



**WATER SECURITY**  
Knowledge Exchange Programme



## Specific Priority Subject 1.2 Summary Report

### Understanding and Managing the Impacts of Climate Change on the Ecology of Catchments

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## Acronyms

WSKEP      Water Security Knowledge Exchange Programme

## Acknowledgement

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## Summary

This report is the Summary Outcomes Report of the WSKEP Specific Priority Subject Workshop 1.2 on Understanding and Managing the Impacts of Climate Change on the Ecology of Catchments. It includes an introduction reporting the key recommendations resulting from the Workshop. This document will be made available on the Programme website [www.wskep.net](http://www.wskep.net) with a link from the Wales Environment Research Hub website. The full Participants Outcomes Report was distributed to all attendees at the Workshop.

## Disclaimer

This document reflects only the combined views of participants at the Workshop

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# 1. Overview

## 1.1. Introduction

The ecology of water bodies is crucial in determining their status in accordance with the European Water Framework Directive (WFD). Ecological status reflects water quantity and quality, both of which are likely to be impacted by future environmental change.

Climate change is predicted to bring a range of impacts to the UK including hotter, drier summers and milder, wetter winters with less snow and frost in Wales and the West. More extreme weather events such as storms, floods and droughts are expected to occur and sea-level rise is already being experienced. Biotic change is likely to include greater prevalence of exotic and invasive organisms and macro-nutrient cycling will also be impacted by altered flow regimes. These changes will affect the ecology of catchments along with the human socio-economic and cultural systems that depend on them. Mitigation of, and adaptation to these impacts are therefore high on the catchment science agenda.

We will need to frame research within the broader context of systems science that addresses the ‘real world’ concerns and needs of all those with a stake in improving societal decision-making and habitat management. Broader scientific perspectives can then become a basis for innovation and multi-benefit solutions. We also need to be able to articulate with authority to the wider public, the causes, consequences and management options for climate-induced catchment changes, and to do so in culturally-resonant terms.

This workshop, the second (programmed) in the series run by the NERC Water Security Knowledge Exchange Programme, addressed the question of whether there is sufficient knowledge available on which to base management options for adaptation and mitigation of climate change impacts in catchments of the future.

## 1.2. What is the big science issue / challenge

The workshop highlighted the need for research to address how our catchment systems are likely to respond to climate change perturbations at regional and local levels. More knowledge is needed of the ways in which aquatic biodiversity underpins ecosystem service delivery, and studies are required on whether “tipping points” are to be expected in the human-ecological interface in the future. Forethought will have to be given to managing the ecological impacts of catastrophic flood events – who will be the winners and losers?

There was a consensus among this workshop audience for research and development of practical and applied tools for catchment management. This included the need for an ecologically sensitive opportunity mapping tool that could be applied at the local level. A climate sensitive “Nitrate management tool” was also suggested. Ecological indicators are required that are more relevant to process, useable at different scales and easy to understand; and there is still a need to model future water temperatures at finer scales and with clearer probabilities.

Participants concurred on the need for a more complete river channel habitat map for the UK, that would improve understanding of connectivity, natural variation and historical legacies.

Other areas highlighted for research included studies of the ecological impact of greater ex-filtration from sewers under higher flow regimes, and expected increases in waterborne pathogens due to climate change impacts.

Suggestions for ways to promote and progress these areas of research included more collaborative cross-sector working and enhancement of networking and alliances (see below). And of course more funding!

### 1.3. Networks and alliances

Participants at this workshop emphasized the need to focus on applied outcomes for research, with clear connections between academic research and real world needs. Strong partnerships are needed between commissioning agencies/regulators and research providers. Extending research placements in industry and government would further promote this aim.

Barriers between researchers also need to be broken down, with encouragement of cross-disciplinary networks for the stimulation of novel ideas. Some participants felt that competition can stifle collaboration and innovation in some academic settings, and that greater standardisation of data formats and terminology, along with willingness to share data, would enhance problem-solving and improve research outcomes.

There was feeling that the relationship between research users and research providers could also be enhanced by the use of more common language and a mutual understanding of the timescales that each group is required to work within.

It was felt that more could be made of “one-stop-shops” at the research provider-user interface, for collating, synthesising, “translating” and disseminating research findings, e.g. evidence “hubs” and “observatories”.

### 1.4. The Water Security KE Programme

Workshop participants appreciated the opportunities provided by the NERC Water Security Knowledge Exchange Programme and felt that it was important that the Programme continue to communicate with all participants, the outcomes, developments and follow-on from the meetings. Impact will depend upon NERC absorbing and acting on the best recommendations from the “consultation process” that the Programme has afforded.

The KE Programme should continue to link theory with practice, and encourage cross-sector working to deliver practical responses to complex ecological and societal needs, including encouraging the development of user-led tools. NERC’s own proposal review process could be adjusted to include user-groups. NERC might also promote information-sharing and knowledge exchange by maintaining an open-access data hub, for example through “cloud computing”.

One way of enhancing impact through the KE workshop process, might also be to ask invitees to bring their own project details to the meetings (or even share them in advance), for use as problem-solving case studies and to build relationships at the KE events.

## 2. The workshop and report

This workshop was the third (chronologically) in a series being run on behalf of the Water Security Knowledge Exchange Programme (WSKEP) with funding from NERC. It was organized by The Wales Environment Research Hub, at Bangor University.

Nine Priority Subjects were identified at a national consultation event held in June 2011. The theme of this workshop was '**Understanding and Managing the Impacts of Climate Change on the Ecology of Catchments**'.

The workshop was designed to support the following key aims:

- increase awareness and uptake of research outputs in the focus area of 'assessing upstream methods of land/water management that improve water quality and quantity'
- identify user needs and potential future research projects
- strengthen research/user group collaboration and networks

The workshop was divided into 4 sessions with initial presentations (available separately) as follows:

- Session 1      Setting the scene and making connections**  
Introduction: Neil Runnalls, WSKEP Programme Development Manager CEH Wallingford
- Towards a shared understanding of the Priority Subject Area**  
Introduction: Mark Everard, Water Resources Consultant
- Session 2      Making the most of current research activity**  
Introduction: Harriet Orr, Climate Change Research scientist, Environment Agency
- Session 3      Identify areas for future research activity/collaborations**  
Introduction: Neil Runnalls, WSKEP, CEH
- Session 4      Alliances, networks and advice to the WSKEP**  
Introduction: Nigel Milner, Senior Fisheries Biologist, APEM Ltd

The heart of the workshop time was devoted to opportunities for participative working among the 30 delegates. This Report features the outcomes from those interactions as written up by delegates during the sessions. As such this report is primarily aimed as an 'aide memoire' for participants.

Elements from this report will be used to inform further development of the Water Security KEP.

## 3. Towards a shared understanding of the Priority Subject Area

Table groups discussed the contextual presentation by Dr Mark Everard and noted key insights and issues, supported by a brief narrative, that enrich the Priority Subject Area, as follows:

Ref	Insight/issue
3.1	The importance of defining and communicating 'catchment' scales
3.2	National mechanism to engage people in citizenship <ul style="list-style-type: none"> <li>• Knowledge and understanding among the general public and stakeholders are key barriers to informed debate</li> </ul>
3.3	Structure vs function – How do we assess freshwater ecosystem functioning? <ul style="list-style-type: none"> <li>• This is fundamental to our understanding of climate change</li> </ul>
3.4	Need for adaptive management to embrace uncertain outcomes
3.5	Understanding catchment history offers an important guide for the future <ul style="list-style-type: none"> <li>• Each catchment is unique, defined by its history, land use and dealing with legacy issues</li> <li>• There are trade-offs over time within the ecosystem. Current research tends to be too short term</li> <li>• Who defines knowledge/evidence/research needs at a catchment scale?</li> </ul>
3.6	Understanding the gaps in knowledge, provide transparency and common language <ul style="list-style-type: none"> <li>• The challenge of policy development where conflict exists</li> <li>• Socio-economic focus helps to provide direction in the long term</li> <li>• Knowledge gaps require transparency</li> </ul>

## 4. Making the most of current research activity

This session gave participants the opportunity to learn more about current research programmes and to make new connections to add value to research taking place. Dr Harriet Orr introduced some relevant current research projects.

Individuals then gave a short introduction to research work they were involved with. Other participants had the opportunity to connect with programmes that interested them. Comments were captured, and participants logged their interest. 10 connections were identified across 7 research programmes.

## 5. Identify areas for potential future research activity / collaborations

Through table group discussions, individuals were invited to identify key propositions where further research/activity could be of value in taking forward this Priority Subject Area.

Other delegates were invited to join in a conversation to further develop the proposition and indicate if they were interested in collaboration in this area, beyond the workshop.

Eight propositions were developed and discussed, as follows:

5.1	Options for modelling future water temperature
5.2	Ecosystems and extreme events – winners and losers
5.3	Ecological indicators that are more relevant to process, useable at different scales and easy to understand
5.4	'sexy' land capability tool for use at local level that quantifies for each unit sustainable limits re management Opportunity mapping for catchment ecology (scale, variation, resilience) Landscape scale research programmes
5.5	Nitrate management tool in response to climate change
5.6	Forethought and adaption related to catastrophic flood events
5.7	Climate change and waterborne pathogens
5.8	Complete river channel habitat map. Connectivity and understanding natural variation and legacies
5.9	Ecological impact of increased sewer ex-filtration

## Prioritisation

Following the discussion, delegates were given 3 sticky dots to indicate the three propositions they believed should be given priority consideration.

The table below shows the results of this prioritisation:

Ref	Proposition	Dots	Position
5.4	'sexy' land capability tool for use at local level that quantifies for each unit sustainable limits re management Opportunity mapping for catchment ecology (scale, variation, resilience) Landscape scale research programmes	14	1
5.2	Ecosystems and extreme events – winners and losers	10	2
5.8	Complete river channel habitat map. Connectivity and understanding natural variation and legacies	9	3
5.3	Ecological indicators that are more relevant to process, useable at different scales and easy to understand	6	4
5.7	Climate change and waterborne pathogens	5	5
5.9	Ecological impact of increased sewer exfiltration	5	5



5.6	Forethought and adaption related to catastrophic flood events	3	7
5.1	Options for modelling future water temperature	3	8
5.5	Nitrate management tool in response to climate change	2	9

## 6. Improving alliances and networks

Dr Nigel Milner gave an overview of alliances and network approaches that help foster research and practice in this area.

Delegates, in table groups, were then invited to make suggestions for steps to further improve communication and networking, as follows:

Ref	Suggestions to improve networks/communication
6.1	No common forums – need for one-stop shops
6.2	Greater standardisation of data format and terminology
6.3	Willingness to share data – top level buy in to this and funding
6.4	Emphasis on adaptive management – partnership between regulators and doers – need for focus on outcomes
6.5	Encourage cross-disciplinary networks for novel ideas
6.6	Competition stifles collaboration
6.7	Research placements in industry/government
6.8	Disconnect between academic research and applied real world needs

## 7. How do we maximise the value of the Water Security KEP?

Table groups were invited to suggest ways to maximise the value of the Water Security Knowledge Exchange programme, as follows:

Ref	Insights for WSKEP
7.1	NERC adjust funding policy to support user-led tools
7.2	How do we fund and research the tool

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7.3	NERC adjust proposal review process to include user groups
7.4	NERC-maintained open-access data hub 'on the cloud'
7.5	WSKEP to work with NERC to develop a funding stream and criteria which deliver the needs of applied research (end users etc)

End