



ERAC-CT-2005-0260025

IWRM-NET

**Towards a European-wide exchange Network for integrating research efforts on
Integrated Water Resources Management**

Thematic priority: Integrated water resource management

DELIVERABLE N°25

List of identified national projects and research priority areas

IWRM-Net draft research agenda

Due date of deliverable: M36 – December 2008

Actual submission date: M39 - March – 2009

Start of the project: 1 January 2006

Duration: 5 years

Organisation name of lead contractor for this deliverable: WP2- Sniffer

Final version

Project co-funded by the European Commission with the Sixth Framework Programme (2002-2006)		
Dissemination level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	X
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).	

IWRM-Net research *Agenda*

Scientific specification framework & Knowledge requirements for Integrated Water Resource Management across Europe

Draft version 17/03/09

THE IWRM ERA-NET PROJECT

The strategic objective addressed by the project is developing long-term coordination among national / regional Integrated Water Resources Management (IWRM) related research programmes in Europe.

The members of IWRM-net are a network of national/regional programme managers, wishing to enhance good practices, both by transfer of knowledge, and by developing new tools and expertise in IWRM and research management.

Context

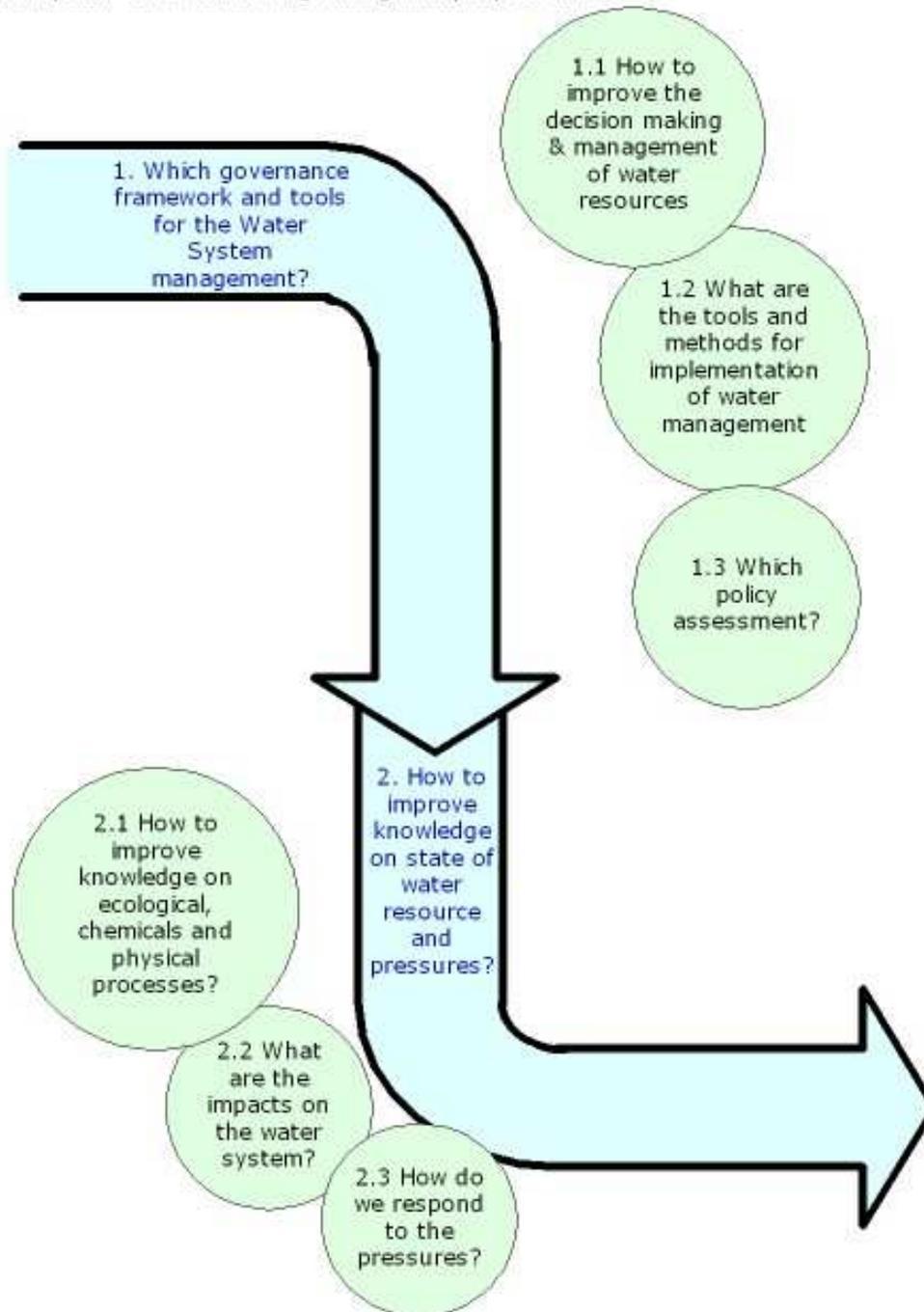
Development of research needs - This document has been created by the collation of ideas and research needs by IWRM-net partners (*work-package 2 and 3*) through workshops across Europe. It is also the start of a process as IWRM-net considers its future and the development of future collaborations on water research.

The future of this document will be as an ongoing working document that collates research needs and assists the analysis on prioritisation of future work of IWRM-net partners. This process will also be supported by the availability of the document online as the 'Forum' and this is where IWRM-net aims to use the internet as a means of gathering a wider input into the development of research needs.

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The Water system - IWRM-net knowledge management perspective...



DPSIR

Responses

- Governance
- Integration of stakeholders
- Modelling and decision support
- Quantification of ecosystem services

I. Which governance framework and tools for the Water System management?

The purpose is to build a sustainable approach for IWRM taking into account the multi-level context: geography, activities, social-economy, policy, institutional organisation, decision support system, scientific community, history, data management etc. IWRM requires a global governance framework based on common social, economical and institutional principles and rules.

1.1) How to improve the decision making process in water management?

There is a strong need to develop ideas and come up with innovative proposals for institutional arrangements that could help to implement integrated water resource management better. When implementing policies, the institutional, economic, social and cultural components need to be understood to ensure that the policy is accepted. There is a need to provide people with an understanding of the many beneficial services provided by aquatic ecosystems to economic and social welfare. The education structure becomes more important as people need to better understand the continual changes to the water resource and supply and demand issues. What are the levers to reach an efficient, integrated, fair and sustainable management? How to involve all the stakeholders? How to define a framework for governance?

Strategic issues

- **Science Policy Interface**
- **Public participation**
- **Adaptive management**
- **Legal and institutional framework**
- **Social values and practices**

1.1.1. How best to organise stakeholder dialogue, participation and perception?

- How to build trust and find ways to engage stakeholders more effectively?

- How to develop methods to facilitate a compromise between stakeholders and researchers?
- How to include recognition of the various phases of implementation of measures?
- What information should be provided and to whom?
- How to create learning process between actors? How to facilitate the communication between involved actors?
- How can we manage and reduce the asymmetry of information among stakeholders?
- How can we improve the evaluation of the impact of participation?
- Does access to information and legitimacy of stakeholders play a role (and how) to ease the public participation thanks to a homogenization of knowledge?
- How to communicate benefits of achieving environmental objectives to engage public interest?

1.1.2. How to improve the communication between citizens?

- How do we implement a system to communicate with stakeholders in a sustainable manner and not only in times of crisis?
- How to do a preventative communication to improve crisis management?

1.1.3. Does the current governance of the WFD allow it to be adaptative considering the future potential changes?

- How to develop scenarios/ foresight for water management which cover impacts of driving forces at different scales, role of actors and should enable to play through different topics ?
- How to develop predictive tools for assessing the consequences of the programme of measures after its implementation?
- How to improve abilities in adaptive management and learning?

1.1.4. How can the legal and institutional framework be adapted/simplified to integrate different policies

- Can we develop methodologies and good practice to integrate biodiversity action plan targets & other legal EU environmental duties with water management at a landscape scale?
- How should the structures and organisations be organised?

- How to find arrangements, institutions or capacities to work across different levels of government?
- What is the right territorial scale for management?
- With so many networks already in place, what is the eligibility of these networks, how do we assess them?

1.1.5. How to change social values and practices to improve the legitimacy of measures to conserve water and the perception of fairness and accountability?

- How do we produce a common vision of the system for participation, negotiation, and consensus building, assessment of risk and uncertainties?
- Can we evaluate and compare planning cultures and participatory cultures?
- How is the WFD being understood by different stakeholders in different national contexts?
- How do we evaluate behaviours?
- How to incorporate the many pressures on the water resources in a comprehensive and holistic management system?
- How to prove benefits of water policy to the society?
- Who will value ecosystem services and other social theories? What values will inform the knowledge production? What is the role of science? What makes knowledge pertinent to societal needs and who decides?
- How to better understand the systems and organisations to improve knowledge transfer/participation (mapping of stakeholders)?

1.1.6. How to improve and develop methods that incorporate social capital in river basin management?

- How do we integrate social, political aspects into characterisation reports?
- How do we apply the methods and tools to analyse society and the environment?
- What are the links between social benefits and ecological improvements?
- How to improve our ability to ensure measure for river basin management such as regulation, voluntary information, education and economic measures take account of social context?

1.2) What are the tools and methods for implementing IWRM?

Strategic issues

- **Integrated River Basin Management**
- **Harmonization and inter-calibration**
- **Indicators and models**
- **Classification tools**
- **Economics, Environmental valuation**

1.2.1. Which decision support systems to support decision making?

- How to set up comprehensive management tools, not only for water but also for energy and economy?
- Can we develop a decision support system(DSS) that allows assessment of risk and uncertainties? Can we develop a DSS based on transfer of knowledge? Can we develop a DSS that integrates different aspects of water management for assessment and comparison of options including cost-effectiveness? Can we develop a DSS that builds consensus by negotiation and participation?
- How can economics support decision-making?
- Can we produce integrated models, simple models as decision-support tools? How to develop a common strategy for typology and reference sites?
- Can we better implement DPSIR methodology?
- Can we produce scenarios for possible future rivers lakes and estuaries and coasts, accounting for climate & socio-economic & governance?
- How to produce interactive maps of priorities - pressures and impacts and contacts?
- What are the methodological tools, jobs and skills required in order to create an integrated water management system in order to match research needs of decision-makers with scientific skills?

- Can we produce a methodology for stakeholder validated descriptions of the distributional significance of IWRM options?

1.2.2. How to improve data monitoring? Which data do we need?

- How to improve data monitoring methodologies? Which compliance methods?
- How to promote the combination of existing datasets of the IWRM participating countries? How to protect existing long term datasets for the future?
- Can we standardize a Water quality monitoring considering physical, chemical, biological aspects?
- What techniques do we need to monitor & collect data for good ecological status?
- How to seek out examples to pilot integration of different types of datasets? Can we integrate them?
- Can we represent compiled historical, spatial and temporal data on selected river basins?
- Can we integrate harmonised Data with GIS?
- Are the techniques good enough for quantification?
- What timelines shall/may be applied for defining reference conditions when historical data are lacking – basin-wide comparability?
- What kind of long-term hydrological and biological monitoring datasets do we need for the detection of ecological effects produced by climate change?

1.2.3. How does modelling of integrated datasets at different scales affect decisions as to programmes of measures that should be used towards WFD?

1.2.4. How to improve the definition of GES and GEP?

- Can we develop methodologies in order to set environmental objectives for hydro-morphological pressures in WFD? How can the WFD and assessment tools keep up with changing knowledge (e.g. taxonomical or bio-geographical issues)? Can we link biological, chemical/physical and hydro-morphological information to reach a definition of ecological status?
- How can/may new pollutants or species (native, non-native) be integrated into reference conditions and assessment tools?

- How to define GES and develop methodologies considering the natural, social and political background? 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?
- Can we have a definition of GES that is a pragmatic and operational compromise? How can we improve the incorporation of public worth and social values into the definition of ecological status?
- What are the main natural and anthropogenic drivers to GES? What affects achieving good ecological status (obstacles)? What are the social and political drivers of GES?
- Can we better specify the five classes of good ecological status? Can we develop a survey of what do we know now about Good Ecological Status, including potential?
- What are the impacts of heavily modified water bodies on Good Ecological Potential?
- Can we create a Practical Ecological Flow Definition?
- How can the decision making for HMWB be supported, *e.g.* designation process?

1.2.5. How to produce a set of reliable and sensible indicators ?

- Can we combine the monitoring with development of sets indicators ?
- How to use indicators developed by an Expert Network to compare and assess water resource management in selected basins?

1.2.6. How to develop interdisciplinarity (physical, chemical and ecological processes and socio-economic aspects)?

- How to develop transdisciplinary approaches in research which integrate non-expert views (e.g. stakeholders views)?
- How to develop inter-disciplinary approaches not only looking at data, providing technical solutions modelling future measures, but combining social, industrial, ecologic & improving confidence in decision-making and the assessment of risk?
- How to integrate hydrology, geomorphology, water, economics and social issues?
- How to improve our understanding of the relationship between flow and ecology based on appropriate data and site specific studies (linked to hydropower also) ?
- How transferable and adaptable are measures? What are the methodological components?

1.2.7. How to improve transfer of knowledge?

1.2.8. How to reveal social values?

- Can we develop indicators to give a measure of more abstract issues such as human well-being?
- Can we develop tools comprehensively taking into account the pattern of interactions between the ecological services, the social actors and the values they assert?
- How to assess welfare accruing from changes in the availability and quality of drinking water with contingent valuation or attribute-based choice modelling (choice experiments etc.)?
- How to assess the awareness of people regarding the importance of eco-system services accruing from the scarce resource water?
- How can we improve the expression of diverse values?

1.2.9. How to value the ecosystem services of Water System?

- What are the components of the value of water?
- How to develop Cost Efficiency Analysis / Cost Benefit Analysis?
- How to quantify monetary benefits of hydro-morphological measures under WFD?
- How to improve the operating tools for management and the utilisation of disproportionate cost?
- How can we evaluate financially the benefits of re-establishing functional aquatic ecosystems (e.g. tourism and nature benefits for communities)?
- How do we evaluate economic flows in environmental services?
- How to reduce (or take account of) uncertainty in economic assessments to improve decision-making?

1.2.10. How to design pricing policies?

- How to decide in pricing policies according to member states programme of measures.
- Which new systems of payment for water to include more effectively the 'distributive' aspects of water economics across all aspects the hydrological cycle (not only for drinking water)?
- Can we develop decision-support tools that assist in allocating charges between the beneficiaries and the polluters?

- How to allocate the correct charges fairly and transparently?
- What are the effects of pricing policies?
- What are the cross-cutting effects of other EU policies on the management of water resources such as subsidies to agriculture?
- How to improve the link between water treatment and the original quality of the water to improve efficiency of treatment and reduction in costs?
- How will the social values of the water and the people's behaviour and practices respond to higher prices of water use (full recovery of costs)?
- Cost Efficiency Analysis / Cost Benefit Analysis
- How to make the change from supply driven to demand driven water management and balance uses with ecosystem needs, but also balance between different uses?
- Which tools and measures to manage water through demand?
- How does demand management allow water resources to be a strong multi-sectoral component of development?

1.3) How to develop framework for policies integration and assessment?

Strategic issues

- **Framework for 1st RBMP assessment**
- **Compliance of European policies and national policies**
- **Indicators for assessment**

1.3.1. How can we assess the WFD, the RBMP?

- Which impacts of the measures identified in the river basin management plans under WFD?
- Which measures to assess the efficiency of water use?
- How to assess the effectiveness of measures in groundwater?
- How can we evaluate the financial impacts of measures? in particular the financial impact on social and economic sectors. i.e. economic indicators/cost effectiveness/cost recovery/investment affordability.

- What are the correct details for impact assessment?

1.3.2. How to improve integration of policies in River Basin Management Plan?

- How to integrate the Waste Water Treatment? Can we develop programme for organic and nutrient pollution in order to understand the costs associated with? While looking for cost efficiencies?
- What are the links between pollution impacts and environmental objectives for the Danube and the Black Sea?
- Can we get the spatial resolution right to be more effective?
- Can we improve our understanding by water body grouping?
- How to integrate the relationship between the urban and rural (communities, water demands etc)?
- How to integrate ecological and socio-economic objectives at a basin scale?
- How do you take a catchment based approach to heavily modified water bodies, including trans-boundary issues ?
- How to integrate terrestrial, transitional and coastal waters in the management process?
- How to assess the status of intermittent (ephemeral) water bodies?
- Can we improve our understanding of erratic flows (both flood and drought) and the impact on ecology/ecological status?
- **How to improve the management of shallow aquifer (Hungary)?**
 - . How to delineate territory for leaving shallow aquifers/stagnant water for ecological benefits?
 - . How can we improve decision-making abilities for management of shallow aquifers?
 - . How can we improve the management of abstraction from aquifers (by agriculture/industry/domestic)?

DPSIR

State

- Hydrology
- Water quality
- Hydromorphology
- Biological inventory
- Ecosystem

Pressures

- Identification of pressures
- Quantification of pressures-impacts relationship

Responses

- Sectorial policies

II. How to improve knowledge on state of water resource and pressures?

The scientific knowledge of water ecosystems must be strengthened to support the WFD implementation. The more accurate the knowledge is, the more efficient the measure should be. Referring to the DPSIR framework, it emerged that the complexity in cause-effects relationship requires more knowledge. There are gaps concerning the consequences (and assessment) of the actions of management (responses) in the cause-effect relationships within the Water system both in short and long term. There are gaps too between the complexity of the Water System and simple representations of it such as, for example, the models that give a simplified view of the system.

In that way, attention has to focus on the following elements:

To understand how water bodies are functioning: physical, chemical and ecological processes and how they are altered.

To consider of various components of the water system: flow regimes, area (coastal, estuaries, rivers, humid zones, lakes..., urban/rural...), water bodies (ground waters, surface waters, stored waters...)

To understand how the drivers are functioning and their influence on the water ecosystems (state and mechanisms).

2.1) How to improve knowledge on ecological, chemical and physical processes?

Strategic issues

- **Environmental flow regimes**
- **Hydro-morphology and GES**
- **Interdisciplinarity**

2.1.1. What are the gaps of knowledge on physical processes?

- How to improve our understanding of morphological changes to estuaries and rivers ?

- How does river bed degradation affect the management of (restoration) of hydro-morphological issues e.g. floodplain connectivity?
- How to avoid saltwater intrusion in stored water (as a means of managing drought))
- How to 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?
- How do we link engagement across scales from reaches to catchments, inter-intra catchment continuity?
- What is the role of flash floods?
- What are the links between sediment transport in the Danube and coastal erosion?
- How will rising sea levels, altered flow regimes and sediment transport affect coastal areas in terms of deposition, erosion and management?

2.1.2. What are the gaps of knowledge on chemical processes?

- How pollutants are modified during transport through a catchment?
- How to improve our knowledge of NO₃ movement in zones and groundwater?
- How to improve our understanding of the processes involved in the transfer/residence times of chemicals in basin?
- How to develop a tool for pollution migration (dispersion)?
- How to improve knowledge of the buffer capacity of soil on pollutants ?
- Can we specify the priority hazardous substances?
- How much NO₃ in groundwater is attenuated before entering the river?

2.1.3. What are the gaps of knowledge on ecological processes?

- How to better understand the environment and the ecological processes?
- How to improve our understanding of the relationship between flow and ecology based on appropriate data and site specific studies?
- How to better understand of the processes and interactions across the eco-hydrology surface-GW interface to better quantify GES?
- What are the ecological aspects of sediment transport changes?
- What is the inter-relation between river ecosystem and other terrestrial ecosystems?

- What are the drought effects in wetlands and the relationship with stream ecology?
- How to improve knowledge on Alien Species?
- Can we specify bioindicators, biomarkers?
- How to improve the management of Eutrophication? What are the causes (specifically for lakes and coastal waters)?
- How do we estimate the water volumes for ecologically safe water use for trans-boundary gauging stations on the rivers?
- Can we develop a reliable site specific method for managing change in flow due to abstraction to avoid environmental damage?

2.2) What are the current and the future impacts on the water system

Strategic issues

- **Water scarcity and drought**
- **Climate change**
- **Ecotoxicity**
- **Diffuse pollution**
- **Cumulative impacts**

2.2.1. How could Climate Change affect Water System and ecosystems?

- How will the climate change impact the water resource characteristics and processes? How will changes in climate affect catchment scale processes?
- How will climate change impact on the hydrology e.g. flow amplitude, frequency and variability?
- What is the resilience of the ecosystems when faced with extreme perturbations?
- What are the ecological impacts of an increase in the temperature of water bodies? Is it predictable?

- How will the changing land-cover (in particular forestry) impact on the water quality and quantity
- Which impact of climate change on energy policies? How does it affect the water management, the water quality and quantity?
- What are the impacts on ecology, energy policies and navigation of changes in water supply by alpine glaciers in summer? Is it affecting achievement of good ecological potential (GEP)?

2.2.2. How anthropogenic drivers are affecting the Water System and ecosystems?

- How to improve our knowledge agriculture impacts on water and aquatic ecosystems? How pollutants are modified during transport through a catchment? How much NO₃ in groundwater is attenuated before entering the river? How to improve our knowledge of NO₃ movement in zones and groundwater? How to improve our understanding of the processes involved in the transfer/residence times of chemicals in basins? How to improve knowledge of the buffer capacity of soil on pollutants?
- How does the size and character of reservoirs affect water quality (e.g. temperature, oxygen saturation) and sediment transport (eg.reservoir flushing)?
- How does land use impact on the hydrology?
- Can we link Urbanisation/Disperse settlement patterns and their impacts on water management?
- How to improve our knowledge tourism impacts on water and aquatic ecosystems?
- How will the changing land-cover (in particular forestry) impact on the water quality and quantity?
- What about demography, growth, exchanges and cultural aspects?
- How wildfires and its impact on land-cover affects water quality and quantity?

2.2.3. How to develop understanding of cause-effects relationships?

- How can we do Pressure and Impact models?
- How to assess potential positive and negative impacts of new technologies on integrated water resource management?
- Which tools for better estimation of soil buffer capacity on priority pollutants in the recharge areas of the groundwaters?
- Can we create an integrative database for unsaturated and saturated soil zone including pF (retention), porosity, structure?

- How can we stimulate chemical/physical changes to reduce pollution in groundwater?
- Which techniques to develop for the removal of arsenic from Groundwater (relates to DWD) and the improvement of cost-effectiveness of these techniques?
- How to improve the ability to model and plan measures to deal with contamination in both groundwater and surface water?
- How to improve our ability to separate out the effects of individual pressures and then the cumulative effects of pressures?
- How can we reach an acceptable level of uncertainty in pressure /impact results to invest in action
- How to develop scenarios/models for organic and nutrient pollution reduction, in order to size the effect of the measures?

2.3) Responses to pressures: How to manage the consequences of pressures e.g. prevention, mitigation and crisis management?

Strategic issues

- **Integrated pollution management**
- **Adaptation to climate change**
- **Water scarcity and drought**
- **Floods**
- **Global change (demography, land-use, energy...)**

2.3.1. How to face perturbation related to climate change?

- How to define indicators which are sensitive to limits and trends toward thresholds (biological , physical and socio-economic indicators)?
- Can we develop early warning systems? (for water managers to avoid reaching a tipping point)
- Which mitigation and adaptation strategies for climate changes?

- How to precise adaptation measures for water quality and quantity?
- Can we produce regional climate change models with better certainty about effects on water management?
- Can we improve models to help water managers to understand and predict how a water body will react to climate changes, in particular at regional or river basin scale?
- How to reduce the siltation of dams following on from wildfires?

2.3.2. How to improve the drought management?

- How can we improve the management of critical drought situations? Can we improve operational management of droughts?
- How to facilitate transfer knowledge of operational management of droughts?
- 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)?
- How to set clear definitions for arid/parched/drought areas and have mapping of these areas?
- How to improve our ability to value competing uses to compare these and assess the most important use or find ways of achieving a balanced and fair distribution of resource use?
- Can we collect data on watersheds that currently or often have drought issues? Can we collect data on watersheds that deal with water scarcity issues due to water usage?
- What are the ecological impacts of drought?
- What is the impact of drought on the economy? How to assess the cost of ecological problems carried out by drought (oxidation of peats and soil-setting)? Which cost-effective measures to deal with this problem?
- How to improve our understanding of erratic flows (both flood and drought) and the impact on ecology/ecological status?
- How can seasonal changes in erratic flow be managed (e.g. storage capacity, methods to recharge aquifers)?
- How to improve and extend indicators to Mediterranean countries and then to rest of Europe?

2.3.3. How to improve the flood management?

- Can we improve our understanding of how the Hydro-Morphology regulations of the WFD impact on flood risk management strategies?

- How can seasonal changes in erratic flow be managed (e.g. storage capacity, methods to recharge aquifers)?
- How can priorities be defined in river basin management, flood management?
- How to develop our understanding of river restoration? How benefits-implementation?

2.3.4. How to improve the pollution management?

- Can we integrate our understanding (and thus management) of nutrient pollution with biology, chemistry and physical aspects? Can we integrate our knowledge with other disciplines?
- How to improve our modelling of hazardous substances in space and time, integrating both surface water and groundwater?
- How to develop guidelines specific to typology (e.g. upper and lower reaches of river) to manage nutrient pollution, which have the support of the inter-calibration process?
- Can we develop new tools for managing pollution e.g. phosphate free detergents, improving technology in industries generating organic pollution?
- Can we develop tools for better estimation of soil buffer capacity on priority pollutants in the recharge areas of the groundwaters?
- Can we develop environmental objectives for hazardous substances in marine coastal regions in sediments and biota?
- Which methods for estimation of the background content (metals, oil, hazardous substances, nitrate) and of the anthropogenic input, links to Drinking Water Directive and the existence of natural contamination and achieving European Standards for DWD?.
- Do we know the efficiency of the pollution reduction measures, can we measure their efficiency?

2.3.5. Which responses to face agricultural pressures?

- How can we change agricultural practice to reduce the input of pollutants into the environment?
- Can we improve management and efficiency of use for nitrates?
- How will changing agricultural practices impact on water quality and quantity?
- Can we develop new techniques including cost benefit analysis for nutrient pollution from agricultural sources? (e.g. buffer capacity of soils, nitrate content in soils, linkages with groundwater, measures affect the environment)
- Can we develop methods to reduce the maximum (peak) concentration of NO₃ in groundwater to 50mg/l?

- Can we develop scenarios/models for organic and nutrient pollution reduction, in order to size the effect of the measures?

2.3.6. Which responses to face industrial pressures?

- How can we change industrial practice to reduce the input of pollutants into the environment?
- Can we develop technologies for re-use – recycling of water and waste water?
- Can we implement ‘Best Available Techniques and Environmental Practices’ for hazardous substances
- Is it possible to develop new tools for managing pollution e.g. phosphate free detergents?
- Is it possible to improve technology in industries generating organic pollution?

2.3.7. Which responses to face energy policy (hydropower) pressures?

- How can the impacts of residual flows be assessed, how do they affect river restoration programmes
- How can the impacts of hydro-peaking (quick fluctuating flow levels) be assessed? How do they affect river restoration programmes?
- 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)?
- Can we develop fish migration facilities for extreme heights, e.g. sturgeon passage at the Iron Gate
- How to improve the management of the trans-boundary issues associated with residual flow and hydro-peaking with hydro-power dams? (Hungary)

2.3.8. Which responses to face other anthropogenic pressures?

- How to manage urbanisation/settlements?
- How to develop methodologies for the ecological rehabilitation on navigational routes?
- How to manage infrastructures? How can we ensure that Environmental Impact Assessments and/or a Strategic Environmental Assessment during the planning phase of future infrastructure projects ensure that hydro-morphological changes do not adversely affect the ecological status of the water body?
- How to manage tourism ?