IWRM-NET
First international workshop
- Launch event -

Workshop Report

DTI Conference Centre, London
10 / 11th January 2007

Content

1 Executive Summary

The IWRM-NET First International Workshop brought research programme managers, researchers and practitioners from diverse fields and parts of Europe together to exchange views on the current state of water research and research gaps, particularly relating to the Water Framework Directive (WFD).

Presentations gave concise insights into specific research needs related to local water management challenges in regions all over Europe as well as methodological challenges and experiences with interdisciplinary work. The presentations can be downloaded: www.iwrm-net.eu. They framed and inspired the discussions presented in this report.

During group work, participants engaged in fruitful discussions, exchanging views and experiences from various disciplines. As a result of the group work, the identification of research issues and questions has created a good base for launching collaboration and the development of one or more joint calls[1].

Research issues and questions identified, range from the definition of relevant concepts such as 'good ecological status', to the practical implementation of trans-boundary and interdisciplinary research. They covered issues ranging from the challenges of flood risk management to the question of how to measure the public's valuation of water and create wider awareness of issues.

Common emerging findings from the group work were that there is still a lack of knowledge and data in specific fields. But a better understanding of what has already been done was also seen as necessary before implementing new research activities.

Another major point was that knowledge already available often still needs to be integrated into best practice. Although the concept of integrated water resource management has been promoted strongly within the last few years, all groups claimed that sectorial management of resources is still predominant and that research is often still based in separate disciplinary approaches. Thus key issues are:

- to develop methodologies and new skills to implement interdisciplinary research
- to develop new skills for transferring results from science to decision-makers and citizens in terms understandable to them

The methodology refers to the way(s) the new skills should be used in the research programme system already existing. Recurrent difficulties were identified in the ability to translate research questions into scientific issues and to disseminate the scientific results to practitioners, stakeholders and the public in a way that they can understand and use easily. Methods and measures emerging from these research activities should also be analysed related to their efficiency.

The potential contribution of a network like IWRM-NET to address these issues was stressed. The Network brings together expertise from different areas of research and allows participants to organise themselves according to specific topics or themes.

All participants are now asked to confirm the ideas generated in this meeting, distribute them to the wider community and encourage the exchange of information and ideas within the network.

Furthermore, the results of the workshop will be one source of information about research needs that will inform the terms of reference of the IWRM-NET pilot call to be launched in 2008. However, some issues identified during the workshop will be defined in more scientific terms.

[1] IWRM-NET partners plan to implement joint research activities that will also be open to other research programme managers.

2 Introduction

2.1 Introduction to IWRM-NET

IWRM-NET is a European Research Area Network (ERA-Net) financed by the European Commission of research programme managers and policy-makers who wish to improve the coherence of integrated water resources management research in Europe. The network aims to become a primary source of knowledge for European IWRM research and will start the process of building an integrated cross-European policy-based IWRM research agenda.

2.2 Objectives of the workshop

The main objective of the first international IWRM-NET workshop held on the 10th and 11th of January in London was to initiate the process of building a "community of practice" among research managers and practitioners involved in the Water Framework Directive (WFD) and associated IWRM activities.

Of central importance was the identification of short and long-term research needs leading to the development of trans-national and trans-regional joint calls for research activities related to IWRM.

2.3 Participants

The workshop brought together an interdisciplinary group of representatives from organisations such as national authorities, universities, consultancies and research institutes from around Europe providing a forum for exchange on various aspects of IWRM research. The 57 participants at the meeting, included research managers, researchers and practitioners from many disciplines including Natural Sciences, Engineering, Economics, Sociology, Biology and Modelling.

2.4 Programme and methods

A combination of plenary presentations and group work was employed. Following short introductions to ERA-Nets and IWRM-NET, three dimensions were presented:

- Regional water resource management challenges around Europe
- Technical challenges in IWRM
- Integrated research programmes and interdisciplinary working

The presentations framed and stimulated subsequent discussions and provided information for a common knowledge base.

To stimulate an intensive exchange between all participants, group work methods were used on both days and the results integrated and elaborated in a plenary session. To improve exchange among individual participants, the break out groups were kept small. All groups were facilitated in such a way that comparable results were achieved.

, The participants were asked to identify a range of open research questions from one of the following five themes

- Characterising the environment
- Environmental objectives
- Pressure and Impact Assessment
- Socio-economic issues
- Monitoring and Indicators

These themes were chosen by IWRM-NET partners as likely to be relevant to short- and long-term research needs related to IWRM and the WFD and of great importance for ongoing activities such as implementation of joint research activities among IWRM-NET partners.

The identification of research issues within the five themes was supported by a *gap analysis*. This included the analysis of the current state of research and the identification of specific gaps and their associated research questions, supported by a 'table structure for research gap analysis'. Using this table and a set of coloured cards, relevant issues raised during presentations or the group work were documented in an organised manner.

The table contains the following columns:

- objective: what is the research objective?
- current state of research: how can current research be characterised?
- deficit / research gap: what is lacking in order to achieve the objectives?
- research question: which concrete research questions should be addressed?
- number of points: How relevant are the single research questions (1 point: low, 8 points: high)
- How can IWRM-NET help: in achieving research objectives or addressing questions

Transcriptions of the tables can be found as appendix to this workshop report.

Table 1: Table structure used for the gap analysis

Objective	Current state of research	Deficit / research gap	Research question	Number of Points	How can IWRM-NET help?
... ...	... ...	... ...	...? ...?		... ...

Short-, mid- and long-term research questions identified (marked with an 'S', 'M' or 'L') were prioritised by giving each participant the opportunity to distribute three points among the specific questions in order to indicate which of the questions he or she perceived as most relevant. For the three priority research questions, each group discussed next steps and how IWRM-NET could support the bridging of the research gaps.

The results of the group work were presented to the plenary by rapporteurs. The subsequent discussions revealed possible further steps and common research interests within IWRM-NET and identified links with other research programmes that may be included into a joint call related to IWRM research activities.

Table 2: Workshop agenda

Wednesday, 10th January	
12:30	**Buffet lunch**
13:30	**Welcome** – Ian Barker – Head of Water Resources – Environmental Agency
13:35	**Presentation of Agenda** – Sophie Rotter – Facilitator – Seecon Germany
13:40	**Session 1: Introduction to the ERA-Net concept** – Ivan Conesa Alcolea – IWRM-NET Project Officer- European Commission
13:50	**Session 2: IWRM Networking in the European Research Area** – Jean-Antoine Faby – International Office for Water
14:15	**Session 3: Regional water resource management challenges from around Europe** 3.1: Finland and NE – Björn Klöve – University of Oulu 3.2: Spain and SW – Joaquin Andreu - Jucar Basin Agency 3.3: Hungary and SE – Laszlo Perger - National Water Centre and Archives 3.4: Great Britain and SW – Bob Harris – UK Environment Agency Discussion
15:10	**Tea/coffee break**
15:30	**Session 4: The technical challenges in IWRM** 4.1: Ecosystem modelling approaches – Kieran Conlan – Cascade Consulting 4.2: Environmental modelling - A. Genty for J.-M. Brignon – INERIS 4.3: Geomorphology – Colin Thorne – University of Nottingham 4.4: Socio – economic modelling - M. O'Connor - Centre for Economics and Ethics of the Environment and Development 4.5: Sociological Challenges - S. Molyneux-Hodgson – University of Sheffield Discussion
16:25	**Group work: Research Programme Building** – Gap analysis by theme
17:30	Close
19.30	**Drinks reception** followed by dinner at One Birdcage Walk (by invitation of the UK Environment Agency)
Thursday, 11th January	
9:00	**Short introduction into days work** – Sophie Rotter, Facilitator, Seecon Germany
9:05	**Session 5: Integrated Research Programmes and multidisciplinary working** 5.1: Interdisciplinary Challenges: Early Experiences from the UNESCO IHP HELP programme - Mike Bonell (formerly) UNESCO Division of Water Sciences 5.2: Interdisciplinary working in environmental research - Phillippe Vervier 5.3: Harnessing the Social and Natural Sciences for Sustainable Rural Development - Jeremy Phillipson – University of Newcastle Discussion
10:05	**Tea/coffee break**
10:20	**Group work: How can IWRM-NET help?** Groups continue focussed discussions from Wednesday
12:00	**Plenary: Conclusions and the way forward** – Sophie Rotter - Facilitator Presentation of outcomes, detecting joint interest in specific research questions
12:45	**Next steps** and **closing words**
13.00	**Lunch** - - external invitees depart by 14.00
Afternoon	IWRM-NET members **General Assembly and workshop follow-up**

3 Presentations on the state of current research

3.1 Abstracts of presentations

3.1.1 Regional water resource management challenges from around Europe

Finland and NE – Björn Klöve – University of Oulu

The Finnish landscape is characterised by crystalline bedrock covered by glacial deposits, lakes, peatlands and forests. The topography is relatively flat with undulating landscape in central and northern Finland. The lakes are shallow and individual groundwater deposits usually quite small and unconfined. Most of the agricultural areas are located along the coast on lowland areas (on former Baltic marine and lake stages).
The major changes in land-use and environment have been related to agriculture and forestry. Former land areas were cleared by burn-beating and lake lowering. Intensive agriculture was possible with drainage and fertilization. Currently, agriculture is the main source for nitrogen and phosphorous loads to watercourses. Eutrophication is a problem in many watercourses. Forestry, peatland uses and drainage is typical for Finland. Many rivers and brooks were straightened for timber floating. Huge land areas were drained for forestry in 1950-1970. This resulted in leaching of nitrogen and above all transport of sand and organic material. The ecology of streams was changed with new channel forms and increased siltation.
Locally, industry and municipalities result in environmental pressures. A recent pressure in northern Finland waters is caused by increased mining. Phosphorous has been efficiently removed from different wastewaters but the nitrogen load is still high. In Finland, the nitrogen removal is difficult due to cold temperature all year long (long pipelines). Also, the inland waters with P-limitation are often wastewater recipients. Energy production such as hydropower and peat harvesting has had considerable consequences on the state of rivers, lakes and peatlands. Many Finnish rivers are dammed and the lakes are regulated for power production.
The improvement of the state of water resources could mean restoration of rivers, lakes and control of pollution from diffuse and point sources. Attention must be paid on loads from agriculture and effects of forest ditching. Groundwater reservoirs in eskers are threatened by forestry ditching, road salting, and many small-scale activities. Also changes in climate can affect hydrology and have various effects on low and peak flows, which effect water resources management. For an integrated approach more information is needed on consequences of main land use activities, on the cause-effects of different measures and on the benefit on carrying out multiple tasks to reduce e.g. floods and improve the state of waters. Also, methods are needed to transfer knowledge to end-users to allow sustainable management decisions to be made.

Spain and SW – Joaquín Andreu Álvarez- Júcar Basin Agency

The presentation describes the risks of not reaching the environmental objectives of the water framework directive (WFD) in surface bodies and groundwater in the Júcar River Basin as well as the causes of not reaching these objectives. The main results of the characterisation that was carried out for the Júcar River Basin were that there exists a high uncertainty on the determination of the risk of reaching the environmental objective. Most of the water bodies will need measures to improve their status (ecological and chemical in surface water bodies; quantitative and chemical in groundwater). The main pressures on surface water bodies are due to point pollution, while on groundwater are due to extractions and non-point pollution.
The main challenges in Spain related to the WFD are:
1. The WFD aims to protect and improve the ecological status of water, aquatic ecosystems and wetlands, and foster the sustainable use of water: This is very different from the objectives included on the current Spanish programmes and laws, which are mainly focused on 'better satisfaction of demands', that means in practice to give preference to water uses, specially irrigation and hydro-electrical use, instead of sustainable water management.
2. The river basin, trans-boundary or not, becomes the basic unit of management: This will make to modify the hydrological plans of the river basins shared with Portugal.
3. The WFD integrates transition and coastal water together with surface and groundwater bodies: In this way, other systems as deltas and coastal platforms and dynamic are finally recognised as dependent from water.
4. The WFD obligates to establish quality objectives for all water bodies and offers some common and standardised mechanisms to assure the fulfilment of those objectives: This will make to include some changes on the hydrological plans and even on the basin organisations to quantify, survey and preserve the ecological status of the water bodies.
5. The WFD uses the combined approach: rules and measures about emissions (limit values) together with the own quality status of the water bodies: This approach has become the basic strategy for water pollution control.

6. The WFD introduces the principle of 'costs recovery' (including the environmental ones) in water management, as well as the need of a cost policy which offered the right incentives for this cost recovery: This will make to review the river basin programmes and the conditions for the hydrological works and actions on irrigating systems.
7. New contents are included in the river basin programmes: A summary of the effect of human activity on surface and groundwater status, a summary of chemical and ecological status of surface water bodies and the definition of the environmental objectives for each one, the chemical and quantitative status of the groundwater, specifying those from which land eco-systems depend on, a summary of the measures programme established to fulfil the environmental objectives, an economic analysis of the water use, a summary of the public information process and the changes involved, the measures for the application of the principle of costs recovery, a summary of measures taken to fulfil with the WFD and the rest of communitarian laws about water protection, a register of protected areas including Natura 2000 Network.
8. Finally, the WFD establishes the guarantee of public information and participation including total access to the documents used to elaborate the basin programmes, and 6 months of public exhibition to present written remarks: This will make to avoid the resistance of basin organisations to transparency and public participation, which is one of the most important and necessary steps to reach a modern and effective water management.
Conclusions: The WFD involves a big chance in main objectives and basic budgets as it is focused on water quality, the environmental functions of water and its sustainable use, and includes the concept of river basin as basic management unit, transition and coastal water and the principle of cost recovery. In the case of Spain, it is important to start as soon as possible the surveillance and control programmes due to the uncertainty of objectives fulfilment in most water bodies. After the results of control programmes, it will be possible to establish the final planning of measures.

Hungary and SE – László Perger - National Water Centre and Archives

The southeast region of Europe shows much variability in topography, hydrology and geology. As far as climate is concerned, it is continental but thanks to „climate-change" it is slowly turning into a semi-Mediterranean one.
Topographically, this region features large sedimentary basins, e.g. the Carpathian basin, with very slow flowing rivers, wrapped around high mountains or extending out to sea, e.g. Romanian lowland to the Black Sea.
Due to this topographical condition, there are many eco-regions in this area with several types of man-made, artificial water bodies and non-ecologically conforming water uses and other water management solutions. It seems that water conditions in the SE region are slightly better than the rest of Europe for both water quantity and quality, so this region has several reference eco-sites and water bodies, which need many sustaining or supporting measures/activities.
To do this and to restore water bodies in poor condition, Hungary has made great efforts in R&D activity to implement the scheduled water management measures prescribed by EU WFD.
Amongst the difficult water research challenges, are activities such as seeking correlation between hydromorphological alterations and water-related ecological status, or how we can best characterise the status of different scales and various groundwater bodies, etc. It seems very difficult to provide good and efficient solutions for public participation or cost-effective techniques in near future. In the SE region of Europe these issues may be facing more and more difficulties. Of course, these are only the major gaps.
The IWRM-NET project provides a very good solution for exchange of partner countries experiences and practices.

Great Britain and SW – Bob Harris – UK Environment Agency

The UK is characterised by a highly varied geology, topography, soils and climate. Combine the resulting variable and intensive agricultural land use with a long industrial mining and manufacturing history and dense population levels on a relatively small island with short river systems and there are many pressures on both terrestrial and aquatic ecosystems.
The Water Framework Directive brings on the one hand an opportunity to manage the environment more effectively through more integrated approaches, but also a huge challenge in public participation. Although the UK led the way with river basin management in 1974, it can be argued that the subsequent privatisation of the water industry and national (top down) approaches to rural environmental management have largely alienated local stakeholder communities from the issues.
It will be difficult for research programmes to influence the first round of River Basin Planning. However, before the 2nd round we need to develop sufficient scientific understanding and appropriate decision-support tools so we can manage the environment at the river catchment scale to acceptable levels of risk. We will need three types of work:
Improving our scientific knowledge of ecosystems, catchment processes and interactions;

Converting our knowledge into understanding using an integrated catchment modelling framework and the creation of risk-based decision support tools;
Developing and testing management solutions to reduce the impact of pressures, ensure they are cost-effective and provide multiple benefits ("win-wins").
To achieve this in the UK will require better integrative approaches; within and between research programme budget holders, scientists, legislators, regulators, and stakeholder communities.
It is a big challenge.

3.1.2 The technical challenges in IWRM

Ecosystem modelling approaches – Kieran Conlan – Cascade Consulting

The presentation briefly frames the needs for ecosytem modelling in response to application of the WFD, highlighting the existing and significant gap between identification of pressures and the implementation of appropriate measures. The gap is significant as it is an acknowledgement that we do not yet have the knowledge or tools to adequately predict the consequence of applying measures at the catchment scale to remove or mitigate the pressures on the ecosystem, which will be required to meet the good status or potential required by the WFD. This is confirmed by recent reports from the Scheldt Commission.
I then describe the basic ecosystems modelling tools required to provide a framework for prediction of pressures, impacts and mitigation measures, leading to formulation of the Programme of Measures. Existing approaches are briefly discussed, including use of deterministic models; data driven (empirical) models; GIS and databases and the potential for combinations of these with emerging methods (e.g. fuzzy logic). The presentation concludes with the range of ecosystem modelling tools and data that will be required to fully embrace the simulation of ecosystems for the purposes of the WFD.

Environmental modelling - Aurelien Genty for Jean-Marc Brignon – INERIS

The Water Framework Directive requires that "programs of measures" are developed, that describe the actions to reach good status of water bodies.
Models are among the tools that could obviously be helpful to fulfil this objective. Two classes of models can be distinguished:
- "pressure / impact" models
- "integrated models" that combine "pressure / impact" models with data and modules dealing with the cost and applicability of the measures.

Integrated models are in theory capable of comparing alternative "program of measures" from the point of view of their ecological efficiency and their economic costs.
Based on feedback from their use in France, the presentation will give some views about the actual ability of integrated modes to deliver this performance. Their merits in terms of predicting the future status of water bodies, helping to choose strategies to reach good status, or helping to communicate with stakeholders will be discussed. Some views on the mean scientific gaps and research needs to make models more reliable and useful will also be presented.

Scientific Challenges - Soils, Sediments and Geomorphology– Colin Thorne – School of Geography - University of Nottingham

Hydromorphology is a term used in the WFD to describe, in combination, the hydrologic and geomorphological processes and attributes of rivers, lakes, estuaries and coastal waters. For rivers, hydromorphology considers not only the form and function of the channel but also its connectivity, which defines its ability to allow up and downstream migration of aquatic organisms and maintain natural continuity of sediment transport through the fluvial system. The Directive requires surface waters to be managed in such a way as to safeguard their hydromorphology so that ecology is protected.
The Directive requires member states to put measures in place to avoid deterioration in status and to aim to achieve good ecological status for all waters by 2015. To achieve this, measures have to be defined in draft river basin plans by 2008, to allow for consultation before their finalisation in 2009.
To support the implementation of the Directive, UK environment and conservation agencies have been developing environmental standards for surface water hydrology and river morphology (www.wfduk.org). Standards link degrees of physical modification to ecological status through an innovative risk assessment tool called MImAS (Morphological Impact Assessment System) that incorporates an assessment of likely impacts from engineering works on river processes and features important to ecological quality.

In Scotland, new regulations were recently introduced to protect hydromorphology. The Water Environment (Controlled Activities) (Scotland) Regulations 2005 control pollution, abstractions, impoundments and engineering works (www.sepa.org.uk/wfd). Controls on abstractions, impoundments and engineering works already exist in England and Wales. The Environment Agency and Defra are currently reviewing how existing legislation can be used to implement the WFD, including hydromorphology. Where gaps are identified, amendments to existing legislation, or new powers and duties may be required

New research related to WFD should evolve along side the developing framework for progressing its requirements through close coupling of strategic and applied research on governance and practical implementation with fundamental research to supply the science base and long-term monitoring to appraise outcomes and support adaptive management.

Water related research needs in soils, sediments and geomorphology more generally centre on:

1. fundamental research to establish links between soils, sediments, morphology, habitats and ecosystems and provide the scientific basis for River Basin Management Plans and the Programmes of Measures proposed to deliver RBMP objectives and targets;
2. cross-disciplinary research to allow water managers to meet simultaneously the aims of both the Water Framework and Floods Directives;
3. applied research on the impacts of river operations and maintenance on sediments, geomorphology and ecosystems to allow the development of Asset System Management Plans, within which linked FRM-WFD performance specifications may be met.

Socio – economic modelling - Martin O'Connor - Centre for Economics and Ethics of the Environment and Development

The research problematique is: Environmental and resource management via stakeholder deliberation. This means that decision support is not only the acquisition, scientific validation and organisation of information, but also – and above all – procedure for effective exploitation of this knowledge/information by the 'stakeholders' in water's sustainability. We speak of Deliberation Support Tools (DST) and Tools for Informing Discussions, Debate and Deliberation (TIDD) rather than the traditional 'decision support' concept, because it is the process of multi-stakeholder deliberation that furnishes the basis for good decisions. Communication and costs push us to consider 'headline' indicators and to try to find 'generic' concepts. How to navigate between 'too few and too many'? The solution is not 'aggregation', it is organisation in relation to stakeholders and policy purposes.

Action-research (and documentation of action-research): Mobilising human agency in support of sustainability objectives. The key task for socio-economic research in integrated (and participatory) water resources management is not the modelling of socio-economic systems, it is the organisation of human agency in relation to sustainability challenges and policy purposes.

Rationales for 'Deliberation': The mobilisation of knowledge, of human agency, and of collective capacity requires deliberation. Deliberation about sustainability challenges and policy options and purposes must be structured and this presumes action-research with tools, methods and process design. But of course deliberation may clarify tensions and contradictions between groups, societies, stakeholders, without resolving them.

Sociological Challenges – Susan Molyneux-Hodgson – University of Sheffield

It is now generally accepted that attention to the socio-economic aspects of water resource management is necessary, indeed the WFD enshrines these perspectives. Perhaps however, this realisation is more common in regulatory circles than scientific or sociological ones and a realisation in itself does not easily transform into meaningful knowledge or practical action. From the perspective of science, an inability to deal with 'the social' presents a particular set of hurdles, whereas in the sociological field the current lack of capacity to engage in joint research is a major limitation. At the same time, whilst knowledge exists about 'water use' from a social perspective, and much is known about the practice of science and processes of governance, bringing existing work together, in ways that can feed into practical implementation strategies, seems some way off.

With this context in mind, this presentation will introduce some key social scientific research needs under the three headings of theoretical, methodological and practical. Theoretical and conceptual questions include how to relate individual behaviour and collective human action in order to generate management plans that will be accepted and appreciated. Methodological concerns include how, as sociological researchers, do we conduct research consequential to the catchment scale? Does this even make sense or do we need to design ways of translating social data between scales? Practical matters are many and include the need for wider recognition of the place of the social within water research and the subsequent production of teams capable of delivering integrated possibilities to the problems of integrated water management.

3.1.3 Integrated research programmes and multidisciplinary activities

Interdisciplinary Challenges: Early Experiences from the UNESCO IHP HELP programme - Mike Bonell (formerly) UNESCO Division of Water Sciences

One of the key objectives of HELP (http://www.unesco.org/water/ihp/help) is to address the current paradigm locks in real basins between scientific research on the one hand and its application to land-water management, water policy and water law on the other.
A global network of 67 basins was established in mid-2004 and placed into four categories based on several HELP criteria. Early experiences from selected basins (mostly in the Operational/Demonstration categories) will be outlined in the following aspects:
Evidence for success and failures in stakeholder dialogue as part of defining research gaps and translating scientific outcomes into policy and management (social learning)
The limited successes so far in terms of integrating hydrology sub-disciplines (surface water hydrology, groundwater, eco-hydrology, water quality processes, isotope hydrology) in field/modelling research programmes at larger scales to be of more practical use to land-water management.
Current steps being taken to find better ways of communicating and converting scientific outputs into improved water legislation. The scientific-water law and policy connection is considered to be "the last frontier" in terms of breaking new ground
A principal message is that even in the most advanced (Demonstration) HELP basins, progress in the above three aspects has been mixed. In particular, social learning remains a steep learning curve even where all parties have embraced HELP principles. Further there is commonly a lack of funding for stakeholder dialogue, and one of the conclusions from a recent HELP workshop was the need for find "champions" (e.g. individuals, an institution, local government) in each basin to drive the HELP process.

Interdisciplinary working in environmental research - Phillippe Vervier

The presentation describes the work of ECOBAG and why it is important to mobilise research in integrated water management (IWM) as well as how to organise interdisciplinary working for IWM. Furthermore it specifies ECOBAG feedback experiences as well as the *undergoing multidisciplinary research* approach in the Garonne River:
- *estuary*: impact of heavy metals on trophic network; economic damages and prospective approach for feedback to "normal" state
- *transfer*: quantification of heavy metals fluxes; role of hydrological and chemical (salinity); changes, dynamics between dissolved and particulate forms of heavy metals
- *industrial* site: quantification of heavy metals from the industrial area (several ha)
- *impact*: eco-toxic and geno-toxic consequences
Within the undergoing research links with water managers and decision makers:
- *knowledge transfer is organised*: requires additional energy (TIME) for scientists and for water managers and decision-makers
- *scientific support efficiency can be improved:* several questions due to several local authorities and actors (water managers, industry, tourism; each scientific approach is describing a part of the problem.
It also addresses the question of what kind of *research* is *needed* to improve scientific support: basic knowledge can be enough, to make effort on Decision Support System development; basic research can be still required; interdisciplinary research of high necessity
The ECOBAG feedback related to the question what kind of *scientific support* is *needed* (basic, research-development, transfer) is: to make hierarchy between the different possible scientific support is of prime importance (when research starts, it takes a long time comparing to "water managers time" to deliver results); global, collective and multidisciplinary identification of the research needs is therefore of prime importance.
To open the discussion the presentation stresses the issues that it is *relevant to develop* "collaborative research" that is characterised by a previous step of collective identification of scientific support objectives. But it takes time and it requires lot of patience for people that do not have the same daily objectives (water managers and researchers, or water managers and stakeholders, or social and natural scientists) and that do not share the same background. It emphasis that IWRM-Net can help a lot at the EU level.

Harnessing the Social and Natural Sciences for Sustainable Rural Development - Jeremy Phillipson – University of Newcastle

The Rural Economy and Land Use (RELU) programme is one of the most comprehensive interdisciplinary research initiatives ever conducted by the UK Research Councils. The 36 million euro programme is funded by and brings together three of the UK's research councils, the Economic and Social Research Council, Natural Environment Research Council and Biotechnology and Biological Sciences Research Council, with additional funding from the Department for Environment, Food and Rural Affairs and the Scottish Executive, Environment and Rural Affairs Department. RELU is committed to pursue interdisciplinary working across the social and natural sciences in every research project it funds. The programme - which runs between 2003 and 2010 - aims to advance a holistic understanding of the major economic, social, environmental and technological challenges facing rural areas, with one of its core areas of interest being the integration of land and water use.
Interdisciplinarity is being pursued at all levels in the programme, at the project level and also at inter-Research Council and programme management levels through various institutional innovations. Experience of managing interdisciplinary programmes suggests the need for attention to programme design; project design; project assessment; training and capacity building; and the wider institutional framework.

3.1.4 Discussion

After each presentation, participants were able to provide comments or pose questions to the presenters. In the following section, the comments and questions arising after the presentations are collected and structured. These included the following themes:

- establishing good communication among scientists as well as with stakeholders,
- questions about the integration of various 'hard' and 'soft' approaches and
- the practical implementation of tools developed within research projects.

Interdisciplinarity and integration of methodological approaches

Question: How can the 'inter-disciplinarity' of a project be assessed? What could be indicators with which assessors could work?

Jeremy Phillipson: Assessors should take the following questions into account:

- Is the rational of inter-disciplinarity explicit in the project proposal?
- Why have they chosen these disciplines?
- Where is the innovation in the project?

Question: How to integrate hard (modelling) and soft (communication) approaches?

Mike Bonnell: If you cannot explain in a simple language what your models do, you do not get support. Many countries, e.g. Australia, New Zealand only accept proposals if they contain stakeholder communication.

Martin O'Connor: There is research dealing with (a) good water (research on natural systems) and with (b) good relationships with water (social issues) which is very important.

Bob Harris: agrees that (b) is crucial. Some problems, for example diffuse pollution, cannot be solved without it.

Joaquin Andreu: We have had good experience with combining the two.

Susan Molyneux-Hodgson: asked about direct contacts: How many natural scientists have asked a social scientist about what we can do? Ask us! I would love to tell you, but I do not know who you are.

Communication between scientists and practitioners / stakeholders

Question: How much of the project budget should be available for communication with stakeholders?

Jeremy Phillipson: Significant resources: at least 5% of the budget should be spend on communication with stakeholders.

Comment: Time scale differences can hinder the collaboration of research and practice, however, they can be bridged by direct contact.
Jeremy Phillipson: It is also very helpful and cheap is to allow researchers to spend a week in a water management office.

Question: At what stage do we move from research about uncertainties to implementation?

Bob Harris: We cannot afford to wait for all the research to be done. Researchers should advise practitioners about the uncertainties. How certain can I be that the land use changes have the desired effect?

Mike Bonell: criticised the fact that scientists do not explain to practitioners exactly what they know. There is a lack of representation of research results in a simple/usable way.

Volker Mohaupt: addressed the issue of awareness of water management within the broader public: How many people know in which catchment they live? How many appreciate yearly flooding? How do we bring our objectives nearer to the people?

Susan Molyneux-Hodgson: Why should they know in which catchment they live? Just because of EU policy?

Kieran Conlan: It is important to sell the benefits of the WFD to people. However, it is also difficult.

Application of models by end users

Question: Are models developed in research projects afterwards used and maintained by end users?

Martin O'Connor: There is a lot of experience available of models not being applied but being maintained at high costs. How to best represent more and more complex systems is a difficult question. Modellers often do not adopt frameworks that are meaningful to practitioners. A dialogue with the people is needed. Things need to be framed in simple ways. For example, what does the quality of water mean to people? In which time scales do they think and act? Researchers need to close the loop of social framing of questions and modelling.

Kieran Conlan: 'Broad scale environmental assessment' is better as a title then 'broad scale modelling'. People do not like models. They are not suitably explained, especially the risks in them. Besides a good explanation of their model, modellers need to have a strategy in case what they predicted is not right.

Comment: There are examples available were models have been used and maintained afterwards.

All presentations can be found at www.iwrm-net.eu.

3.2 Objectives, state of research and open research questions raised in presentations

3.2.1 Sustainable water resources management

The presentations covered a broad range of challenges in water management and their related gaps in the current state of research. The underlying objective of many of these challenges was finding a way to govern and implement environmental management in a sustainable way. A lot of models, environmental standards and knowledge are already available. However, it is still difficult to assess the effects and the cost efficiency of specific methods or combination of methods. Here, more knowledge about cause-effect-relationships and progress in modelling (for example, priority substances) is

needed. Uncertainties need not only to be acknowledged, but actively incorporated in risk based decision support tools.

Equally important, however, is that the knowledge and tools developed are transferred to and applied by end users. Specific skills should be developed and applied to improve the dissemination of scientific results to practitioners. Concrete management solutions, new measures for water management, taking more into account the diverse and specific local conditions in case studies are other axes to be considered to help researchers to deliver scientific outcomes relevant to practitioners. Finally, presenters mentioned a lack of integrated basin wide water management, asking for not only common data sets across borders but also integrated modelling frameworks.

3.2.2 Social learning

Further presentations addressed the question about how to create the conditions for supporting social learning among various actors in water management. This requires identifying the relevant stakeholders and defining performance criteria for effective collective action, taking the heterogeneity of actors and the specific context into account.

3.2.3 Interdisciplinary research

Finally, integrated water management requires interdisciplinary research. However this interdisciplinary research also requires more capacity and this needs to be taken into account by the funding bodies. Multidisciplinary workshops have already been set up, but it is very difficult to promote collaboration between participants with diverse objectives and backgrounds, working at different scales and, in many cases, lacking a long-term horizon. To cope with these challenges, programme managers should take more time to choose appropriate approaches. It needs to be clarified in which cases interdisciplinary approaches are useful, and how the success of interdisciplinary research can be assessed.

4 Results of group work

4.1 Group 1: Characterising the Environment

Chair: Stephen Midgley
Rapporteur: Stephen Midgley

4.1.1 Summary of the discussion

'Good ecological status' is an important and complex concept for which many different views and arguments exist. Looking at it from a political versus scientific viewpoint leads to different conclusions on what is achievable. The group decided to be pragmatic about it.

Main goals for characterising the environment were identified as:

- an applied research programme to determine good ecological status
- a better understanding and a better knowledge of the process by which we define good ecological status
- better management and achievement of the 'good ecological status'

Currently, classification systems for some biological elements are being developed and monitoring data on environmental quality exist. However, the definition of ecological status is limited to information defined by certain interest groups and does not include 'public' measures. Compromises between stakeholders and researchers have to be made and an integration of social, political and economic aspects into environmental characterisation is needed. As a basis for this, public understanding of the WFD goals is still missing.

More specific gaps are mentioned including:

- an understanding of how changes in climate will affect 'catchment scale' processes,
- how aquatic ecosystems work and
- how multiple pressures affect them?

4.1.2 Main research questions identified and next steps

In the short-term, it is necessary to analyse what is known about 'good ecological status'. IWRM-NET can help by contributing scientific expertise.

The next important step is the development of methodologies that identify good environmental status and combine methods and insights from natural and social sciences, civil society and polity. Furthermore, drivers behind the concept of 'good ecological status' need to be identified. The latter questions should be researched after the first river management plan has been established (please see table 3 below).

Table 3: Main research issues and questions identified and next steps

Main research issues and questions presented in the plenary	**Timing and Next Steps**
Finding out what we know now about good ecological status including potential (S) (4 points)	- start as soon as possible - collect **scientific expertise** with help of IWRM-NET. Responsible **WP** needs to identified.
Develop methodologies that identify good status that combine methods and insight from natural and social sciences, civil society and polity (L) (8 points)	Not before first river management plan
What are the drivers behind the concept of good ecological status, as a process of dynamic interactions? (L) (5 points)	Not before first river management plan

S = short term, L = long term

Other relevant research gaps and research questions identified can be found in table 10 in appendix 3.

4.2 Group 2: Environmental Objectives

Chair: Lucila Candela
Rapporteur: Peter Allen - Williams

4.2.1 Summary of the discussion

Initial discussion by the group to define the theme of environmental objectives raised a broad range of objectives, ranging from very broad to very specific:

- IWRM as part of comprehensive resource management not only for water, but also energy, nutrient flux, social and economic aspects
- Communicating the benefits of achieving environmental objectives as part of wider sustainable development agenda to multiple interest groups and engage public interest
- integrating bio-diversity action plan targets and other legal EU environmental duties with water management at a landscape scale
- developing tools to support the delivery of the WFD programme of measures on the ground.

Some more specific questions discussed included:

- how to reduce the maximum concentration of NO3 in groundwater to 50mg/l?
- how to have reliable, site specific methods to link changes in flow due to abstraction with actual environmental damage?
- how to integrate environmental-physical based processes within river basin management?

A major deficit in this field is the lack of interdisciplinary approaches, combining the various social, technical, economic, ecologic and natural sciences. Detailed studies of NO3 leaching, the unsaturated zone and groundwater movement are missing as well. It is also important to understand the relationship between flow and ecology, based on appropriate data and site specific studies.

4.2.2 Main research questions identified and next steps

The following three, equally relevant, research questions emerged from the gaps identified;

- How can researchers get added value from different types of data sets? The task here is to seek out examples (short-term) for pilot integration of various data sets (mid-term).
- What is the appropriate amount to pay to achieve environmental objectives and how can ecological and sociological questions be integrated at basin scale? (short term)
- How can the concentration of nitrates in rivers be reduced? Much research on this question is already available. However, more research needs to be carried out related to quantitative effects of various measures on the concentration of nitrates in rivers.

It is expected that Work Package 4 will follow up on these questions and will also consult research managers within IWRM-NET to collect feedback (please see table 4 below).

Table 4: Main research issues and questions identified and next steps

Main research issues & questions presented in the plenary	**Next Steps**
Obtaining added value from different types of data sets – seek out examples to pilot the integration of various types of data sets. (S) Try to integrate them. (M) (6 points)	**Research Managers** within IWRM-NET will be approached in the hope that they are interested in these questions. **WP4** will follow up on it.
To identify the appropriate amount to pay to achieve ecological objectives. How do we integrate ecological and sociological objectives at a basin scale? (S) (5 points)	

What 'Programme of Measures' will achieve the objectives in shortest possible time? What are the quantitative effects of different POMs on NO3 concentrations in rivers and groundwater?(S) (5 points)	

M = medium term; S= Short term

Further relevant research gaps and research questions identified can be found in table 11 in the appendix 3.

4.3 Group 3: Pressures and Impact Assessment

Chair: Marc de Rooy and Kirsty Irving
Rapporteur: Marc de Rooy

4.3.1 Introduction

4.3.2 Summary of the discussion

The group compiled research gaps related to pressures and impact assessment and classified them according to whether they would have rather to be addressed by ERA-Net or by an EU funded project. The difference is that EU funded projects generate knowledge that is relevant over most of Europe, while ERA-Net works may be confined only to certain regions of Europe.

Gaps related to climate change with its pressures and impacts were identified. Here, especially scenarios for possible future changes are needed for specific regions, but which also account for socio-economic and governance changes, effects on infrastructure, water supply and groundwater.

Further research deficits include river restoration, effects of pressures and measures on ecosystems as well as full catchment analysis and causal links between land management, water quality and quantity in rivers, lakes and groundwater.

IWRM-NET could contribute by developing an interactive map of priorities showing the pressures and impacts for each country. This map could help to identify those countries that may be interested in working with each other. Furthermore, within IWRM-NET, 1-2 day meetings could be organised to address common issues.

4.3.3 Main research issues and questions identified and next steps

Research issues that were prioritised as 'high' by the group are:

- Changes in flood risk management
- Development of decision support systems (already taking place around Europe. System developers can learn much from existing experiences.)
- Climate change
- Methodology to assess the efficacy of measures.

The group expects that all research issues identified will be further developed by WP 2 and 3 and subsequently given to WP 4. Table 5 summarises research issues identified and next steps (please see table 5 below).

Table 5: Main research issues identified and next steps

Main research issues presented in the plenary	**Next Steps**
Changes in flood risk and flood risk management strategies (because of the hydro-morphological regime of WFD) (S) (6 points)	Contact **ERA-Net** CRUE to related research question.
Development of decision-support systems (S and L) (5 points)	ERA-Net, IWRM-NET could provide **meetings** to discuss research questions such as **DSS**

Climate change – regional models, carbon flux, effects on water supply. (2 points)	EU / ERA-Net
Methodologies to assess and prioritise the efficacy of measures for pressures (S) (3 points)	ERA-Net
	All: Further develop topics. Use these results as a starting point in **WP 2 and 3**

S = short term, L = long term

Further relevant research gaps and research questions that have been identified can be found in table 12 in appendix 3.

4.4 Group 4: Socio-economic Issues

Chair: Jean-Antoine Faby
Rapporteur: Natacha Amorsi

4.4.1 Summary of the discussion

The questions identified by this group were:

- How to apply the WFD? How much time is needed to do so?
- How to take into account 'value' in a cost-benefit-analysis?

The current situation is that socio- and economic research is separated and often focuses on financial questions and institutions not on persons with less financial power or social capital who do not have a voice.

The group identified the problem of interdisciplinary transparency of research. They recognised that more knowledge is needed about research being done in sociology and economics. Deficits in these fields also arise from different planning and participatory cultures. Furthermore, information is missing on what people know and think about water and how stakeholders can be involved as well as how to raise acceptance of measures being implemented in the frame of the WFD.

4.4.2 Main research questions identified and next steps

A relevant research question identified by the group is to find out how water can be valued according to, for example, hydrological and ecological considerations and institutional, collective and individual scales. It is important to find out in which way the historical and political context and the different perspectives of stakeholders involved can be taken into account and how participation should be enabled. In order to solve these research questions, an interdisciplinary approach is needed in which various sources of knowledge from various disciplines can be brought together.

All research questions mentioned should be addressed in the short term. Next steps include collation of a state of the art report of existing research and practises and production of a collective bibliography. The specific tasks have to be allocated at programme level (please see table 6 below).

Table 6: Main research questions identified and next steps

Main research questions presented in the plenary	**Next Steps**
How do we value water? (S) (8 points)	**State of the Art Report** (i.e.. collate existing research and practice, produce a collective bibliography, review and evaluate) Specific **tasks** need to be allocated at programme level (**very short term**)
How is all of this patterned by socio-cultural-historical contexts? (S) (4 points)	
How should participation be enabled, with whom? (S) (6 points)	

S = short term

Further relevant research gaps and research questions that were identified can be found in table 13 in the appendix 3.

4.5 Group 5: Monitoring and Indicators

Chair: Daniela Hohenwalder and Irene Huber
Rapporteur: Volker Mohaupt

4.5.1 Summary of the discussion

This group identified relevant research questions based on three objectives:

- Status assessment of water bodies
- Effects assessment (monitoring of effects of measures)
- Harmonisation of monitoring procedures around Europe

The monitoring systems for the WFD were set up in 2006 and have to be implemented in 2007. However, data sampling is often not followed immediately by data processing. There are also deficits the reliability of old monitoring systems.

Finally, there is still a lack of confidence in the data and the information and recommendations that can be drawn from them.

4.5.2 Main research questions identified and next steps

The main three research gaps identified by the group concern the lack of development and harmonisation of methodologies for biological monitoring. In the short- and long-term, a common typology and methodology for reference sites assessment should be developed. More knowledge about the connection between hydromorphology and biology is required in the short- and long-term. Here, the group perceives a need for experts in taxonomy. This was thus considered a task for universities. There is also a lack of methods for the assessment of several biological components. This research gap needs to be addressed in the short-term. Furthermore, there is the task of collecting and downscaling data and information for integrating them into models (short-term).

In order to address the research gaps identified, the group has already identified member states that may like to be involved in a call for proposals (please see table 7 below).

The group produced an Excel sheet showing their group results.

Table 7: Main research issues identified and next steps

Main research issues presented in the plenary	**Next Steps**
Lack of common strategy for typology and reference sites and methodology (4 points) (S and L)	Hungary, Germany and Greece. Should be a topic within the pilot call.
Hydro-morphology and biology interaction (3 points) (S and L)	Austria and Germany. Should be a topic within the pilot call
Lack of several methods for biological components (4 points) (S)	Hungary and Germany. Should be a topic within the pilot call
Transformation of data into information (3 points) (S)	Germany, Hungary and Greece. Should be a topic within the pilot call

S = short term, L = long term

Further relevant research gaps and research questions that have been identified can be found in table 14 in Appendix 3.

5 Appendix 1: Contact details of participants

Table 8: Contact details of participants

	Last name	First name	Organisation	Telephone	Email
1	Allen-Williams	Peter	Environment Agency, UK	+44 1522 785848	peter.allen-williams@environment-agency.gov.uk
2	Amorsi	Natacha	OIEAU		n.amorsi@oieau.fr
3	Andreu	Joaquin	Jucar Basin Agency		joaquin.andreu@chj.mma.es
4	Bauer	Heike	Federal Ministry for Research, Germany		heike.bauer@bmbf.bund.de
5	Blind	Michiel	RIZA	+31 320 298721	Michiel.blind@riza.rws.minvenw.nl
6	Bonnell	Mike	Ex UNESCO		m.bonell@cegetel.net
7	Boyiacioglu	Hulya	Dokuz Eylul University, Izmir		hulya.boyacioglu@deu.edu.tr
8	Candela	Lucila	University of Catalonia		lucila.candela@upc.edu
9	Barker	Ian	Water Resources, Environment Agency, UK		barkeic.Bristol1.HO@environment-agency.gov.uk
10	Hardiman	Nick	Royal Society for the Protection of Birds		rob.cunningham@rspb.org.uk
11	Delage	Didier	OIEAU		d.delage@oieau.fr
12	d'Rooy	Marc	RIZA		M.dRooy@riza.rws.minvenw.nl
13	Drumea	Dimitriu	Ministry of Environment and Natural Resources	+373 22 23 86 86	drumead25@yahoo.com
14	Ekstrand	Sam	IVL Swedish Environmental Research Institute	+46 8 598 56 345	sam.ekstrand@ivl.se
15	Euzen	Agathe	CNRS	+33 1 44 07 75 99	euzen@univ-paris1.fr
16	Faby	Jean-Antoine	OIEAU		ja.faby@oieau.fr
17	Gooch	Geoffrey D.	Linköping University, Sweden		geogo@eki.liu.se
18	Graham	June	Scottish Environmental Protection Agency, UK	+44 1786 452428	JGraham@sepa.org.uk

19	Guedet	Laurence	OIEAU, France		l.guedet@oieau.fr
20	Harris	Bob	Environment Agency, UK		bob.harris@environment-agency.gov.uk
21	Haubold	Herbert	Umweltbundesamt, Austria		Herbert.Haubold@umweltbundesamt.at
22	Hodgson	Susan	University of Sheffield, UK		S.Hodgson@sheffield.ac.uk
23	Hohenwallner	Daniela	Umweltbundesamt		Daniela.Hohenwallner@umweltbundesamt.at
24	Huber	Irene	Project Management Organisation Research Centre - Karlsruhe, Germany		irene.huber@ptka.fzk.de
25	Conesa-Alcolea	Ivan	IWRM-NET project officer, European Commission, DG Research		Ivan.CONESA-ALCOLEA@ec.europa.eu
26	Irving	Kirsty	SNIFFER, Scotland & Northern Ireland Forum for Environmental Research, UK		kirsty@sniffer.org.uk
27	Janák	Emil	North-Danubian Environment and Water Directorate		janak.emil@eduvizig.hu
28	Jöborn	Anna	IVL Swedish Environmental Research Institute	+46 31 72 56 212	anna.joborn@ivl.se
29	Kalinin	Mikhail	Central Research Institute for Complex Use of Water Resources	+375 17 264 05 23	Aliaksandr.Pakhomau@cricuwr.by
30	Barkham	Mary	Natural Environment Research Council, UK		maryb@nerc.ac.uk
31	Keto	Antton	Ministry of Environment, Finland		antton.keto@ymparisto.fi
32	Klöve	Björn	University of Oulu, Finland		bjorn.klove@oulu.fi
33	Lieutaud	Anne	Ministry of Ecology and Sustainable Development, France		Anne.lieutaud@ecologie.gouv.fr
34	Midgely	Stephen	SNIFFER		stephen@sniffer.org.uk
35	Mohaupt	Volker	Umweltbundesamt	+49 340 2103 2312	volker.mohaupt@uba.de
36	Nelson	Gabriel	DOENI, Northern Ireland, UK	+44 28 9262 3099	Gabriel.nelson@doeni.gov.uk
37	Neveu	Gilles	OIEAU, France		g.neveu@oieau.fr
38	O'Connor	Martin	C3ED ecological economics		Martin.O-Connor@c3ed.uvsq.fr
39	Oosting	Jolanda	RIZA, Institute for Inland Water Management and Waste Water Treatment, Netherlands		j.oosting@riza.rws.minvenw.nl

40	Past	Daniela	Umweltbundesamt, Austria		daniela.past@umweltbundesamt.at
41	Perger	László	National Water Centre and Archives, Hungary	+36 1225 44 60	perger.laszlo@ovf.hu
42	Catovsky	Sebastian	Defra, UK		sebastian.catovsky@defra.gsi.gov.uk
43	Smitz	J.	University of Liege, Belgium	+32 4 366 2353	j.smitz@ulg.ac.be
44	Solomenikova	Irina	Latvian Council of Science, Latvia		irina@lacis.lza.lv
45	Tahy	Agnes	National Water Centre and Archives, Hungary		tahy.agnes@ovf.hu
46	Thorne	Colin	University of Nottingham, UK	+44 115 951 5431	c.thorne@ntlworld.com
47	Vervier	Phillipe	ECObag, - Garonne Basin Research Programme, France		direction@ecobag.org
48	Vlaanderen	Niels	MWW, Ministry of Transport, Public Works and Water management, Netherlands		Niels.Vlaanderen@minvenw.nl
49	Kilroy	Garrett	Irish Environmental Protection Agency, Eire		g.kilroy@epa.ie
50	Genty	Aurelien	INERIS France		Aurelien.Genty@ineris.fr
51	Kossida	Maggie	National Technical University of Athens. Greece		m.kossida@chi.civil.ntua.gr,
52	Costache	Mihai	Ministry of Environment and Water Management, Romania		dga@mappm.ro
53	Conlan	Kieran	Cascade Consulting United Kingdom		kieran.conlan@cascadeconsulting.co.uk
54	Phillipson	Jeremy	University of Newcastle United Kingdom		Jeremy.Phillipson@newcastle.ac.uk
55	DeVial	Luke	UK Water Industry Research United Kingdom		Luke.DeVial@wessexwater.co.uk
56	Jacovella	Luce	University College London, UK		l.jacovella@ucl.ac.uk
57	Rascher	Karina	Seecon, Germany (Facilitator)		karina.rasche@seecon.org

6 Appendix 2: Table transcription – Objectives, current state and gaps mentioned in presentations

Table 9: Objectives, current state and research gaps mentioned in presentations

Objectives	Current state of research	Deficits / research gaps	Research questions
Preserve our riches; governance for sustainability	Water management models available Environmental standards developed Improving scientific knowledge	Analysis of cost efficiency of methods Lack of knowledge about effects of combinations of measures Improved observation and modelling needed Knowledge incomplete: Connectivity and interaction	What happens at the interfaces of environmental compartments? What are the cause-effect-relationships? What is the correlation between hydromorphological alterations and water-related ecological status?
		Deficits in modelling of priority substances Problems in modelling of pesticides, groundwater, fish populations	
	Acknowledgement of complexity in space and time	Embrace uncertainties Risk-based decision support tools	
		Transfer of knowledge to end users Developing management solutions Scientific support efficiency to be improved	How to ensure the implementation of measures?
		New ways of thinking needed, e.g. emission trading and purchase of private land Consider the full flow envelope (low, high, typical)	
		Pilot studies needed, Consider local conditions	
		Consider trans-national issues, the basin as a whole Lack of common data sets Integrated modelling frameworks needed	
Social learning	Lack of funding for stakeholder processes	Public participation Make use of collective intelligence Take socio-political context into account Take heterogeneity of actors into account Address environmental justice and social equity Lack of sociological research of relevance to IWRM and WFD	How does society value water? What are performance criteria for good collective action? Who are the stakeholders?
Interdisciplinary research	Multidisciplinary workshops are set up Participants have diverse objectives and background Disciplines working on different scales Lack of long-term horizon	Build capacity for long term interdisciplinary research Strategic co-operation between funding bodies Sufficient time for project management Take time to think and choose approaches	
		Guidance for project assessment Lack of breadth of understanding and experience of assessors Need for clear separation of peer review and assessment of a project's interdisciplinary construction	Should we follow interdisciplinary approaches in every research project?

7 Appendix 3: Table transcriptions - Results of Group Work

7.1 Group 1: Characterising the Environment

Table 10: Results of Group Work 1

Objectives	Current State of Research	Deficits / Gaps	Research Questions and Issues	Number of Points	How can IWRM-net help?
	Groundwater – 'bad' surface water – 'good' water ecosystems - 'bad'	Efficiency of the pollution reduction measures (monitoring network)	Can we have a pragmatic and operational compromise of GES		
		Integrating social, political and economic aspects into environmental characterisation			
	Intercalibration exercise for some biological elements	We cannot quantify the flux of pollutants and how they are modified during transport through a catchment, e.g. how much NO3 in groundwater is attenuated before entering the river.	What affects achieving good ecological status (obstacles)?	1	
	Development of classification systems for some biological elements	'good' for the ecological point of view?			
		Ecological risk and human ability to manage risks needs to be studied together			
		Is good ecological status a definition of environmental science, social science or political science?			
Applied research programme to determine good ecological status	Ecological status - limited to info: on fish as defined by anglers catches and surveys of invertebrate species - no 'public' measure of worth	We have little understanding how aquatic ecosystems work and thus do not know how multiple pressures affect them.	What pressures act in combination? Measuring the interaction between pressures	3	
		Effects of cumulative pressures on ecology			
Better understanding and knowledge of the process by which we define good ecological status	Monitoring of data on environmental quality. Is it enough for quantification?	Ecological aspects of sediment transport changes	What do we know now about GES, including potential? i.e. baseline survey.	4	
		Process understanding of the transfer/ residence times of agri-chemicals in basins (non-point pollution)	What are the social, political, economical, ecological and drivers of GES	4	
			What are the drivers behind the concept of GES as a process of dynamic interactions	5	
To better manage and achieve good ecological status	Using existing databases and scientific research - can we 'quantify' good ecological status.	How will changes in climate affect 'catchment scale' processes?	Develop methodologies that identify 'good status' that combine methods and insights from natural science, social science, civil society and polity.	8	
		Organising the evaluation and funding of basic and applied research projects			
		Valuation of economic flows (environmental services) of IWRM actions in basins	Processes and interactions across the eco-hydrology surface-GW interface to better quantify GES	2	
	Compromise between researchers and stakeholders	Public understanding of WFD goals – why bother?			
	More proposals for the development of the sciences and research priority areas (ecology, climate)	Hydromorphology and ecological dependencies	Estimation of water volumes for ecologically safe water use for trans-boundary gauging stations on the rivers.		
		How does hydro-morophology affect ecological status?			

7.2 Group 2: Environmental Objectives

Table 11: Results of group work 2

Objectives	Current State of Research	Deficits / Gaps	Research Questions and Issues	Number of Points	How can IWRM-NET help?
To develop tools to support the delivery of WFD programme of measures on the ground	Very varied				
How to reduce the maximum (peak) concentration of NO3 in groundwater to 50mg/l	Some people looking at crops, others the unsaturated zone, others at the groundwater	Detailed studies from NO3 leaching, unsaturated zone movement, groundwater movement. Looking at by-pass flows from peaks too. Effectiveness of different programmes of measures with above model.	What programme of measures will achieve objective in soonest possible time? What are the quantitative effects of different POMs on NO3 concentrations in rivers groundwater? (S)	5	
How to have a reliable, site specific method to link change in flow due to abstraction to genuine environmental damage	CAMS/UKTAG look up tables - but based on 'opinions', 'not site specific'	Relationship between flow and ecology based on appropriate data and site specific studies	If appropriate data and site specific studies can't develop a clear relationship there can't be much of an issue. Short (3gr) site-specific studies. (S)	2	
			How to integrate ecological and socio-economic objectives at a basin scale.	5	
Integrate bio-diversity action plan targets and other legal EU environmental duties with water management at a landscape scale			How to set environmental objectives to hydro-morphological pressures in WFD. (S)	3	
Communicate benefits of achieving environmental objectives as part of wider sustainable development agenda, to multiple interest groups. Engage public interest.			What techniques do we need to monitor (collect and analyse data)		
IWRM as comprehensive resources management. Not only for water but energy, nutrient fluxes, economical aspects as well		Inter-disciplinary approaches not only looking at data, providing technical solutions modelling future scenarios, but combining social, technical, economic, ecological and natural science approaches	Integration of knowledge (data management) How to integrate data and models from different sources efficiently? (L)		
To integrate environmental-physical based process in the basin management.	Still to be defined for some catchments. Not clear in some SW areas	Lack of data (knowledge of process) for good definition of final objectives.	Seek out examples to pilot integration of different types of data sets. (S) Try to integrate them. (M)	6	
			How does 'modelling' of integrated data sets at different scales affect decisions as to programmes of measures that should be used towards WFD? Research advanced for e.g. FRM but not for integrated data.		

7.3 Group 3: Pressures and Impact Assessment

Table 12: Results of group work 3

Objectives	Current State of Research	Deficits / Gaps	Research Questions and Issues	Number of Points	How can IWRM-NET help?
	EU / ERA-Net	scenarios for possible future rivers lakes and estuaries and coasts, accounting for climate & socio-economic & governance changes	Carbon flux in soils – how to influence it with water?	2	interactive map of priorities (pressures, impacts and contacts)
	EU?	Regional climate change models with better certainty about effects on water management (storms)			Specific meeting on common issues
	EU?	Climate change effects on infrastructure, water supply and groundwater	Effect of extremes on low and high flows in different landscapes/land-use		
		Pressure: hydrological changes due to climate land-use change - Impact: morphological damage to rivers and estuaries (L)	Pressure: hydro-morphological requirements of WFD - Impact: changes in flood risk management strategies	6	
	EU	Suitable monitoring to answer the specific questions	To reach an acceptable level of uncertainty in pressure/impact results to invest in action	2	
	-		How to identify effects of hydropower and eutrophication on ecological status	1	
	ERA-Net	River restoration: how? benefits? implementation	Improve understanding of the interactions of different pressures on aquatic ecosystems (L) Develop methodologies to assess and prioritise the efficacy of measures for pressures		
	ERA-Net	Cumulative effects of pressures (S + L)			
	ERA-Net	Effects of measures on ecosystems		3	
	ERA-Net	Cause and Effect of measures – to include 'in combination' effects			
	ERA-Net	inter-intra catchment continuity	Development of Decision Support Systems (DSS) as tools: integrate different aspects increase understanding transfer of knowledge assessment of alternatives 'common vision of the system' for participation, negotiation and consensus building assessment of risk and uncertainties	5	
	ERA-Net	assessment of scale - reach to catchment interpolation			
	ERA-Net	Full catchment analysis			
	ERA-Net	Development of integrated catchment model using suitable level(s) of complexity			
	ERA-Net	Causal links between land use management and water quality and quantity in rivers, lakes and ground water			
	ERA-Net	Multiple task management flood – water quality – land use			

7.4 Group 4: Socio Economic Issues

Table 13: Results of group work 4

Objectives	Current State of Research	Deficits / Gaps	Research Questions and Issues	Number of Points	How can IWRM-NET help?
How can I apply the WFD? How much time do I need?	Adaptive management and learning	Planning cultures, participatory cultures... cross-national research	How do we value water? (how is the WFD being understood by different stakeholders in different national contexts?)	8	
		How to participate (method)? How to value the impact? Evaluation of behaviours?	How do we intervene? What tools what impacts?	2	
		Acceptance of measures (as implemented by WFD)	How should the institutions be structured / organised?	3	
		What do people know or think about water?	How is all of this patterned by socio-cultural-historical contexts?	4	
		Which water perception? Which stakeholders?	How should participation be enabled? Who? How?	6	
	Being poor (or lacking in social capital) means you don't have a voice	Ecosystem services and other social theories			
How to take into account 'value' in a CBA?	Socio and economics research separated	What counts as 'good'? And who will get to decide? Preferences of Ecosystem who decides? Water pricing	How to apply methods and tools to analyse environment and society - CBA. How do we characterise the environment?	3	State of the Art e.g. collate existing research and practice e.g. produce a collective bibliography e.g. review and evaluate
	International river basins - several social, economical status	Institutional structure / organisation	Risk management for all stakeholders	3	
	Benefits of WFD	Power relations, conflict resolution			
	Socio-economics usually means just economics (money)	What about public participation?	Deliberation support tools for assessing IWRM options against multiple bottom lines		
	Balance of measures - regulation, voluntary information, education, economic measures, how affected by social context?	How best to organise stakeholder dialogue and participation? Expressing values, valuing diverse	Whose knowledge will be valued? And what values will inform knowledge production?		
		Stakeholder validated descriptions of the distributional significance of IWRM options.	What makes knowledge (of different sorts) pertinent to societal needs – and who decides)		
		Economics modelling - integrated models, simple models as decision-support tools	State of the Art: Examples of effective use of maps and spatial modelling for highlighting trade-offs of policy options		
	State of the art? Experiences of success in bridging gaps in communication between different 'epistemic communities'	Gap: Documentation of best practice with simple economic analysis that can highlight the tensions and trade-offs between multiple societal objectives	State of the Art: Assess use and effectiveness of deliberation support tools for multi-stakeholder assessment of IWRM options		

7.5 Group 5: Monitoring and Indicators

Table 14: Results of group work 5

Objectives	Current State of Research	Deficits / Gaps	Research Questions and Issues	Number of Points	How can IWRM-NET help?
Water body/-ies status assessment	Monitoring systems in operation in 2007	Eligibility of existing networks (S)			Turkey and Hungary
		Confidence and precision of data and recommendations (WISE requirements) (S)		2	
	Data sampling often not followed by immediate data processing	Combine the WFD monitoring with the development of new sets of indicators (L)			Greece
		Frequency of spatial resolution (water body grouping) (S)			
		Transformation of data in information? (S)		3	Germany, Hungary and Greece
		Upstream-downstream relations (S)		1	
		Need for trans-boundary monitoring sites (S)		1	Germany
Measurements - effects - assessment	Analysis of emerging new PS (except e.g. for C8-C12, bro-mated flame retardants,...)	Environmental objectives for hazardous substances in marine and coastal regions in sediments and biota (L)		1	Hungary, Greece
		Lack of common strategy for typology and reference sites and methodology (S) -> (L)		4	Hungary, Germany, Greece, Turkey
		Lack of several methods for biological components (see intercalibration tab. e.g. FISH) (S)		4	Hungary, Germany
Harmonisation of monitoring procedures around Europe	Results from ECOSURV project	Hymo-biological interaction (S) -> (L)		3	Austria, Germany
		Need for taxonomy (diatomes...) and experts (L)			
		Downscaling satellite meteor data for integration into models (S) -> (L)		1	Greece