemented by targeting how specific policies should be changed.
- The assimilation of scientific research into policy must be explored, perhaps by connecting with the common strategy group and by supporting the translation of science to policy.
- The multi-disciplinary nature of the needs would require integration among researchers and stakeholders.
- The spatial scale of these RDI needs should be defined.
- A common thread for many of the issues identified is the need to capitalise on the existing knowledge and apply innovation to this.
- The timeline to address these needs must be defined.

The Moderator asked the attendees, what RDI need identified should be addressed first? The discussion consisted of the following:

- Research need 3-1 and 3-2 are very relevant due to the climate change link and should be considered together, not separately.
- Research need 1-2 deals with the structure, function and the delivery of ecosystem services which could be complimented well by research need 3-3 on ecosystem resilience across tipping points.
- Research need 2-2 should be addressed due to the relevance of governance systems in the collation of research to develop the state of the art.
- Research need 2-2 could be linked to 3-1, to develop governance form a catchment management point of view.
- The research needs identified for subtheme 2 would provide a good oversight of how to get stakeholders and researchers to work together to transfer knowledge to policy makers.
- Before selecting a project to be addressed, each research need should be assessed for the scale and size of the project to determine the extent of funding and time needed to fill the knowledge gap.
- Policy makers and environmental regulators should be involved in the research project from the beginning to ensure the product of the research is implemented by decision makers.
- It is important to involve the end-user in the project so that the solutions created by researchers can be implemented quickly for their benefit.

Discussions surrounding how to strengthen the global dimension included:

- The Water JPI should be aware that the processes and types of activities in countries outside of Europe can differ significantly to those within Europe.
- The risk to the Water JPI by involvement with countries outside of Europe should be assessed as certain countries will be more attractive from an alignment and interest and financial perspective.

- The SRIA does not appear to be directed towards an international audience at present but when the SRIA is revised, it should be linked to the UN SDGs.
- It must be considered that countries outside of Europe may identify similar RDI needs but the prioritisation of these could differ to the European priorities.
- The opportunity to work with global partners should be used to work on common problems together and create solutions to these.
- The Water JPI must not work in isolation and should link in with the PRIMA initiative, Afri-alliance, Belmont Forum, FACCE JPI and BiodivERsA etc. and in doing so carve out a niche for the Water JPI.
- The Water JPI needs to identify who the problem owners are and what the Water JPI can offer as a solution.
- Co-designing and co-creating with global countries is very important and should enable the identification of what can be exported from Europe and imported from non-European countries to meet the global knowledge gaps.
- The Water JPI should define what the objectives of international cooperation are and develop a strategy around how to prepare for this.
- The global challenge of water and food security must be linked to sustainable water management.
- The influence of the Water JPI needs to be quantified, as the objective to include the global dimension seem very ambitious, and perhaps it is the European dimension of influencing Horizon 2020 or the national institutions that should be the primary focus of the Water JPI in its current state.
- The Water JPI must have a long-term vision of how it will integrate the global dimension in all Water JPI activities.
- The broadening of the geographic base to include the global dimension, may be an effective strategy to increase the Water JPI's chances of surviving.

3.3.b. Panel Discussion

This section is based on the notes provided by the panellists and the rapporteur's notes on the day, see below an image of the active panel discussion in **Figure 7**.

Q1. Should there be a two-step panel evaluation process, one of which carries out a scientific review and the other a review by stakeholders?

BiodivERsA: BiodivERsA use a two-step evaluation panel. In the first step, two groups would be created of equal size, consisting of stakeholders and the other of scientists. Within their groups there is free ranking of the projects. The knowledge needs must be identified, when the two groups come together to agree how the ranked projects will be married together to come to a joint decision. Some funders have national requirements which can cause difficulties, in that the organisation can only fund research that is uniquely ranked (i.e. scientific group with no stakeholders involved) but this is a matter for negotiation in the Memorandum of Understanding.

Water JPI: Currently the Water JPI has a two-step evaluation process. This process involves one evaluation panel led by an independent Chair, which combines stakeholders and scientists, each having a Vice-Chair to represent the consensus view. The two-panel evaluation process was not chosen, as it was felt it may create difficulties when bringing the panels together with respect to ranking. The transdisciplinary issues that can arise can be minimised by choosing relevant representatives to keep the evaluation context specific.

WssTP: As many research questions can be transdisciplinary, it is important during the establishment of an evaluation panel to choose scientific experts who represent the transdisciplinary nature of the call. It is vital to have the correct representation of experts.

UN-Water: Multi-stakeholder involvement adds credibility and ownership in most processes but each process must be context specific and it can be difficult. It is important to have both groups in the room together, to get a final consensus. One example is the SDG process, which was multi-stakeholder driven and resulted in positive actions.

Figure 7: Panel Discussion between the initiatives.

Q2. How can local / regional dimension be addressed within the Water JPI activities?

UN-Water: The need for innovation is one of the early signals emerging from the SDG 6 Synthesis Report on Water and Sanitation to be presented next year at the High level Political Forum on Sustainable Development. An efficient way to include local and regional is innovating through citizen science, although this poses a challenge to the harmonisation of data.

BiodivERsA: BiodivERsA has partners that are regional and can work through advisory boards to get these regional points addressed. A specific call or action could be outlined in the Memorandum of Understanding, where the regional/local aspect can be highlighted. It can be difficult to do this systematically.

WssTP: The decision to address the local/regional dimension should be taken by the Funding Agencies.

Water JPI: The Water JPI are trying to address this within the planned additional activities. The Knowledge Hub and TAP activities should address the local / regional dimension to a certain extent. In calls, stakeholders' participation is encouraged.

BiodivERsA: The call should be framed in such a way that the region is not specified but it infers a specific region. The scope of the call should be focused but not geographically limited. The development of a transferable tool that could be used in many regions could address the local / regional dimension.

Comments & Clarifications:

- There are examples of how academics have worked together with municipalities and the society. Different municipalities could be provided opportunities to visit each other, to exchange knowledge between them. This can be achieved on a local level and but also at a higher scale.
- INTERREG is designed to provide for the local/regional dimension, be careful of the potential duplication.
- There are impacts on ecosystems which can only be evaluated on a local and regional dimension, such as identifying and protecting ecosystems more and less prone to change.

Q3. How can the involvement of the economic sector be increased?

WssTP: Water utilities are interested in participating if their specific needs are considered by the initiatives.

UN-Water: Think about why the Water JPI should involve the economic sector? Is the aim to seek additional funding or to involve the end-user? Sectors are very broad, and due to this organisations should seek out different opportunities to understand what is valuable to the economic sector by attending the world economic forum over water specific events.

BiodivERsA: The economic sector should be included as a stakeholder on the Governing Board or Advisory Board of the initiative. The Water JPI could include reference to the economic sector as part of the call. A call that aims to involve SMEs must have consideration for the variation in size of the SME, and how this can influence their ability to apply for the call. Engagement with the economic sector can be high risk yet very rewarding, and can be achieved by providing a call theme relevant to both utilities and researchers. The funding aspect can be challenging as the funders of the call can be Research and Innovation Agencies and Research Funders in the same country, for the call to succeed their needs must be aligned.

Water JPI: The interest in funding a call with the economic sector can vary depending on the topics and themes. It is important to note that some Water JPI partners cannot fund Enterprises, including SMEs. The Water JPI are currently exploring with the WssTP how the economic sector could be integrated in all activities along the Research and Innovation intervention chain. An incentive for the economic sector could be the access to labs and research communities usually not available to them. Not all research needs the involvement of the economic sector. At the project level, research from TRL 3, 4 must have a connection to it. The Water JPI aims to carry out more applied research and demonstration projects (pilot) if needed and not covered by other programmes. The Water JPI's niche is in promoting excellent science in the water field. The relevance of topics covered in the call can for the economic sector and the policy makers. It is not possible to overcome challenges related to research in the economic sector without the economic sector being involved in the process.

WssTP: If "excellent science" is a given, perhaps the Water JPI's niche should be more defined.

Comments & Clarifications:

- The involvement of stakeholders was a requirement of the 2015 Water JPI Joint Call.
- The Water JPI must find its unique identity and highlight the factors required in this need to include the economic sector without losing the scope for meaningful research to be implemented.
- The Water JPI must assess the impact generated due to the inclusion of the economic sector to determine the benefit gained.
- The Water JPI must be aware that by becoming involved with the economic sector, the JPI could run the risk of becoming a sub-contractor to the sector.
- There are topic areas where SMEs and the economic sector are very well placed, but the Water JPI should be careful not to streamline this to be the common architecture of all projects.
- The generation of patents could be an area of concern when dealing with the economic sector.

- The role of the economic sector in their involvement with the Water JPI must be well defined.

Q4. How to strengthen the global dimension of the Water JPI activities, link with other on-going initiatives and involve the economic sector?

UN-Water: There are many things to investigate including scalability, cost relations, synergies and working with existing processes, as outlined below:

- Co-designing and co-creating are important facets when working on a global level. The reduction of costs and prove effectiveness to policy makers. This can be strengthened by getting involved in fora in other sectors, which have horizontal needs in common with the water sector.
- Communication is extremely important, and it can help the organisation reach its goals. There are wonderful examples from the SRIA strategy but this is hidden and needs to be displayed more through showcase campaigns. The 2030 agenda language and the use of jargon words that are easily identifiable for policy makers should be included.
- The need to observe and learn from others: A concrete example, some low income countries are using high income countries sanitation solutions as examples of what not to do. By exchanging practices with other organisations, the reach of the Water JPI could be scaled globally.
- The reduction of costs can be achieved by developing inter-linkages between organisations, identifying trade-offs and understanding that meeting one UN SDG can be a step towards meeting the other UN SDGs.
- Stories on the Water JPI website which can resonate with the media and create interest should be displayed e.g. similar to UN-Water's stories for world toilet day.
- Advocating the message of the Water JPI better will allow people to see the bigger picture.

Water JPI: Co-design and co-creating are important to the Water JPI. For example, the JPI is in talks with the Bill & Melinda Gates Foundation, to explore the opportunity of linking with the Water JPI to fund researchers and connect researchers internationally. The Water JPI needs to identify the synergies with global partners as a step towards exploiting the opportunities to join forces.

BiodivERsA: Outreach is integral, especially the use of Ted Talks but these must be delivered by good candidates.

WssTP: The Water JPI must define what it wants to achieve and subsequently develop a strategy towards achieving this.

3.3.c. Next steps

Alice Wemaere led the final part of the workshop, a presentation on the next steps. It was explained that the presentations, programme and speaker biographies would be uploaded for the attendees and the public to view, on a dedicated page of the Water JPI website for the 2017 Exploratory Workshop. A workshop proceedings report would be drafted and feedback requested from all attendees before the report is finalised and uploaded to the 2017 Exploratory Workshop webpage. The outputs of the workshop including the RDI needs list and the top three needs identified, would be considered as part of the following activities:

- The Water JPI Vision update on key horizontal activities over the next two years.
- The Water JPI SRIA update.
- The TAP instrument dedicated to ecosystem services.
- The Water JPI Knowledge Hub which will generate knowledge, establish benchmarks and conduct horizon scanning on the topic of emerging pollutants.

- The Joint Call with relevant initiatives with the support of the EC COFUND or independent of the EC top up.

4. Conclusion

4.1. Key Conclusions

The 2017 Water JPI Exploratory Workshop was organised in close cooperation with BiodivERsA and achieved its intended objectives. The workshop provided an environment for participants to network and share knowledge, discuss views on the knowledge gaps and RDI needs in Theme 1, come to a consensus and elaborate on how these RDI needs could be addressed to link to the UN SDGs, water policy and predict impact.

The synergies between the Water JPI and BiodivERsA were evident from the beginning and the collaboration was welcomed by those in attendance as the needs of both in relation to water ecosystems overlapped considerably. A large range of RDI needs were identified in Table 2, 3 and 4 including a proposed change in subtheme name, which illustrates the breadth of research required in Theme 1 and the constant shift in needs, highlighting the advantage in updating the SRIA.

The elaboration of the prioritised needs in Annex 5, 6 and 7 was a useful exercise in understanding the extent of information required to scope a RDI need to determine the benefits and interlinkages required to implement the research. The discussion both in the breakout sessions and in the plenary sessions suggested there is an inherent need for Theme 1 RDI needs and knowledge gaps to be addressed through transdisciplinary research where the end-users and policy makers are involved from the beginning. The economic sector was deemed relevant to Theme 1 but the attendees recommended that the Water JPI's engagement must be structured and the interaction must be of benefit to both sides.

A key message from the discussions at the workshop is that there is a need for carrying out a State of the Art of the current RDI activities (past and on-going; national & international) in this Theme. This should be the first step when considering any future Joint transnational activities in this area.

4.2. Feedback from the Follow-up Survey

At the end of the workshop, a follow-up survey was circulated to gather feedback on the event from the attendees. There were twenty replies to the survey. The survey had a mix of questions regarding the quality of the event in general, the venue, the breakout sessions, and the organisation and information provided including suggestions for improvement.

Question 1: Overall, how did you find our event?

Of the 20 answers received, fourteen responded "Very Good", while six responded "Good".

Question 2: Why did you attend our event?

The following responses were collated from the 20 respondents:

- To be updated on the current SRIA and contribute to the update of the next SRIA.
- Interest in exploring future RDI needs related to SRIA theme 1.
- Interest in the workshop programme.

Question 3: Logistics

Table 5 provides a summary of the responses received to the workshop logistics.

Table 5: Feedback from the attendees on the workshop logistics.

How would you rate the following?	Very Good	Good	OK	Not So Good	Not Satisfactory
Venue	13	5	2		
Programme	12	8			
Speakers (Plenary Session)	12	8			
Speakers (Breakout Sessions)	13	7			
Panel Discussion	8	6	5	1	
Split between Talks & Discussion	8	10	1		1
Information provided	15	3	2		
Help & Support on the day	16	4			

The following additional feedback was also provided:

- There was a lot covered in a short period which was commendable.
- This was a well organised and valuable event, with good logistical support.
- The programme was balanced well between the plenary and breakout sessions.
- The presentations should be shorter and more interactive, with a greater focus on the workshop purpose.
- The Chairs did a good job in moderating the discussion, although it was felt more guidance on the structure of the session would be useful.
- The breakout sessions were well prepared beforehand and produced good outputs.
- The discussion was too orientated around the topics of the presentations, resulting in some issues not being addressed.

Question 4: What could be improved?

Some of the feedback included:

- The RDI needs identified as well as those prioritised, should be considered as part of the SRIA update.

- There should be a better balance in representation from all the Water JPI member countries.
- The workshop should involve more end-users, in particular private companies.
- The provision of a workshop dinner for all attendees would be a useful opportunity for all to network.
- There should be more time allocated for discussion.
- The plenary session-3 feedback on breakout sessions, could be improved by a better focus on the main message of the workshop.
- The panel discussion was not relevant for the workshop.
- The use of design thinking methods should be considered as an element of the next workshop to enable researchers to think beyond their own area of expertise.
- A presentation on the future situation of the Water JPI would be welcome.

Question 5: Any suggestions on raising awareness?

Seventeen respondents were aware of the activities of the Water JPI before the workshop, while the remaining three had no knowledge of the Water JPI.

The following suggestions were made regarding how to raise the awareness of the Water JPI:

- The Water JPI should improve its communication outside of the Water JPI to increase awareness.
- The provision of 'bring home messages' for the workshop would ensure the workshop has an improved impact level.
- Information on forthcoming Water JPI events should be provided.
- The Water JPI should continue to share information with the researchers on call opportunities and the progress of on-going projects.
- A presentation should be provided on the results to date of Water JPI funded projects.
- Links should be established with the common implementation working groups at the EU level.
- The Water JPI should continue its efforts in influencing science policy.
- The links between the Water JPI and other initiatives should be explained further.
- A specific agenda setting meeting related to the Water JPI SRIA should be organised at a national level.

4.3. Summary of Lessons Learned

The lessons learned from the workshop vary in terms of representatives attending to improving the focus of the workshop, and developing a clear focus on the vision of the Water JPI. The funding partners of the Water JPI countries could be more active in nominating national experts to attend the workshop ensuring that a broad range of experts from academia, industry, non-governmental organisations, and the economic sector are represented. The Water JPI will prioritise the need to communicate more readily with relevant stakeholders and increase the exposure of the JPI, while ensuring the Water JPI defines its niche.

The results of the survey indicated that the event was well received and provided recommendations for improvement in Water JPI communication activities, the spread of experts invited and the panel discussion. The response rate to the hard copy survey was 44%, an increase of 30% on the 2016 survey, which suggests attendees prefer to provide their views at the workshop than in an online survey afterwards.

The output of these proceedings and the conclusions will be included in the SRIA update, the preparation for the call with BiodivERsA, and the progression of TAP and Knowledge Hub activities to facilitate knowledge exchange between researchers.

Annex 1: Water JPI Theme 1
(Extract from the SRIA)

The Water JPI SRIA Theme 1 comprises three subthemes:

- Subtheme 1.1. Developing Approaches for Assessing and Optimising the Value of Ecosystem Services;
- Subtheme 1.2. Developing and Applying Ecological Engineering and Eco-hydrology;
- Subtheme 1.3. Managing the Effects of Hydro-climatic Extreme Events.

Subtheme 1.1. Developing Approaches for Assessing and Optimising the Value of Ecosystem Services

1.1.1. Developing approaches for assessing the ecological functioning of ecosystems o Understanding and quantifying the ecological functioning of ecosystems

1.1.1.-Objective.a. Developing an ecosystem services multi-scale approach based on this better understanding and quantification of the ecological functioning of ecosystems.

1.1.1.-Objective.b. Developing indicators and other monitoring schemes regarding the good functioning of aquatic ecosystems in support of the WFD, the Floods Directive and international policies/strategies (e.g. MDGs). Developing the next generation of monitoring schemes and indicators of the good functioning of aquatic and riparian ecosystems. Developing new bio-assessment tools and validation methodologies. o Understanding the role of biodiversity as a driver of ecosystem resilience.

1.1.1.-Objective.c. Assessing the role of aquatic ecosystems in the global biogeochemical cycle.

1.1.1.-Objective.d. Developing mechanistic models for the forecasting and evaluation of changes in ecosystems in response to water management measures.

1.1.2. Developing and testing methodologies for the valuation of ecosystems services (link with 5.2.2)

1.1.2.-Objective.a. o Developing and applying harmonised databases and new methodologies for assessing and mapping the social, economic and environmental value of water ecosystem services.

1.1.2.-Objective.b. o Evaluating methodologies for the valuation and monitoring of ecosystem services and for predicting the impacts of water management measures on ecosystem functioning through full-scale test cases.

1.1.3. Establishing multiple pressure–impact–response relationships in aquatic, riparian and groundwater-dependent ecosystems

1.1.3.-Objective.a. Developing a better understanding of the effects of hydromorphological pressures (damming, embankment, channelling, non-natural water-level fluctuations) on the structure and functioning of aquatic and riparian ecosystems (link with 1.2.1).

1.1.3.-Objective.b. Quantifying the effects of pollution on biological communities. In this regard, it is necessary to further analyse the links between ecotoxicological tools and biological assessment tools based upon the structure of biological communities.

1.1.3.-Objective.c. Assessing the vulnerability of ecosystems to pressure factors.

1.1.3.-Objective.d. Supporting experimental research (e.g. microcosms) to quantify multiple impacts on ecosystems.

1.1.3.-Objective.e. Understanding the resilience of ecosystems to multiple pressures.

1.1.3.-Objective.f. Assessing risks related to multiple pressures on ecosystems and developing innovative risk management approaches.

1.1.3.-Objective.g. Improving knowledge of the direct and indirect effects of climate change and climate change adaptation strategies.

1.1.4. Integrating ecosystem services into management of water resources

1.1.4.-Objective.a. o Developing meta-ecosystem services by overcoming the existing fragmentation of responsibilities and the dispersion of knowledge between disciplines. o Developing innovative water management schemes. o Developing a better understanding of the barriers to policy application and implementation in terms of ecosystem services.

1.1.4.-Objective.b. o Adopting an ecosystem services approach to the roles of agriculture, forestry and aquaculture to allow for careful planning in the use of water resources while addressing the needs of local users. A comprehensive monetary and social evaluation of all secondary services provided by all agents is required. 1.1.5. Adapting and integrating our water/ecosystem management, planning and governance systems with better environmental data and information (link with 5.2.3)

1.1.4.-Objective.c. o Aligning the monitoring and reporting frameworks through ecosystem approaches.

1.1.4.-Objective.d. o Developing new integrated systems for in situ and remote sensing data collection seamlessly coupled with mechanistic modelling that is open to stakeholders' and citizens' involvement in data collection and water management processes.

Subtheme 1.2. Developing and Applying Ecological Engineering and Eco-hydrology

1.2.1. Restoring morphology continuity and hydraulic connectivity

1.2.1.-Objective.a. Developing hydromorphology options to understand the processes and dynamics of sediment transport, hydraulic connectivity, flow regimes and fish migration within river systems (link with 1.1.3).

1.2.1.-Objective.b. Overcoming difficulties (in particular resilience and stability) in assessing ecological status in temporary streams.

1.2.1.-Objective.c. Understanding the processes and dynamics of sediment transport, hydraulic connectivity, flow regimes and fish migration within river systems (link with 1.1.3).

1.2.1.-Objective.d. Developing methodologies to assess the impacts of restoring good hydromorphological status through, inter alia, reconnecting aquatic systems. Understanding the underlying remobilisation, phase transfer, availability and transport of contaminants in sediments, particularly under extreme conditions.

1.2.1.-Objective.e. Studying the linkage between the terrestrial parts of a catchment and the aquatic ecosystem, including wetlands and peatlands.

1.2.1.-Objective.f. Analysing the linkage between upstream and downstream areas, the role and functional importance of floodplain/lateral connectivity and channel dynamics, and the interaction between groundwater and the hyporheic zone (e.g. analysing hydrochemical and microbial dynamics along flow lines – surface water and groundwater).

1.2.1.-Objective.g. Improving knowledge of the quantity and quality of matter flowing across the various reactive zones between soil–plant systems and the different water bodies (vadose zone, capillary fringe, hyporheic zone and coastal zone).

1.2.2. Managing the risks caused by invasive species and options for remediation

1.2.2.-Objective.a. Understanding the impacts of alien species on river balance, notably on water quality (dilution capacity, nutrient cycles and chemistry of the biomass).

1.2.2.-Objective.b. Developing techniques for the long-term removal of alien species and for the restoration of infested river bed material (gravel, pebbles) with minimum impact on river ecology.

1.2.3. Understanding and managing ecological flows

1.2.3.-Objective.a. Quantifying ecological flows in order to enable the good functioning of ecosystems while ensuring the availability of water for different uses. Estimating ecological (or environmental) flows for different habitats for fauna and flora.

1.2.3.-Objective.b. Improving the theoretical background to quantify the effects of different flow regimes on ecosystems using hydraulic, hydrological and ecological data and models. 1.2.4.

1.2.4. Integrated eco- technological solutions for the remediation and mitigation of degraded water bodies and aquatic ecosystems

1.2.4.-Objective.a. Developing systems-based approaches – including socio-economic aspects – for the identification of existing or innovative cost-effective measures to restore or design sustainable ecosystems.

1.2.4.-Objective.b. New green infrastructure, nature-based solutions and ecological engineering methods for cleaning up lakes, streams, inner waters, etc.

1.2.4.-Objective.c. Understanding the techniques and approaches, including modelling tools, that can be efficiently used to maintain and improve the ecological potential of heavily modified water bodies, that is, those defined as being subject to several concurrent pressure factors.

Subtheme 1.3.: Managing the Effects of Hydro-climatic Extreme Events

1.3.1. Understanding the causes of drought/scarcity, predicting drought events and water scarcity and developing adaptation measures

1.3.1.-Objective.a. Diagnosing the causes of water scarcity in Europe, and forecasting the incidence of drought events under climate change scenarios. Studies at the regional scale will be favoured.

1.3.1.-Objective.b. Developing management strategies focusing on cost–benefit analyses of agricultural evapotranspiration versus water conservation for alternative hydrological uses.

1.3.2. Developing innovative (or improved) tools for adaptation to hydro-climatic extreme events, especially floods (link with 2.2.1)

1.3.2.-Objective.a. Developing innovative tools (such as EWSs) for adaptation to extreme events, including sensor technology and monitoring networks.

1.3.2.-Objective.b. Improving EWSs for the forecasting of flooding and the assessment of associated risks. o Implementing trans-national strategies on flood event management and recovery (for trans-boundary catchments).

1.3.3. Improving water management to mitigate the harmful impacts of extreme events (extreme weather events, impaired water quality) (link with 2.2.1)

1.3.3.-Objective.a. Diagnosing droughts, floods and impaired water quality as a result of climate change. Developing people-centred monitoring and EWSs, including both expert and local knowledge. Relevant

questions include: Is local knowledge concerning hazards and impacts reliable enough? What are the main limitations of local knowledge regarding natural phenomena? How can we overcome these limitations? How can we improve the integration of local and scientific knowledge? How can we deal with the different time and spatial scales?

1.3.3.-Objective.b. Setting up risk management strategies taking into account socio-economic needs, environmental dynamics/risks and land use in areas vulnerable to droughts and floods. Key stakeholders should be involved in setting up such strategies.

1.3.3.-Objective.c. Maximising the reliability of projections of precipitation on various spatial scales and timescales.

1.3.3.-Objective.d. Improving the historical database of past events to establish the risk of future events in response to the effects of climate change.

1.3.3.-Objective.e. Improving the short- to medium-term forecasting of extreme events.

1.3.3.-Objective.f. Preparing strategies for improving the handling of extreme weather events through the collection and analysis of post-disaster data (including practices/measures).

1.3.3.-Objective.g. Developing integrated modelling across surface water and groundwater, coastal and fluvial systems, hydrological and meteorology, water and sediment transport.

1.3.3.-Objective.h. Improving existing hydrodynamic models, coupled with the development of a monitoring scheme adapted for aquifers, in order to improve the quantitative management of the resource.

1.3.3.-Objective.i. Assessing the role of aquatic systems in nutrient and carbon fluxes and other global biochemical cycles in response to climate change and extreme events.

Annex 2: List of Attendees

First Name	Last Name	Organisation	Country
Natacha	Amorsi	EURO-INBO	France
Per	Backe-Hansen	Research Council of Norway (RCN)	Norway
Jose María	Bodoque	Universidad de Castilla-La Mancha	Spain
Sandra	Boekhold	National Institute for Public Health and Environment (RIVM)	Netherlands
Daniella	Bostrom Couffe	UN-Water	Switzerland
Celine	Casenave	Institut National de la Recherche (INRA)	France
Matt	Crowe	Environmental Protection Agency	Ireland
Dominique	Darmendrail	Water JPI Coordinator / Agence Nationale de la Recherche (ANR)	France
Esther	Diez-Cebolloro	IRSTEA	France
Nathalie	Dörfliger	BRGM / Allenvi	France
Hugh	Feeley	Environmental Protection Agency	Ireland
Marco	Ferraris	ENEA	Italy
Nikolai	Friberg	Norwegian Institute for Water Research	Norway
Miguel A	Gilarranz	Spanish State Research Agency (AEI / MINECO)	Spain
Lena	Goldkuhl	Lulea University of Technology / WssTP	Sweden
Carlos Mario	Gómez Gómez	University of Alcalá	Spain
Harri	Hautala	Academy of Finland	Finland
Maurice	Heral	Water JPI Chair / Agence Nationale de la Recherche (ANR)	France
Herman	Helness	SINTEF	Norway
Daniel	Hering	University of Duisburg-Essen	Germany
Richard	Johnson	Swedish University of Agricultural Sciences	Sweden
Jörgen	Johnsson	University of Gothenburg	Sweden
Martin	Kainz	WasserCluster Lunz	Austria
Margaret	Keegan	Environmental Protection Agency	Ireland
Mary	Kelly-Quinn	University College Dublin	Ireland
Jussi	Kukkonen	University of Jyväskylä	Finland
Jaap	Kwadijk	Deltares	Netherlands
Henrik	Lange	Swedish Environmental Protection Agency / BiodivERsA	Sweden
Padraic	Larkin	Water JPI Co-Chair	Ireland

Cecilia	Lindblad	Swedish Environmental Protection Agency	Sweden
Antonio	Lo Porto	EURAQUA / IRSA-CNR	Italy
Frances	Lucy	Sligo IT	Ireland
Áine	Murphy	Environmental Protection Agency	Ireland
David	Murphy	AquaTT	Ireland
Amy	Oen	Norwegian Geotechnical Institute	Norway
Geir Inge	Orderud	Norwegian Institute for Urban and Regional Research, Oslo and Akershus University College of Applied Sciences	Norway
Jeremy	Piggott	Trinity College Dublin	Ireland
Maria-Helena	Ramos	IRSTEA	France
Jens Christian	Refsgaard	Geological Survey of Denmark and Greenland (GEUS)	Denmark
Andrea	Rubini	WssTP	Belgium
David	Schwesig	IWW Water Centre	Germany
Teppo	Vehanen	EIFAAC	Finland
Jan	Vermaat	NMBU	Norway
Alice	Wemaere	Environmental Protection Agency	Ireland

Annex 3: Programme

2nd November 2017 Workshop Programme

2.30pm: Welcome Matt Crowe (Environmental Protection Agency (EPA), Ireland)

Plenary Session-1

Chaired by: Matt Crowe (EPA, Ireland)

2.35pm: General Introduction on the Water JPI & Strategic Research & Innovation Agenda
Dominique Darmendrail (Water JPI Coordinator, France)

2.40pm: Scientific Insights on the key RDI challenges in the broad thematic area of the Water JPI SRIA Theme 1
Seppo Rekolainen (Ministry of Agriculture and Forestry, Finland)

2.50pm: Policy Perspective on the Water JPI SRIA RDI needs within Theme 1
Daniella Bostrom Couffe (UN-WATER, Switzerland)

3.05pm: BiodivERsA: Synergies
Henrik Lange (BiodivERsA, Sweden)

3.15pm: End-Users / Economic Insights on the key RDI challenges in the broad thematic area of the Water JPI SRIA Theme 1
Teppo Vehanen (EIFAAC, Finland)

3.25pm: Questions & Answers

Breakout Sessions-1 (4pm – 5.45pm)

Breakout Session-1: Developing Approaches for Assessing and Optimising the Value of Ecosystem Services[2]

Chaired by: Natacha Amorsi (EURO-INBO, France)
Rapporteur: Alice Wemaere (EPA, Ireland)

4.00pm: Multiple stressor impacts on European surface waters: A synthesis resulting from the MARS project
Daniel Hering (University of Duisburg-Essen, Germany)

4.15pm: DESSIN - Demonstrate Ecosystem Services Enabling Innovation in the Water Sector
David Schwesig (IWW Water Centre, Germany)

4.30pm: Questions & Answers

4.40pm: Group discussions moderated by the Chair on the assessment of RDI gaps within this area (using the Water JPI SRIA as the basis)

Breakout Session-2: Developing and Applying Ecological Engineering and Eco-hydrology[3]

Chaired by: Andrea Rubini (WssTP, Belgium)
Rapporteur: Margaret Keegan (EPA, Ireland)

[2] Water JPI SRIA Subthemes 1.1.
[3] Water JPI SRIA Subthemes 1.2.

4.00pm: Insights from SalmoInvade: policy recommendations based on biological and social findings

Jörgen Johnsson (University of Gothenburg, Sweden)

4.15pm: WssTP Working Group on Eco-System Services

Lena Goldkuhl (WssTP, Sweden)

4.30pm: Questions & Answers

4.40pm: Group discussions moderated by the Chair on the assessment of RDI gaps within this area (using the Water JPI SRIA as the basis)

Breakout Session-3: Managing the Effects of Hydro-climatic Extreme Events[4]

Chaired by: Jens Christian Refsgaard (Geological Survey of Denmark and Greenland, Denmark)
Rapporteur: Áine Murphy (EPA, Ireland)

4.00pm: Overview of IMPREX - IMproving Predictions and management of hydrological EXtremes

Maria-Helena Ramos (IRSTEA, France)

4.15pm: LIMNOTIP - Biodiversity dynamics and tipping points in our future freshwater ecosystems

Martin Kainz (WasserCluster Lunz, Austria)

4.30pm: Questions & Answers

4.40pm: Group discussions moderated by the Chair on the assessment of RDI gaps within this area (using the Water JPI SRIA as the basis)

Plenary Session-2

Chaired by: Padraic Larkin (Water JPI Co-Chair, Ireland)

6pm: All attendees to review the list of RDI needs from the three breakout sessions and identify their top three priorities (via stickers)

6.45pm: Close of Day 1 of the Workshop

[4] Water JPI SRIA Subthemes 1.3.

3rd November 2017 Workshop Programme

Breakout Sessions-2 (8.30am – 10am)

Session-1	Session-2	Session-3
Subtheme 1.1	*Subtheme 1.2*	*Subtheme 1.3*
Developing Approaches for Assessing and Optimising the Value of Ecosystem Services	Developing and Applying Ecological Engineering and Eco-hydrology	Managing the Effects of Hydro-climatic Extreme Events

Plenary Session-3

Chaired by: Padraic Larkin (Water JPI Co-Chair, Ireland)
Moderator: David Murphy (AquaTT, Ireland)

10.30am: Rapporteur's Summaries (5 minutes) & Discussion (All)

- *RDI needs identified from breakout session*
- *Top 3 RDI needs*
- *How the subjects of the three breakout sessions could be considered together?*
- *How to strengthen the Global dimension?*

12pm: Panel Discussion

Water JPI (Dominique Darmendrail), UN Water (Daniella Bostrom Couffe), BiodivERsA (Henrik Lange) & WssTP (Lena Goldkuhl)

12.50pm: Next Steps — Alice Wemaere (EPA, Ireland)

1pm: Close of the Workshop

Annex 4: Short Biographies of Speakers

Daniella Bostrom Couffe

Daniella Bostrom Couffe is UN-Water's Communications Manager. She has over ten years of international experience in strategic communications, public information, public relations and marketing. Before joining UN-Water, she was in charge of communications, media and institutional work at the World Water Council. She has also worked with international research projects and in corporate and healthcare sectors. Daniella has a B.A. in strategic communications and an M.A in media and cultural studies.

Dominique Darmendrail

On obtaining her Doctorate (Hydrogeology/Hydrogeochemistry), Dominique Darmendrail began her professional career as a consulting engineer in water and environmental studies, specialising in identification, pollution diagnosis, risk assessment and remediation, the impact of subsurface activities on the environment (waste dumps, operating and abandoned industrial sites), and the inventory of new water resources. From September 2008 to August 2017, she was the secretary general of the Common Forum on Contaminated Land in Europe (www.commonforum.eu), European network of contaminated land policy experts and advisors created in 1994. She is also organising the meetings of the International Committee on Contaminated Land (www.iccl.ch).

Since July 2014, she became programme manager of Environmental technologies at the French Research Agency (ANR). Since November 2014, she is the Coordinator of the EU Water Joint Programming Initiative (www.waterjpi.eu) which aims to increase coordination in European research, development and innovation (RDI), and address issues such as user participation, attaining targets in the coordinated use of funds and progress in the integration of RDI agendas and activities.

Henrik Lange

Henrik Lange, Ph.D., has an educational background in Zoology (M.Sc.) and Ethology (Ph.D. 2003). During his professional career, he worked as a researcher and university teacher for several years in Sweden, Finland and the United Kingdom. His research focused on different aspects of behaviour, population ecology and neurophysiology of birds. From 2010-2014, he was employed by the Swedish Research Council Formas, working with research funding (focus on the natural environment) at national and European level. From 2010-2012, he also worked part-time on a Governmental Commission of Inquiry into the population goals and management of large carnivores in Sweden. From 2014 to early 2017, he was the national Research Coordinator at the Ministry of Environment and Energy, representing Sweden in the Programme Committee for Environment under Horizon 2020.

Since June 2017 he is employed by the Swedish EPA, responsible for the scientific knowledge base for the national implementation of the EU directive on Invasive Alien Species. He joined BiodivERsA in 2010 as Work Package leader and has been a member of the Coordination Team since 2014.

Seppo Rekolainen

Seppo Rekolainen has a PhD from the University of Helsinki. He worked for a long time at the Finnish Environment Institute being responsible for research and development of water resources and water pollution. His present position is at the Ministry of Agriculture and Forestry, where he is responsible for international water co-operation, both bilateral and multilateral.

Teppo Vehanen

Teppo Vehanen is the chairperson of the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), Technical and Scientific Committee. He works as senior researcher at the Natural Resources Institute Finland. He received his Diploma (M.Sc.), Doctorate (Ph.D.) and Docenture in Fish Biology from the University of Oulu, Finland. In 2008 he accomplished a Diploma in Environmental Economics from the University of Helsinki. He has 25 years of experience in the blue bio-economy, especially from the fish and fishery issues. He is author of more than 40 peer reviewed scientific publications and numerous other publications. Currently he is also working on several international duties in Europe.

Lena Goldkuhl

Lena Goldkuhl is an engineer with a PhD in Marketing. Goldkuhl's research focuses on the development of, and transition to, planning processes for more sustainable stormwater systems. Her research especially focuses on how to involve all relevant water actors already at the beginning of the planning process, and the identification of key factors needed to achieve this, in order to increase the use of green/blue infrastructure. Her research is mainly action research based, and is conducted in trans-disciplinary collaborations, including practitioners. Goldkuhl is also leader of the WssTP Working Group "Ecosystem Services".

Daniel Hering

Daniel Hering studied Biology at the University of Marburg (Germany). His PhD thesis was about land-water interactions in alpine floodplains. After a postdoc at the US Forest Service (Corvallis, Oregon), he started to work at the University of Duisburg-Essen (Germany), where he is currently employed as a professor of Aquatic Ecology. He has been deeply involved in the development and inter-calibration of ecological assessment systems for the European WFD. He coordinated the FP5 project AQEM and the FP7 projects WISER and MARS. His current research focus is on river restoration and the impact of multiple stressor on European surface waters. He has (co)authored more than 100 scientific papers.

Jörgen Johnsson

Jörgen Johnsson completed his PhD-thesis at the Department of Zoology at Gothenburg University (UGOT) in 1992 and became associate professor at the same department in 1996. Since 2005, he is full professor of the Department of Biological and Environmental Sciences, UGOT. He is also member of the Board of Faculty of Science at UGOT. Professor Johnsson´s main expertise is in behavioural and evolutionary ecology with a multidisciplinary approach, also including social sciences. His research is characterised by a strong interaction of basic and applied aspects often using salmonid fish as model species. He has published more than 100 peer-reviewed research papers and about 20 book chapters, popular science articles and reports. Professor Johnsson´s research projects have been awarded numerous grants from national and international funding sources. He has about 30 years´ experience of research conducted in collaboration with a network including researchers from Canada, China, Czech Republic, Denmark, France, Germany, United Kingdom, Norway, Spain, Sweden and USA. His research has frequently been used by authorities to guide fishery management and environmental conservation in Sweden, EU, North America and Asia. He has been invited as an expert to inform Swedish and international authorities on biological risks associated with escapes and releases of transgenic and domesticated salmonids, including the Swedish Gene Technology Advisory Board, the Swedish GMO authorities, the United States Department of Agriculture (USDA), the European Food Safety Association (EFSA), and the Atlantic Salmon Trust (AST).

Professor Johnsson is presently finalising the policy recommendations from the recently finished BiodivERsA-project SalmoInvade.

Martin Kainz

Martin Kainz obtained his PhD (2001) in ecotoxicology and environmental sciences at the Université du Québec à Montréal, Canada, followed by post-docs at the University of Victoria, BC, and the Canadian National Water Research Institute, Burlington, Ontario. Since 2006, he works as head of the working group LIPTOX at the inter-university centre for aquatic ecosystem research WasserCluster Lunz, Austria. His current research is in aquatic ecology, in particular nutritional quality of aquatic resources, development of invertebrates and fishes, production and trophic transfer of lipids/fatty acids and their stable isotopes, and climate change effects on aquatic food webs. Martin conducts research in lakes, streams, and aquaculture, and also in experimental units such as micro- and mesocosms. He is actively involved in several international research networks, such as the Global Lake Ecological Observatory Network (GLEON) and the Alpine Limnology Network (LimnoAlp) in Europe. He teaches trophic ecology, aquatic ecotoxicology, and scientific working and writing at the University of Vienna, Danube University Krems, Austria, and Tongji University in Shanghai, China. Martin currently serves as an editorial member of two journals: *Inland Waters* and *Advances in Limnology and Oceanography*, and is president of the Austrian Limnological Society.

Maria-Helena Ramos

Dr. Maria-Helena Ramos is a researcher in hydrology and hydrometeorology at IRSTEA (National Research Institute of Science and Technology for Environment and Agriculture), in France, since 2007. She has broad experience in flood forecasting, hydrometeorological risk reduction, uncertainty quantification and communication. She has supervised over 20 MSc/PhD students and has participated in national and international projects, including national SCHAPI-MEDDE programs on flood forecasting, DG JRC EFAS Project on the European Flood Awareness System, FP7 XEROCHORE project on research needs and policy choices on drought, and FP7 COMPLEX project on climate-related renewable energies. She was also the coordinator for IRSTEA in the Interreg IVB DROP project on drought governance and adaptation to climate change and is currently WP leader in the H2020 IMPREX project on improving predictions of hydrometeorological extremes. In May 2017, she was deployed as an Environmental Expert in a Support Mission from DG ECHO for the United Nations Disaster Assessment and Coordination for Flooding Assessment in Peru. Since June 2014, she is co-chair of the international initiative HEPEX (Hydrologic Ensemble Prediction Experiment) and, since 2015, chair of the Hydrological Forecasting Sub-division of the Division on Hydrological Sciences of the European Geosciences Union (EGU). Dr. Ramos is also an occasional lecturer on hydrology at engineering schools and Masters programs in Paris. She is the author of over 65 publications and is currently guest editor for the HESS open-access journal.

David Schwesig

David received a Diploma in Environmental Sciences from University of Bayreuth (Germany) in 1998 and completed his PhD in 2001 on “Biogeochemistry of organomercury compounds in forested watersheds” at the Bayreuth Institute for Terrestrial Ecosystem Research. Since 2002 he has been working with IWW Water Centre in Germany, an applied research institute covering all issues relevant for the drinking water sector e.g., water resources management, water treatment technologies, analytical water quality control, water distribution networks, asset management, applied microbiology and water economics. From 2002 until 2009 David was responsible for an analytical department within the water quality control unit of IWW, and carried out a number of applied research projects on the environmental fate of trace metals, analytical quality control and method validation.

Since 2009 David is a Research Co-ordinator of IWW Water Centre. He supports the management board in development and implementation of the research and innovation strategy of the institute, and represents IWW in European networks such as NORMAN (www.norman-network.net) and the Aqua Research Collaboration (www.arc-online.eu). He has coordinated a couple of large scale collaborative water-related projects on a national and European scale, e.g. the FP7 funded projects TRUST (“Transitions to the urban water services of tomorrow” and DESSIN (“Demonstrating that ecosystem services are enabling innovation in the water sector), and is currently a member of the H2020 projects BINGO (“Bringing innovation to ongoing water management) and STOP-IT (“Strategic, tactical, operational protection of water infrastructure against cyber-physical threats”).

Annex 5: Harmonising approaches for assessing and enhancing Ecosystem services as a tool to inform policy

Key Research Need 1-1

Linking the measures to their effects on the ecosystem and to their societal impacts

Challenge, Scope & Key Objectives

Challenge:

Ecosystems are complex
Understand how the measures impact on ecosystem structures, functions and services
Focus and deliver information on what is important to society (of benefits to society well-being) – inform policy/decision-making
Integrating knowledge (trans-disciplinary approach)

Scope:

Linking the measures to their effects on the ecosystem and to their societal impacts
Scale (spatial & temporal), Stakeholders
Measures which are part of the Programme of Measures
What are the measures addressing: Existing or emerging pressures?

Top 4 Objectives:

1. Quantify & Qualify relations between measures and ecosystem services
2. Integrating knowledge (trans-disciplinary approach)
3. Metrics to communicate the changes & translating results to key stakeholders, including planners & policy makers
4. Informing choices and decision-making

Top 3 Expected Impacts

☒Social ☐Economic ☐Technological ☒Environmental ☒Policy	Better informed policy & practices leading to Environmental improvements resulting in benefits to society Selecting better / Improving measures

End-Users Needs

Inform policy & planners, improve decision process, restoration, analyse current practices

Policy Relevance

Better informed policy

Type of Instrument

Tick relevant boxes below

☒Research project Research & Innovation Action (i.e. transnational R&I project)
☐Networking activities (e.g. COST action, Knowledge Hub, TAP, etc.)

☐Research Infrastructure
☐Other (please specify)

Type of TRLs targeted

Tick relevant boxes below

☒**TRL 1** – **3** basic principles observed to experimental proof of concept
☒**TRL 4** –**6** technology validated in lab to – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
☐**TRL 7** –**9** system prototype demonstration in operational environment to actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

RDI Needs for Theme 1:

Tick relevant boxes below

☒1.1.1: Developing approaches for assessing the ecological functioning of ecosystems
☐1.1.2: Developing and testing methodologies for the valuation of ecosystems services
☐1.1.3: Establishing multiple pressure–impact–response relationships in aquatic, riparian and groundwater-dependent ecosystems
☒1.1.4: Integrating ecosystem services into management of water resources
☐1.1.5: Adapting and integrating our water/ecosystem management, planning
and governance systems with better environmental data and information
☐1.2.1: Restoring morphology continuity and hydraulic connectivity
☐1.2.2: Managing the risks caused by invasive species and options for remediation
☐1.2.3: Understanding and managing ecological flows
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extreme events, especially floods
☐1.3.3: Improving water management to mitigate the harmful impacts of extreme
events (extreme weather events, impaired water quality)

Relevant UN SDGs:

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Key Research Need 1-2

Quantifying & linking ecological & social resilience of ecosystems

Challenge, Scope & Key Objectives

Challenge:

Deepening the understanding of the resilience of ecosystem services
Resilience from a societal point of view
Adaptability of policy to an unpredictable future

Scope:

Scale (spatial & temporal), Stakeholders
Metrics to measure the resilience
Pressures: resilience to what?

Top 4 Objectives:

1. Informing choices and decision-making
2. Aid in valuing ecosystem services
3. Improving our understanding of & managing for uncertainties
4. Robust policies, adaptable planning

Top 3 Expected Impacts

☒Social ☐Economic ☐Technological ☒Environmental ☒Policy	*Better informed policy & practices leading to Environmental improvements resulting in benefits to society* *Coordinated water policies with Climate adaptation policies* *Technological impact* *Better understanding of biodiversity*

End-Users Needs

Inform policy & planners, improve decision process, restoration, analyse current practices

Policy Relevance

Coordinated water policies with Climate adaptation policies

Type of Instrument

Tick relevant boxes below

☒Research project Research & Innovation Action (i.e. transnational R&I project)

☐Networking activities (e.g. COST action, Knowledge Hub, TAP, etc.)

☐Research Infrastructure

☐Other (please specify)

Type of TRLs targeted

Tick relevant boxes below

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Key Research Need 1-3

Framework and methods for assessing ecosystem services

Challenge, Scope & Key Objectives

Challenge:
State of the Art,
Harmonising the different approaches
Mainstreaming the use of Ecosystem services – bringing them into practice

Scope:
Standard approaches to quantify Ecosystem Services (standardised methodology)
Improving the ecosystem to have better ecosystem services
Society well-being, informing innovative policies, ecosystem-based management/nature-based solutions (how do you assess NBS contributions to ESS)

Top 3 Objectives:

1. Informing practical applications
2. Improve comparability
3. Aid in valuing ecosystem services
4. Improving our understanding of & managing for uncertainties

Top 3 Expected Impacts

☒Social ☐Economic ☒Technological ☒Environmental ☒Policy	Better informed policy & practices leading to Environmental improvements resulting in benefits to society Technological impact Better understanding of biodiversity

End-Users Needs

Inform policy & planners, improve decision process, restoration, analyse current practices

Policy Relevance

Robust policies, adaptable planning
Coordinated water policies with Climate adaptation policies
WFD 2.0, Payments for Ecosystem services

Type of Instrument

Tick relevant boxes below
☒Research project Research & Innovation Action (i.e. transnational R&I project)
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☐Research Infrastructure
☐Other (please specify)

Type of TRLs targeted

Tick relevant boxes below

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Annex 6: Developing and Applying Ecological Engineering and Eco-hydrology

Key Research Need 2-1

Water related Urban Infrastructure and associated Ecosystems

Challenge, Scope & Key Objectives

Challenge:

1. Economic and ecologic evaluation of ESS from Urban Green/Blue Infrastructure, e.g.,
   - Flood protection,
   - Water quantity and then quality,
   - Recreation,
   - Biodiversity
   - CO_2 retention in stormwater pond sediments
2. Tradeoffs/conflicts between ESS and Urban Green/Blue Infrastructure, e.g.,
   - Stormwater ponds are serving as biotope for different species, while at the same time being a treatment facility;
   - How species in stormwater ponds are affected by pollutants;
   - How to perform maintenance without affecting biotope
   - Aesthetics vs. functionality
3. The identification of key factors needed to increase the use of urban green/blue infrastructure, e.g. How to achieve a planning process that involves all relevant water actors.

Scope:

It will involve a multi-sectoral process to include planners, engineers, ecologists, hydrologists to address the challenges

Top 3 Objectives:

1. To manage water in a more sustainable way in urban area to have a more resilient water system
2. To better understand the role and cost effectiveness of Blue/Green infrastructure with ecosystem services
3. Support the capacity of the overall water system in urban areas

Top 3 Expected Impacts

☒Social ☒Economic ☒Technological ☒Environmental ☒Policy	All expected impacts Highlight biodiversity – Re-Greening the city

Annex 7: Managing the Effects of Hydro-climatic Extreme Events

Key Research Need 3-1

Extreme hydroclimatic events, governance and catchment management

Challenge, Scope & Key Objectives

Challenge:
Decision-makers and stakeholders who are effected by hydroclimatic events struggle to make use of the knowledge available
Do not know how to deal with the uncertainties (natural and social systems)

Scope:
Multi-hazards including floods and droughts

Top 3 Objectives:

1. To understand processes of transformative and social learning
2. Balancing top-down and bottom-up governance
3. Bridging local and global knowledge

Top 3 Expected Impacts

☒Social ☐Economic ☐Technological ☒Environmental ☒Policy	In order of importance: Social (1), Policy (2), Environmental (3) Identifying and resolving the bottlenecks to implement the research The extreme events will be better managed to reduce the disruption to society

End-Users Needs

To increase the active involvement of stakeholders to improve the governance of handling extreme events

Policy Relevance

How this would affect the development / change to…

Type of Instrument

Tick relevant boxes below

☒Research project Research & Innovation Action (i.e. transnational R&I project)

☒Networking activities (e.g. COST action, Knowledge Hub, TAP, etc.)

☐Research Infrastructure

☐Other (please specify)

Type of TRLs targeted

Tick relevant boxes below

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Key Research Need 3-2

Key Research Need Title

Multi-risk approach to dealing with extreme events

Challenge, Scope & Key Objectives

Challenge:
You have traditionally analysed / addressed risks and costs one-by-one, not considering interlinkages of multiple risks which have led to non-optimal solutions

Scope:
Extreme events related to the response of ecosystems

Top 2 Objectives:

1. Understand the linkages between the multi-cascade processes and assess the magnitude of their response
2. Assess the related costs of these multi-cascade processes including valuation

Top 3 Expected Impacts

☐Social ☒Economic ☐Technological ☒Environmental ☒Policy	In order of importance: Environmental (1), Economic (2), Policy (3)

End-Users Needs

To avoid non-optimal decisions

Policy Relevance

Decisions and policies can communicate better across risk sectors and strategies will be more integrated with the solutions proposed

Type of Instrument

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RDI Needs for Theme 1: *New research need not covered by SRIA*

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Key Research Need 3-3

Tipping points caused by extreme events

Challenge, Scope & Key Objectives

Challenge:
Extreme events can push ecosystems irreversibly into a new state

Scope:
Natural and social systems

Top 3 Objectives:

1. Understanding how much change the ecosystem can deal with and the response
2. When this could happen and where, linking these to scenarios
3. Categorising extreme events and their system specific effects on different ecosystems

Top 3 Expected Impacts

☐Social ☐Economic ☐Technological ☐Environmental ☐Policy	In order of importance: Environmental (1), Policy (2), Technological (3) Better knowledge of systems that are the most vulnerable to avoid crossing the tipping point

End-Users Needs

Information on what systems are vulnerable based on a vulnerability index, expressing the vulnerability towards irreversible change.

Policy Relevance

Basis for prioritisation of actions

Type of Instrument

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☐Research Infrastructure
☐Other (please specify)

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