



Water security
Knowledge exchange programme



WATER SECURITY, RISK AND SOCIETY

**KNOWLEDGE EXCHANGE OPPORTUNITIES
FOR UK AND EUROPEAN AGENCIES**

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“Water security is tolerable water-related risk to society”

Professor David Grey
University of Oxford

*“Decisions under uncertainty are politically evaluated by their
consequences, not by their wisdom”*

Professor Jerson Kelman
CEO of Light S.A.
Federal University of Rio de Janeiro

1. ABOUT THE CONFERENCE

Oxford University hosted the first International Conference on Water Security, Risk and Society on 16–18 April 2012, which brought together over 200 of the world's leading thinkers and practitioners from science, policy and enterprise communities. The contributors included many researchers and government officials actively involved in the implementation of the European Union Water Framework Directive (EU WFD).

The aims of the conference were to i) assess the emerging evidence base about the status of and pathways to water security, ii) debate a risk-based framework as an approach to understand and achieve water security across scales and contexts, and iii) provide the foundation for collective global action by science, policy and enterprise communities to achieving water security.

2. ABOUT THE AUDIENCE: CONNECTING SCIENCE WITH DECISION-MAKERS

This briefing note is part of a series of short briefs to outline the challenges and opportunities for knowledge exchange, based on conference findings, most likely to affect the initiatives and programmes of UK and EU governmental agencies meeting the demands of the EU WFD. The findings seek to inform the Natural Environment Research Council (NERC) and more generally UK Research Council thinking in developing their global water security research agenda. The agenda emerging from the conference also seeks to inform the path beyond Rio+20 by connecting science, policy and business.

The emerging research priorities and science questions have clear links to NERC's strategic priorities under the Water Security Knowledge Exchange Programme, namely: *Integrated Water Management; Increased Resilience to Extreme Events; Ensuring Water Resources Security; Coordination of Water Data; Sources, Behaviour and Control of Persistent and Emerging Environmental Contaminants*. The UK Water Research and Innovation Framework provides further impetus and context to this agenda, emphasising linkages across science, policy and enterprise.

The European Union has identified water as a major societal and economic challenge within Europe and to Europe globally sourced supply chains. These challenges pose both threats and opportunities for innovative European industries. The EU has launched a range of new initiatives to address these challenges including the industry focussed Water Supply and Sanitation Technology Platform WssTP, the near market EUREKA Acqueau cluster, the European Innovation Partnership EIP on Water and the Joint Programme Initiative JPI on Water to improve coordination of Member State funded water research and innovation.

3. MOTIVATION

Water security is a defining global challenge in the 21st century. The enduring struggle to cope with water access and shocks is now magnified by global change to societies, economies and climate at multiple scales.

During the Oxford conference risk was put forward as a unifying framework as it links across multiple water security challenges, ranging from natural hydro-climatic events through socioeconomics to political influences.

Risk-based principles for defining and managing water security motivate interdisciplinary research to investigate:

- ◆ The framing of decisions in risk-based terms
- ◆ Non-stationarity and uncertainty of knowledge
- ◆ Tradeoffs and valuation of risks across multiple and often competing objectives
- ◆ Working across scales to address social, environmental, political and economic externalities

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4. WATER SECURITY CHALLENGES AND CROSS-CUTTING THEMES FOR UK AND EU AGENCIES

Agencies across the European Community have responded to the EU WFD with many initiatives to meet the targets for good water quality and good ecological status of their surface water systems. Yet challenges to meeting these standards will result from governments reacting to particular stresses such as low flow events, increasing water demand and over allocation of resources, and further exacerbated by demands to meet climate change mitigation/adaptation objectives.

During the presentations and discussions at the Oxford conference, three major cross-cutting themes emerged particularly relevant to government agencies:

- i. Understanding water security risks to natural water systems
- ii. Science and technological pathways to reduce water insecurity and protect natural water systems
- iii. Balancing risk management policy across the water-energy-food nexus

4.1. UNDERSTANDING RISKS TO NATURAL WATER SYSTEMS

The increased investment in water supply and wastewater treatment systems and the development of enhanced governance and legal and regulatory frameworks has led to improved status of many European rivers recently. Supporting research initiatives through many national governments and EU framework programmes have led to a greater understanding of current/future conditions.

However there remain some key areas of potential water risk still needing greater exploration:

- ◆ Changes in low flow regimes, affecting biochemical processes and the ability of rivers to dilute and flush contaminants (Whitehead)
- ◆ Changes in high flow regimes, causing stress on existing water infrastructures with potential responses tempered by economic austerity
- ◆ Variability in flow regimes under climate change, requiring changes in water allocation and water use in closing river basins, affecting flows and quality variables
- ◆ Changing groundwater recharge and abstraction levels, and pollutants, challenging nitrate sensitive aquifer management
- ◆ Determination of environmental flows and its relationship to the indicators of ecological status according to the EU WFD

The sovereign debt crisis of many European countries and its political and economic ramifications will likely affect the investment by governments and the enterprise sector in managing water service infrastructure, possibly leading to degraded water conditions. Understanding risks to EU water security thus needs political, economic and social sciences to be included in any analysis too. In examining EU WFD performance, Pahl-Wostl found that this was not a function of GDP: "There is a huge difference in countries for the same level of GDP... does not necessarily mean that when you have economic development you have institutional development" (Professor Claudia Pahl Wostl, University of Osnabrück).

4.2. BALANCING RISK MANAGEMENT POLICY ACROSS THE WATER-ENERGY-FOOD NEXUS

EU countries have led global efforts to reduce the impacts of energy and water provisions, yet conflicting targets of different directives raises the important question of balancing the political agenda to reflect water, food and energy security needs without compromising the environment. The developments in solar energy in Spain and the negative impacts on local water resources and wetlands provide an important example of these interactions (Closas).

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4.3. SCIENCE AND TECHNOLOGICAL PATHWAYS TO REDUCE WATER INSECURITY AND PROTECT NATURAL WATER SYSTEMS

Technology/engineering adoption or changes to operations can bring benefits to stream health and increase water security, such as through improving wastewater recovery, improving desalination, growing crops with less or more marginal quality water, increasing water use efficiency (Beddington, Koch, Mikkelsen, O'Hagan). However factors affecting the adoption of technology such as return on investment, responses to government incentives, and regulatory frameworks, need to be understood alongside social/cultural/political influences on uptake inertia.

5. RESEARCH PRIORITIES FOR KNOWLEDGE EXCHANGE

Adopting a water security framework requires water research funded under NERC and other UK Research Councils to develop greater understanding of the highly complex, multi-disciplinary and interconnected variables influencing it and their relations. Consideration of the many challenges will influence *what questions need to be answered and how the questions need to be framed in future research* (Calow).

5.1. THE PROGRAMMES AND PROJECTS AGENDA

Resonating throughout the conference was the need for more information on variables that control and impact water security, and the need for an integrated, multi-disciplinary, multi-scale, multi-agency approach to research. Key areas highlighted were:

Development of understanding through new data. Developing new knowledge or knowledge framed on understanding natural water resource security is central to informing government agencies (Conway).

Development of models to support risk analysis in a multi-stakeholder environment. Multi-disciplinary teams of government agencies need to be involved in steering the direction of scenario modelling to help represent the complexities of the policy environment (Conway, Gober, Goulden, Islam). Policy analysis/strategic planning need quick responses, which cannot be obtained from sophisticated models

Improving water management to support natural ecosystems and water security. Science, engineering and technology are important tools for ensuring water security. New technology that addresses both water and energy resource constraints simultaneously should be an area of continued focus, with a developed understanding of the impacts of such initiatives (and important links to the Engineering and Physical Sciences Research Council and the Economic and Social Research Council).

Understanding the social/economic/political context of technology adoption. There is a strong need to consider links to social science research to understand barriers to uptake, the complexities of social/cultural/political environments in which technologies are used, and indirect impacts.

Key areas include:

- ◆ Managing extremes – characterising natural events including their uncertainty and non-stationarity, and the politics and economics of responses amongst differently vulnerable community groups, businesses and government agencies.
- ◆ Decision-making and behavioural responses to water-related risks – how do uncertainty and risk interact in providing improved decision-making?
- ◆ Role of incentives, regulations and information to promote water (and energy) efficiency; limit impacts on the environment; and in the development of non-freshwater use.

5.2. KNOWLEDGE EXCHANGE OPPORTUNITIES

The need for knowledge exchange to support policy is imperative but this should be beyond the shared workshop or collaborative research project where much of the thinking is undertaken away from decision-makers.

Data needs to be available for all. Data collected under NERC-funded research needs to be made available in a *standard user-friendly format*, accessed through tools such as Google Earth, in addition to the usual research outlets for knowledge.

Flexible assignments to different work environments. There is a need to bring government and science communities together in a meaningful way. Secondment of researchers to government agencies already takes place, but there are fewer possibilities for policy developers to work in scientific/modelling laboratories etc to bring more multidisciplinary ideas to the research process. The Engineering and Physical Sciences Research Council's sandpits are an example that could be further developed for water security multi-disciplinary research.

There is a need to support such initiatives through **further development of university research assessments** to ensure applied research is valued for its multi-disciplinary complexity as much as traditional focused scientific studies.

5.3. NETWORKS OF PARTNERS – UK AND INTERNATIONALLY

Networks need to be well devised and focused to ensure the time and financial commitments to take part yield the insight and results sought by the participants. The mix of participants should reflect changing needs under a water security framework that reach beyond traditional natural science and engineering. This will help bring fresh ideas to discussions away from current established thought sets.

REFERENCES

All presentations referenced in this briefing note are available online at:
<http://www.water.ox.ac.uk/events/water-security-risk-and-society/programme/>

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