Strategic analysis between research programmes and partners of IWRM-net

IWRM-Net is funded under the ERA-Net scheme within Framework programme 6 Directorate General for Research in the European Commission.

Contract number ERAC-CT-2005-026025

IMPRINT Jun 2010

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Thematic priority: Integrated water resource management

Deliverable : 2.6 & 2.7

Due date of deliverable:

Actual submission date: Jun 2010

Start of the project: 1 January 2006

Duration: 5 years

Project co-funded by the European Commission with the Sixth Framework Programme (2002-2006)		
Dissemination level		
PU	Public	yes
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services).	
CO	Confidential, only for members of the consortium (including the Commission Services).	

Acknowledgements To all members of the IWRM.Net General Assembly who assisted in providing information on their respective countries.

Cover photographs From left to right – Malta Coastline, Killin Falls Scotland, Water of Leith, Scotland, - all ©Trevor Elliot.

Introduction

This paper is a subjective analysis of the research and knowledge gaps from the various initiatives undertaken by SNIFFER in the delivery of its work package. From this information 2 joint calls have been developed.

THE IWRM ERA-NET PROJECT

IWRM-Net is working towards trans-national collaborative research calls. The first call was launched in November last year and we have selected 3 trans-national projects for funding. The themes of the call were hydro-morphology and water governance. The next stage in the project is investigating in more detail the research needs for a second joint call. This will be towards the end of 2009 with the projects starting during 2010.

Opportunities for shorter timescale research may also present themselves to delegates through the IWRM-Network and the partners have agreed to provide information such as current research across Europe, joint call principles and draft legal agreements but IWRM-net is unlikely to be able to provide administrative support (i.e. a secretariat) for smaller calls due to resource constraints.

IWRM-Net has available a database of research related to integrated water resource management and a knowledge management tool for analysis of the database. For more information visit the IWRM-Net website or contact Laurence Guedet of the International Office of Water. (l.guedet@oieau.fr)

IWRM-Net currently classifies research programmes in the database using two systems. The first uses thematics developed by the International Office for Water that relate to IWRM, such as socio-economics or water and land planning. The second is based on the various articles within the Water Framework Directive, such as programme of measures or sociology and public participation. SNIFFER has recently started to investigate the more detailed classifications created by the CIS working group in 2005 that looked at knowledge gaps the WFD. The three classification systems have been used for analysis of gaps in knowledge.

Regional Workshop for collaborating on IWRM Research: Eastern Europe and the Danube region

AIMS

To discuss the research needs within Romania, Hungary, Germany and Austria along with potential partner countries in the region and to include (but not exclusively) the following topics:

I: **SURFACE WATER** (ORGANIC AND NUTRIENT POLLUTION)

II: **SURFACE WATER** (HYDROMORPHOLOGICAL ALTERATION)

III: **SURFACE AND GROUNDWATER** (HAZARDOUS SUBSTANCES POLLUTION AND GROUNDWATER QUANTITY)

PRESENTATIONS

As listed above the first session was hydro-morphology, the second was pollution and the third was groundwater. Before each session there was a presentation to introduce the topic. The presentations were not focused but provided an overview of a range of issues. The presentations can be found at www.iwrm-net.eu

NATIONAL ADMINISTRATION 'ROMANIAN WATERS', scientific priorities.

- Link between water management objectives for Danube and environmental objectives for Black Sea (especial for nutrients and priority substances).
- Looking at by-pass flow from peaks for effectiveness of different programmes of measures
- Develop methodologies to assess and prioritise the efficacy of measures for pressures - the impacts of measures identified in the river basin and the efficiency of the pollution reduction measures
- Financial analysis concerning implementation / financing of measures at the basin / national level – the impact of measures on economic sector
- Improving the operating tools for management and the utilisation of disproportionate cost.

Surface Water Bodies at risk:

- 224 (9,5 %) at risk; 128 (5,5 %) possibly at risk; 1995 (85 %) without risk from the point of view of organic substances;
- 290 (12,3 %) at risk; 171 (7,3 %) possibly at risk; 1886 (80,4 %) without risk from the point of view of nutrients;
- 56 (2,4 %) at risk; 77 (3,3 %) possibly at risk; 2214 (94,3 %) without risk from the point of view of priority substances/priority hazardous substances;
- 492 (20,9 %) at risk; 364 (15,5 %) possibly at risk; 1491 (63,6 %) without risk from the point of view of hydromorphological alterations;

- 639 (27,2 %) at risk, 370 (15,8 %) possibly at risk; 1338 (57 %) without risk from all risk categories point of view.

Dr. eng. Daniela RĂDULESCU, Director, National Institute of Hydrology and Water Management and Dr. eng. Andreea GĂLIE, National Administration "Apele Romane", member in HYMO TG-ICPDR presented on hydro-morphology issues. The Romanian National Report 2004 on risk analysis showed that the hydro-morphological changes are one of the most important pressures resulting in a high percentage of SWBs probably failing the good ecological status.

- **Transversal river works: *Weirs , sills***
  - **Effect** : on hydrological regime, on sediment transport and migration of biota
- **Transversal river works: *Dams, reservoirs***
  - **Effect** : on the flow downstream reservoir and biota
- **Longitudinal river works*: Embankments, …***
  - **Effect** : on lateral connectivity, the foodplain vegetation and spawning habitat
- **Longitudinal river works: *Banks regulation / consolidation works***
  - **Effect** : on river longitudinal profile, on substrate structure and biota
- **Navigation channels**
  - **Effect** : on bed stability and biota
- **Water intakes, discharges, river derivation**
  - **Effect** : on the low flow, bed stability and biota

Mr Harry Vermeulen talked about the SNOWMAN project and the soil and groundwater priorities

- **Energy and climate change,**
- **Sustainable water management,**
- **Sustainable agriculture,**
- **Sustainable urbanisation.**

From these main issues the presentation focused on sustainable water management. The issues listed below were presented as the sub-themes within sustainable water management;

- **Retention and flooding,**
    - Capacity, how to increase?
    - Effect of flooding on soil quality
- **Groundwater quality,**
    - Effects of land use, emissions, diffuse pollutants
- **Soil as a water filter,**
- **Water management strategies,**
- **Sediments.**

The presentation then listed the following issues as examples of specific issues within European countries.

- Pollution of groundwater from mining activities
- Pollution of groundwater from related chemical industries
- Redevelopment of old industrial sites in urban areas
- Redevelopment of abandoned army sites

Session 1: Hydro-morphological alteration

Group 1;

Knowledge on ecological status

- Definition of good ecological status (to set up the boundaries among the five classes);
- Good monitoring data to produce data through WFD compliance methods (confidence in data, access to data);
- Biological, chemical-physical and hydro-morphology – linkage to reach good ecological status;
- Ecological status for temporary streams (*agreement with the Valencia workshop priorities*);

- Links between sediments in the Danube river and coastal erosion;
- Linkage between discharges and status – link to environmental flow (related to points 1.2 and 1.3 from background document).

(1.2) Better understanding and knowledge of the processes by which we define good ecological status?

- What are the drivers behind the concept of GES as a process of dynamic interactions i.e. is good ecological status a definition of environmental science, social science or political science?
- Develop methodologies that identify good status that combine methods and understanding from natural, social and political science.
- How can we improve the incorporation of public worth and social values into the definition of ecological status

(1.3) To improve our understanding of the hydro-biological interaction

- Improve our understanding of the relationship between flow and ecology based on appropriate data and site specific studies
- Practical Ecological Flow Definition
- What are the drought effects in wetlands and the relationship with stream ecology (*agreement with Valencia workshop*)
- Fish migration facilities (for extreme heights);
- Interrelation between river ecosystem and other terrestrial ecosystems;
- Quantification of monetary benefits of hydro-morphological measures under WFD (*agreement with Germany, according to background documents*);
- Rehabilitation of navigation routes – ecological friendly solutions;
- Improve our understanding of how the Hydro-Morphology regulations of the WFD impact on flood risk management strategies.

Group 2;

Climate change –

- How will climate change affect hydrology (high/low flow amplitude, frequency, and seasonal / annual variability)?
- How will rising sea levels, altered flow regimes and sediment transport affect coastal areas (deposition or erosion, management) and ecosystems (changing salinity)

- Erratic Flows –
- How can seasonal changes in erratic flow be managed (e.g. storage capacity, aquifer recharge)?

Hydropower –

- How do size and character of reservoirs effect water quality (e.g. temperature, oxygen saturation), sediment transport (e.g. reservoir flushing) and aquatic organisms?
- How can impacts of residual flows be assessed, how do they affect river restoration programmes?
- How can impacts of hydro-peaking (quick fluctuating flow levels) be assessed, how do they affect river restoration programmes?
- How can trans-boundary management issues be solved (e.g. residual flow, hydro-peaking)?
- How does river bed degradation affect the management (e.g. restoration) of hydro-morphological issues (e.g. floodplain connectivity)?
- What solutions can be applied for up- and downstream migration of fish, especially at large obstacles (e.g. sturgeon passage at the Iron Gate)?

Management of River basin/flood plain

- How can priorities be defined in river basin / flood management (e.g. priority habitats, priority economic drivers)?
- How can impacts on ecosystems from economical drivers (e.g. improved navigation routes) be avoided or limited?

What are the benefits of re-establishing functional aquatic ecosystems, how can they be evaluated financially (e.g. tourism and nature benefits for communities)?

HMWB

- What are the impacts of HMWB on GEP?
- What are the links between social benefits and ecological improvements?
- How do you undertake a catchment-based approach for HMWB (e.g. transboundary issues)?
- How can be the decision-making on HMWB or not be supported (e.g. designation process)?

Reference Conditions

- How can the WFD and assessment tools keep up with changing knowledge (e.g. taxonomical or bio-geographical issues)

- Not specific to pollution topic but of value in group
- How can/may new pollutants or species (native, non-native) be integrated into reference conditions and assessment tools?
- What timelines shall/may be applied for defining reference conditions when historical data are lacking – basin-wide comparability?

Session 2 - Organic pollution, Nutrient pollution:

Group 1

Identify origin of the organic and nutrient pollution (diffuse, point sources or others) – based on measures – and than based on that to apply cost effectiveness measures;

Scenarios of organic and nutrient pollution reduction – models to size the effect of the measures of the programme of measures (in PoM);

How to evaluate the cost effectiveness of the measures – to evaluate the financial impact of the measures on social and economical sectors (which economical indicators related to environmental indicators are appropriate to assess the impact of the measures on social and economical activities); -i.e. economical indicators/cost effectiveness/ cost recovery/investment affordability

Methodologies for cost benefit analysis – for nutrient pollution from agricultural sources (buffer capacity of soil, content of nitrate in soil, linkage with groundwater, how measures affect the environment;

Tools for improving of technologies - free of phosphates detergents (research in production process, research and development in wastewater treatment); tools for improving of the best available technologies in Scientific research for linkage, impact between environmental objectives for pollution for Danube River and for Black Sea.

Group 2

Integrated Management of nutrient pollution

- How do you integrate management of nutrient pollution with biology, chemistry, physical aspects
- Integration with other disciplines

Waste Water Treatment Directive

- Development of next programme of investment for organic/nutrient pollution
- Costs to deal with these issues?

PREVENTION BETTER THAN CURE

- How can we change industry/agricultural practice to reduce the input of pollutants into the environment, improving management and efficiency of use of nitrates.

MANAGING EUTROPHICATION

- Specifically for lakes and coastal waters there is a need to improve the ability to specify the cause and develop new techniques and technologies to manage eutrophication.

GUIDELINES for NUTRIENT POLLUTON

- Specific to typology e.g upper and lower reaches of a river
- Support of intercalibration process

GROUNDWATER

Groundwater should not be separate from surface water for management purposes and there were a number of aspects that require short-term research;

- Dealing with contamination (modelling and planning)
- Soil buffer capacity against contamination (filtration capacity)

Session 3, Groundwater, soils and Hazardous Pollution

Group 1

- Aquifer recharge and aquifer discharge – tool for identification, tool for pollution migration (dispersion);
- Methods for estimation of the background content (metals, oil, hazardous substances, nitrate) and of the anthropogenic input;
- Research for establishing soil buffer capacity for pollutants (*agreed on Valencia priorities);*
- Tools for better estimation of soil buffer capacity on priority pollutants in the recharge areas of the groundwaters
- Creation of an integrative database for unsaturated and saturated soil zone (cover soil) including pF (retention), porosity, structure

(10.1) Integration of groundwater with related fields

- Some people looking at crops, others the unsaturated areas, and others groundwater.
- Better understanding of the processes and interactions across the eco-hydrology surface-GW interface to better quantify GES

(10.2) Improve our understanding of the processes involved in the transfer/residence times of agro-chemicals in basins. Non-point sources pollution

(10.3) Improve our understanding of carbon plus in soils, how to influence it with water effects on extremes on low flows in different landscapes/land-use, climate change on infrastructure, water supply and groundwater

(10.4) Groundwater Quantity

- Drought and drying out of areas for a variety of reasons can cause ecological problems and the oxidation of peats and soil-setting. Finding cost-effective measures to deal with this problem requires further research.
- In mitigating the drought water can be used to flood dry areas, but the ecological consequences of using water from outwith the region are little understood.
- Also there are currently no clear definitions for arid/parched/drought areas and thus little effective mapping of these areas.

Group 2

The discussion started with a discussion on development of storage capacity for erratic flows, for example low flows in summer and the use of aquifers as a means of storage.

Shallow Aquifers and stagnant water

- How to delineate territory for leaving stagnant waters for the ecological benefits
- Improve understanding of how decisions are integrated into planning system

Natural Contamination of Aquifers

- Drinking water directive
- How to achieve the European standards
- Managing over abstraction (by industry and agriculture etc domestic?)

Highly polluted areas (Groundwater)

- Movement of pollutants through soil and groundwater
- Assessing the effectiveness of measures
- How do you stimulate chemical/physical changes
- Developing new management strategies

ARSENIC removal from groundwater relating to the Drinking Water Directive

- Research needed on techniques and the improvement of the cost effectiveness of these techniques - how much money can you afford to spend on removal?

HAZARDOUS pollutants

- Improve our modelling of hazardous substances in time and space integrating both surface and groundwater combined.

SUMMARY OF THE PLENARY SESSION

One issue raised that was not part of the themes presented was the management of non-native species, for example under which circumstances should non-native species be considered as substitute for native species (e.g. biodiversity, biomass) and thus be integrated into WFD assessment tools? and how do invasive non-native species affect native bio-coenosis and thus prevent from achieving a good ecological status?

The plenary session combined the two groups research needs listed where there was an agreed overlap.

The final list of research needs presented to the INBO delegates is within annex 1. The prioritised list was then summarised into the format seen below.

In the responses from the EURO INBO delegates the needs were prioritised and also again where overlap was present the issues were brought together.

PRIORITISATION OF THE SUMMARY RESEARCH NEEDS

The delegates came up with the following prioritisation of issues that were listed from the working groups. The subjects were taken as the areas where there were common issues within the three groups and provide a summary of the research needs.

Headline research themes	Votes
Integrated Pollution management *(incl)* Hazardous Pollution, Aresenic in Groundwater	9
Management of River basins and floodplains	9
Good Ecological Status	7
Hydro-power	6
Reference Conditions	6
Integration of Socio-economic and environmental evaluation	5
Groundwater Management	5

ANNEX 1: Questionnaire presented to EURO-INBO delegates.

Identified Research Needs from IWRM-Net Sibiu research workshop

The topics listed below represent the priority subjects proposed by the delegates at the IWRM-Net workshop on the 1st October.

These subjects will be taken forward and considered by the IWRM-Net partners for subjects within the second call to be launched in late 2009.

We are now inviting INBO delegates to review the topics listed and vote of the three main topics they believe are of high importance. If you wish to place your three votes (ticks √) for one subject this is OK, but you are requested to use just three votes per person.

IWRM-net would like you to vote for the headline issues and the bullets below are for guidance on the issues associated. The debate will continue at www.iwrm-net.eu

Research Topic	tick
Definition of good ecological status • How does the Biological, chemical-physical and hydro-morphology interact to define good ecological status;	
Hydro-morphology • How will climate change affect hydrology (high/low flow amplitude, frequency, seasonal/annual variability)? • How will rising sea levels, altered flow regimes and sediment transport affect coastal areas (deposition or erosion, management) and ecosystems (changing salinity) • Links between sediments in the Danube river and coastal erosion;	
ERRATIC STREAMS • the storage capacity, managing seasonal change and aquifer recharge • Ecological status for temporary streams	
Hydropower • How do size and character of reservoirs effect water quality (e.g. temperature, oxygen saturation), sediment transport (e.g. reservoir flushing) and aquatic organisms? • How can impacts of residual flows be assessed, how do they affect river restoration programmes? • How can impacts of hydro-peaking (quick fluctuating flow levels) be assessed, how do they affect river restoration programmes? • How can transboundary management issues be solved (e.g. residual flow, hydro-peaking)? • How does river bed degradation affect the management (e.g. restoration) of hydro-morphological issues (e.g. floodplain connectivity)? • What solutions can be applied for up- and downstream migration of fish, especially at large obstacles (e.g. sturgeon passage at the Iron Gate)?	
Management of River basin/flood plain	

• How can priorities be defined in river basin / flood management (e.g. priority habitats, priority economic drivers)? • How can impacts on ecosystems from economical drivers (e.g. improved navigation routes) be avoided or limited? • What are the benefits of re-establishing functional aquatic ecosystems, how can they be evaluated financially (e.g. tourism and nature benefits for communities)?	
HMWB • What are the impacts of HMWB on GEP? • What are the links between social benefits and ecological improvements? • How do you undertake a catchment-based approach for HMWB (e.g. transboundary issues)? • How can be the decision-making on HMWB or not be supported (e.g. designation process)?	
Reference CONDITIONS • How can you develop reference conditions that can adapt to new pollutants and invasive species, that also take into account lack of historical data	
Integrated Pollution Management • Development of scenarios and models to understand the effectiveness of programmes of measures. • Link the above to financial impacts and socio-economic indicators and investment programmes for Waste water treatment • Methodologies for cost benefit analysis – for nutrient pollution from agricultural sources	
GUIDELINES for managing NUTRIENT POLLUTON & Eutrophication • Make them specific to typology e.g upper and lower reaches of a river • Scientific research for linkage, impact between environmental objectives for pollution for Danube River and for Black Sea. • Specifically for Lakes and coastal waters we need to improve our ability to specifying the cause • Develop new technologies and techniques for dealing with eutrophication	
Aquifers recharge and aquifer discharge • Develop a tool for identification, tool for pollution migration (dispersion); • Relating to the drinking water directive, how can members states achieve the European standards if well below natural contamination levels	
Improve our groundwater management capabilities • Improve Modeling and planning methods • Develop methods for estimating background pollutant content • Creation of an integrative database for unsaturated and saturated soil zone (cover soil) including pF (retention), porosity, structure • Improve our knowledge of the movement of pollutants through soil and groundwater • Assessing the effectiveness of measures to reduce pollution • How do you stimulate chemical/physical changes to reduce pollution	

• Developing new management strategies to deal with the above issues	
ARSENIC removal from groundwater • Relates to DWD, Research needed on techniques, how much money can you afford o spend on removal?	
HAZARDOUS pollutants • Improve our modeling of hazardous substances in time and space, integrating both surface and groundwater	

Regional Workshop for collaborating on IWRM Research: Southern Europe and Mediterranean region

AIMS

To discuss the research needs within Spain, Portugal, France, Italy, Greece, and other similar countries and to include (but not exclusively) the following topics:

- **The development of decision-support systems**
    - for transfer of knowledge
    - for integrating different aspects of water management
    - for assessment and comparison of options
    - for participation, negotiation and consensus building
- **water scarcity and managing extreme events**
    - ephemeral streams
    - critical drought situations

There are already a number of groups working in the region and these include the EMWIS group whose priorities are agreed by the EUROMED Water Directors. The group has organised a number of conferences which are listed here;

- Extreme Phenomena (Water Scarcity, Drought and Flooding)
- Non-conventional water resources (wastewater reuse, desalination)
- Sanitation and domestic pollution
- participatory approach in IWRM

EMWIS also proposes the importance of horizontal themes, which can work on a Pan-European basis, but their focus is on the Mediterranean region;

- Strengthening institutional capacity and training
- Exchange of Information and know-how
- Implementation of national information and regional information systems
- creation of an observatory of data and indicators at the regional level

The MEDA-Water programme is also working on similar areas that are suggested as areas for further development and support;

- Integrated management of local drinking water supply, sanitation and sewage
- Local water resource and water demand management (quality and quantity) within catchment areas and islands
- Prevention and mitigation of the negative effects of drought and equitable management of water scarcity
- Irrigation water management

Another group involved in water activities in the region, The Global Water Partnership - Mediterranean (GWP-Med) works on a number of themes and promotes action by facilitating a number of processes/initiatives in the Mediterranean Region. Indicatively these include:

- Promoting awareness and facilitating action towards sustainable water use and IWRM
- Enhancing the establishment of a water partnership across the Mediterranean
- Promoting wide stakeholder involvement and interaction (including national authorities, civil society, private sector, donor community)
  Stressing the interface between IWRM and climate change, with particular focus in the Mediterranean
- Exploring the interaction among the different water uses-users and the need to include other sectors of the national political economy in the IWRM planning and implementation process
- Facilitating the work of the Mediterranean Component of the EU Water Initiative (MED EUWI) by running the Initiative's Secretariat

- Leading the IWRM Component of the GEF Strategic Partnership for the Mediterranean
- Acting as the technical facilitator of the Petersberg Phase II/Athens Declaration Process, dealing with transboundary water resources management in Southeastern Europe
- Facilitating the Rabat Process on National IWRM Planning in the countries of North Africa

Finally the EU has set up an expert group on the subject of Water Scarcity and Drought that has the following themes to discuss;

- Identification of the extent and magnitude of the problems: zones concerned by water scarcity and droughts, causes of these phenomenon and their impacts (social, economic and environmental);
- Identification of the size of gaps in the EU legislation to address WS&D (prevention and mitigation measures)

All these current work areas will be considered when developing the research needs for this group.

PRESENTATIONS

Joao Lobo-Ferreira from the National Engineering Laboratory (LNEC) in Portugal introduced two projects that are currently underway. The first was 'Groundwater reserves increasing using artificial recharge for extreme droughts in ASEM countries'. And the second investigated the effects on water due to forestry and climate changes.

Tiago Capela Lourenço from the Faculty of Sciences at the University of Lisbon presented the CIRCLE ERA-net **CIRCLE´s Group Approach to Collaborative Project Calls.**

Teodoro Estrela from the Spanish Ministry of the Environment, Rural and Marine Affairs presented the current projects underway and **short term research needs in Spain.**

Eleftheria Sofialea from the National Technical University of Athens in Greece presented '**managing drought and water scarcity**'.

RESULTS FROM WORKING GROUPS

Group 1

After a short presentation of the ERANET initiative and the IWRM.net to the participants, two rapporteurs (Galbiati and Brouma) were appointed. Also one more participant (Prof Sahuquillo, UPV) was invited to participate in the discussion group. Participants were asked

for specific subjects to address water research in the Southern Europe and Mediterranean region, considering their different points of view (administration and researchers).

Proposed topics broadly ranged from DSS research needs for IWRM, climate change impacts in water bodies with special emphasis in groundwater and considering quantity and quality, through the problem of water scarcity and extreme events (floods and droughts) as per WFD implementation and groundwater sister directive.

The group discussed in more detail the following broad needs: droughts, water scarcity (management oriented) and use of non-conventional resources as a very specific problem in the region; analysis and definition of ecologic flow regimens (rivers are heavily modified, being the majority ephemeral): how to develop tools for society involvement, acceptance and adoption of decisions. Regarding climate change research (short and long term) methodologies on extreme events and efficiency of water use, water management and governance are needed.

Research priority areas (short-medium term):

- IWRM implementation tools
- Consider trans-basin/trans-boundary basins management
- Climate impacts and adaptation measures (quantity and quality)
- Methodology development for droughts and floods
- Methodologies for surface-groundwater interactions including the ecological aspects
- Research needs in hydro-morphology & ecology
- Society involvement in the decision making
- Long term experimental data monitoring/gathering. Need for future research
- Use of non conventional resources
- Efficiency of water use;
- How can be improved water management and water governance
- Ecologic flow regimes

Group 2

PART 1 – SUMMARY OF PRIORITY AREAS FOR RESEARCH

- Data collection and management in a standardised form allowing
- Sharing Knowledge in the South East European Region

- Through developing and integrating ICT systems to gain synergies both in real-time and non-real-time modelling
- Extremes:
    - Drought
    - Floods
    - Ephemeral streams
- Re-use and recycling of water and waste-water
    - Methods to recharge of aquifers in times of plenty
- Pollution
- Climate changes and effects on Land uses and Land Management
- Human Health aspects

Part 2 - The group's initial and un-prioritised research suggestions, roughly grouped by expected time for realisation:

Short term

- Drought Indicators: Improve and extend indicators to Mediterranean countries and then to rest of Europe
- Compile historical, spatial and temporal data on selected river basins to represent:

  Watersheds that currently or often have drought issues

  Watersheds that deal with water scarcity issues due to water usage
- Improve operational management of droughts
- Water quality monitoring and standardisation - physical, chemical, biological
- Data harmonisation and integration and presentation => modelling with GIS
- Defining Good Ecological Status
- Assessment of status of intermittent (ephemeral) water bodies, role of flash floods

Medium Term

- Drought effects in wetlands and relationship with stream ecology
- Use indicators developed by an Expert Network to compare and assess water resource management in selected basins
- Transfer knowledge of operational management of droughts
- Re-use – recycling of water and waste water
- Identification of ecological risks and issues resulting from
    - Floods
    - Droughts
    - Climate change
    - Pollution

      =>Defining Good Ecological Status

      =>Human health implications
- Developing and integrating Decision Support Tools in water resource and flood risk management taking advantage of ICT tools and developments in computers – eg:
    - Computer clusters
    - Grid computing
    - Agent-based models
    - etc
- Warning and alert systems – real and non-real-time modelling

Long term

- Use of Aquifers to mitigate effects of droughts.
- Improve knowledge of artificial water recharge from surface water surplus or ephemeral streams (floods and ephemeral springs)
- Contribute to the design of a drought alert system or improve water resources management nationally and internationally
- Develop models and scenarios for operational management of droughts
- Social and public acceptance of new water paradigm (charges and changes of behaviour): water rights and uses (Public, Industry and Agriculture)

- Integrate land cover scenarios along with climate change scenarios for future water resources management
- Integrate land cover management within catchment management

Working group 3

This group used the CIS classification as a guide to manage the ideas being presented. The following research needs were identified but not prioritised.

Physical Processes:

- How to avoid saltwater intrusion in stored water (as a means of managing drought)
- Improving knowledge of the buffer capacity of soil on pollutants.

Ecological Processess:

- To better understand the impact of drought on ecological processes.
- Improve the understanding of how wildfires and its impact on landcover affects water quality and quantity.
- How to reduce the siltation of dams following on from wildfires.
- Improve knowledge of how energy and water are interlinked.
- How to maintain water quality during the process of infill of dams and the measurement of quality (considering the fluctuations of the state due to the infill process)

Surveillance (monitoring):

- The harmonisation of surveillance of water scarcity and droughts and the use of indicators.

Impacts of Climate Change

- How will the changing land-cover (in particular forestry) impact on the water quality and quantity
- How will changing agricultural practices impact on water quality and quantity. (example of grazing higher and higher land in mountains and the impact of phosphates on springs and water sources)
- Adaptation measures for water quality and quantity

Data Management

- Improve the collation of data for water management
- harmonisation of data across trans-boundary river basins

Programme of Measures

- How can we use artificial recharge of waters as a drought management measure
- How to locate the ideal place for storing water in aquifers as a drought management measure (links to saltwater intrusion question)
- Better Implementation of DPSIR methodology
- Improving the operating tools for management and the utilisation of disproportionate cost.
- Improve the *integrated* management of river basins – confidence in decision-making and the assessment of risk.
- Improving the link between water treatment and the original quality of the water to improve efficiency of treatment and reduction in costs.
- Measures to assess the efficiency of water use.

Economy

- What is the impact of drought on the economy

Participation

- Re-connect the responsibility for water quality with the suppliers
- Society involvement in decision-making and how to communicate decisions taken.

Valencia - Results from Working groups - combined

Droughts, Floods and Ephemeral Streams

- Short term - Improve operational management of droughts and water scarcity
    - including use of non-conventional resources as a very specific problem in the region
    - Efficiency of water use;
    - Ecologic flow regimes
    - Floods
- Short term - Drought Indicators: Improve and extend indicators to Mediterranean countries and then to

rest of Europe

- Short term - Assessment of status of intermittent (ephemeral) water bodies, role of flash floods
- How to avoid saltwater intrusion in stored water (as a means of managing drought)
- Medium term - Identification of ecological risks and issues resulting from
    - Floods
    - Droughts
    - Drought effects in wetlands and relationship with stream ecology

Improving efficiency of use and re-use of water and waste-water

- Medium term - Re-use – recycling of water and waste water
- Methods to recharge of aquifers in times of plenty

Transferring knowledge of water management practices

- Medium Term - Transfer knowledge of operational management of droughts
- The harmonisation of surveillance of water scarcity and droughts and the use of indicators.
- Short term - Water quality monitoring and standardisation - physical, chemical, biological

Integrating data collection and management

- Improve the collation of data for water management
- Harmonisation of data across trans-boundary river basins
- Through developing and integrating ICT systems to gain synergies both in real-time and non-real-time modelling
- Long term experimental data monitoring/gathering. Need for future research
- Data collection and management in a standardised form allowing better sharing of knowledge in the South East European Region
- Short term - Compile historical, spatial and temporal data on selected river basins to represent:
    - Watersheds that currently or often have drought issues
    - Watersheds that deal with water scarcity issues due to water usage
- Short term - Data harmonisation and integration and presentation
    - modelling with GIS

Developing societal perception of water resource management and providing tools for

managers

- Re-connect the responsibility for water quality with the suppliers
- Society Involvement in decision-making and how to communicate decisions taken.
- Short term - How to develop tools for society involvement, acceptance and adoption of decisions.
    - IWRM implementation tools
    - Consider trans-basin/trans-boundary basins management
    - How can be improved water management and water governance
- medium term - Use indicators developed by an Expert Network to compare and assess water resource management in selected basins
- medium term - Developing and integrating Decision Support Tools in water resource and flood risk management taking advantage of ICT tools and developments in computers – eg:
    - Computer clusters
    - Grid computing
    - Agent-based models

Land cover change and water management issues

- Improving knowledge of the buffer capacity of soil on pollutants.
- Improve the understanding of how wildfires and its impact on land-cover affects water quality and quantity.
- How to reduce the siltation of dams following on from wildfires.
- Improve knowledge of how energy and water are interlinked.
- How to maintain water quality during the process of infill of dams and the measurement of quality (considering the fluctuations of the state due to the infill process)
- Analysis and definition of ecologic flow regimens (rivers are heavily modified, being the majority ephemeral):
- Research needs in hydro-morphology & ecology
- How will the changing land-cover (in particular forestry) impact on the water quality and quantity
- How will changing agricultural practices impact on water quality and quantity. (example of grazing higher and higher land in mountains and the impact of phosphates on springs and water sources)

PRIORITISATION OF THE SUMMARY RESEARCH NEEDS

The delegates came up with the following prioritisation of issues that were listed from the working groups. The subjects were taken as the areas where there were common issues within the three groups and provide a summary of the research needs.

Droughts, Floods and Ephemeral Streams	12
Improving efficiency of use and re-use of water and waste-water	9
Transferring knowledge of water management practices	8
Integrating data collection and management	8
Developing societal perception of water resource management and providing tools for managers	7
Land cover change and water management issues	4

Regional Workshop for collaborating on IWRM Research: Northern Europe and Baltic region

WATER MANAGEMENT & TRANSNATIONAL FOREST MANAGEMENT STRATEGIES IN RESPONSE TO REGIONAL CLIMATE CHANGE IMPACTS (FORESTCLIM).	*Richard Johnson, Mountain Environments*
LAKES AND WETLAND MANAGEMENT	*Johan Schutten – Scottish Environment Protection Agency*
DRAINAGE BASIN ISSUES IN THE BONUS+ CALL AND BONUS-169 STRATEGIC RESEARCH AGENDA	*Bonus Portal, Programme Manager, Mr Andris Andrusaitis*
HYDROPOWER AND WATER MANAGEMENT	*David Crookall, Scottish and Southern Energy.(tbc)*

Discussions for group 1.

Table created using the headline themes from the Research agenda for IWRM-net

1. Ecological Processes • Science of Wetlands • Develop easy WQ assessments with indicators *HS1, JH1+2, OB4, RR1.*	9. Water Resources and Demand Management *OB2, HS3.*	5. Social and Political • Use of wetlands *(JH3)* *AJ1+3, GG2, RR4, HS3.*	11. Policy Assessment *GG2, HS3.*
2. Physical Processes *HS1, OB2, JS1, JS2, OS3, OB3.*	6. Groundwater Management	6. Economy *JS1+3, HS1+2, OB4.*	12. Prospective Models and Scenarios
3. Impact Assessment • Peat Mining • Climate Change *RR2, OB4,*	7. Monitoring and Surveillance • Data on priority substances	13. Communication and Participation *GG3, AJ1, HS1, HS2.*	
4. Measure Assessment *OB3, HS4.*	8. Data Management		

Impact Assessments

- Sustainability of maximizing production from woody residues (stumps etc) in forests. Where is it sustainable to remove these from forests after harvesting, what is the impact on the environment.

Pollution (and health)

- Biogeochemical processes and nutrient retention in wetlands
- Measuring and understanding the internal nutrient loading of lakes and reservoirs.
- Assess nutrient retention and (natural) baseline leaching from forests and impact of climate change.
- Measuring and demonstrating the role of targeted woodland creation in managing diffuse pollution within agricultural dominated catchments. Planting woodland on sensitive soils and along pollutant pathways as a means of reducing transfer of pollutants into water bodies.

- What is the impact of energy forests and other biomass crops on water resources? What are the implications for managing future water resources under a changed climate?

Water supply and demand

- Demonstration of how to integrate all water resource demands in the basin in relation to the available supply. Related – what is the scope for varying the baseline water resource by managing its vegetation?
- Climate change
    - ? Changes of HMWB state in the context of climate change and the impact on GES. Hydro-morphological changes in relation to climate change????
- Improve our understanding of the relationship between the protection of water resources and land use planning. Can we quantify the impacts of land use and the value? Develop the understanding on a basin scale.

Hydro-morphology and ecology

- Develop methodology for bio-indication of h-m pressures.
- Apply interdisciplinary approaches to comprehensive integrated assessments to complex projects. (hydropower as an example)
- Contribution of forestry to flood risk management and better integration/improved subsidies to secure land use change for ecosystem services.
- Integrating FRM with WFD. Will it happen?
- Links between h-m and ecology
- How to evaluate biological diversity contra water use (hydropower)
- How to define ecological flows
- What is GES, how to define it. GEP.
- Linking GES with water resources.
- GES for wetlands within 2nd gen RBMP.

Social and political issues

- What is the balance between social use (ie. Recreation) and environmental status. How do decisions on water flow based on social use impact on the environmental status. (e.g. changing water flows at a hydropower dam – timing of flows may not be optimal for environment)

- Trans-boundary management
- Improving relation between EU states and non-EU states – need for harmonizing approaches and achieving consensus on RBP.
- Good Ecological Status
    - What is the theory between GES and GEP? Comparison of definitions, policy level discussion

POLICY

- Balance and synergies of water and environment policy and other policy objectives. Different member states policy objectives are not harmonised and finding methods of balancing decisions based on the different policy objectives within member states.
- Look into integrated WRM as a technique to optimize poverty/health risk reduction from project investment.
- Compare the pillars of sustainability development as frames for decisions, comparing economic frame with environment etc. what are the constraints from each perspective to manage conflict.
- Assess the consequences of the global env. Policy conventions for hydropower (as an example) design and implementation.

Data Management

- How do we deal with Uncertainty concerning statistical information (links to climate change)

Communication and participation

- Develop methods for stakeholder participation in large scale basins integrating natural and social sciences.

ECONOMICS

- Developing a method to value ecosystem services - need to develop an agreed methodology
- How do we evaluate the environment? e.g. the fish, the algae (the components of the system)

Combined Discussion group research questions

Research questions

Impact Assessments

- Sustainability of maximizing production from woody residues (stumps etc) in forests. Where is it sustainable to remove these from forests after harvesting, what is the impact on the environment.
- Impact assessment of key activities – eg peat mining
- General effects of intensive forest management on water ecosystems – eg ditching, fertilization, introducing new species
- What is the impact of energy forests and other crops on water resources? What will be the implications on water resources in the future?

Pollution (and health)

- Biogeochemical process and nutrient retention in Wetlands
- Measuring and understanding the internal nutrient loading lakes and reservoirs.
- Assess the nutrient retention and (natural) baseline leaching from forests (relating to climate change?)
- The need for evidence based demonstrations on the role of woodland creation in managing different pollution sensitivity of soils and pollutant pathways in soils. Using forest as a means of reducing transfer of pollutants into water bodies.
- Assessment of P (phosphorous) leakage – sources and transport –> risk-map –> cost-effective measures
- Mercury – measures to deal with high levels

Water supply and demand

- Demonstration of how to integrate all water resource demands in the basin. In relation to the available supply. Related – what is the scope for varying the baseline water resource by managing its vegetation?
- Climate change
    - ? Changes of HMWB state in the context of climate change and the impact on GES. Hydro-morphological changes in relation to climate change????

- Improve our understanding of the relationship between the protection of water resources by land use planning. Can we quantify the impacts of land use and the value? Develop the understanding on a basin scale.

Hydro-morphology and ecology

- **Develop methodology for bio-indication of h-m pressures.**
- Apply interdisciplinary approaches to comprehensive integrated assessments to complex projects. (hydropower as an example)
- Contribution of forestry to flood risk management, better integration information on forestry to make decisions to consider use of forestry to tackle environmental issues.
- Integrating FRM with WFD. Will it happen?
- Links between h-m and ecology
- How to evaluate biological diversity contra water use (hydropower)
- How to define ecological flows
- What is GES, how to define it. GEP.
    - Linking GES with water resources.
    - GES for wetlands within 2nd gen RBMP.
    - Developing tools for assessments of ecological status
- Water quality assessment and operational methods – lack of relevant information
- Tools for managing local hydrology (based on work in Africa etc)
- Cold water species monitoring and understanding effects of climate change

Science of Wetlands

- Wetlands – where they are
- What are the environmental conditions supporting wetlands? (water quality and quantity)

Social and political issues

- What is the balance between social use (i.e. Recreation) and environmental status? How do decisions on water flow based on social use impact on the environmental status. (e.g. changing water flows at a

hydropower dam – timing of flows may not be optimal for environment)

- Effects of Hydro-power/regulation on water ecology –> optimising industry/ecological requirements –> including pricing
- Trans-boundary management issues
    - Improving relation between EU states and non-EU states – need for harmonizing approaches and achieving consensus on RBP.
- Good Ecological Status
    - What is the theory between GES and GEP? Comparison of definitions, policy level discussion
- Institutional setup – multi-layer governance, power relations, conflict resolution/reduction mechanisms and dialogue methods
- How to get the Integration into IWRM
- How to create institutional contexts that facilitate integration of water resource management

POLICY

- Balance and synergies of water and environment policy and other policy objectives. Different member states policy objectives are not harmonised and finding methods of balancing decisions based on the different policy objectives within member states.
- Look into integrated WRM as a technique to optimize poverty/health risk reduction from project investment.
- Compare the pillars of sustainability development as frames for decisions, comparing economic frame with environment etc. what are the constraints from each perspective to manage conflict.
- Assess the consequences of the global env. Policy conventions for hydropower (as an example) design and implementation.
- Linking implementation of the WFD with implementation of the Marine Strategy Directive
- How can wetlands be used to reduce the impact of climate change? (C-store, flood abatement, etc)

Data Management (& Uncertainty?)

- How do we deal with Uncertainty concerning statistical information (links to climate change)
- How we manage Uncertainty and Complexity

Communication and participation

- Develop methods for stakeholder participation in large scale basins integrating natural and social sciences.
- How to develop methods to:

    a) define stakeholders

    b) develop communication strategies (as a two way process)

- Communication tools to explain effects of changes on local streams – eg biological values, endangered species, environmental quality

ECONOMICS

- Developing a method to value ecosystem services - need to develop a agreed methodology
- Identify the ecosystem services provided by water-bodies
- Evaluate ecosystem services provided by water-bodies
- How do we evaluate the environment, e.g the fish, the algae. (the components of the system)
- Develop policy instruments to protect and manage ecosystem services provided by water bodies

Priority Questions:

Demonstration of how to integrate all water resource demands in the basin in relation to the available supply. Related – what is the scope for varying the baseline water resource by managing its vegetation? (7 votes)

Develop policy instruments to protect and manage ecosystem services provided by water-bodies (6 Votes)

Improve our understanding of the links between hydro-morphology and ecology (5 votes)

How can wetlands be used to reduce the impact of climate change? (C-store, flood abatement, etc) (5 votes)

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