Final newsletter

RESEARCH PROJECTS
POLICY BRIEFS

FINAL CONFERENCE SYNTHESIS

EDITION APRIL 2015

CONTENT

FOREWORD
by the French Ministry of Ecology, Sustainable Development and Energy

As the implementation of the water framework directive pointed to the need for a more consistent, long-term scientific approach to integrated water resources management (IWRM), fourteen countries decided to launch a European research area network on this topic, the IWRM-Net, with a first joint call in 2007.

To pursue this networking dynamic, a second joint call was launched in 2009 on three major topics, climatic change and adaptation for IWRM, water scarcity and drought, and economic and social values for integrated water management. Its allowed to carry out six international research projects from 2010 to 2014, with subjects of particular complexity and interest for the sake of the on-going water policies, going from the ecosystem services issues to the impact of climate change on ecosystem and water resources.

To support the strengthening of this network, the French Ministry of Ecology, Sustainable Development and Energy funded a scientific coordination project led by the International Office for Water. Amongst other actions, it organised the final conference, held in Brussels on the 21st and 22nd of October 2014, where the outcomes of the six projects were presented and discussed between researchers, policy makers and water managers.

As part of its networking mission, the International Office for Water also produced several newsletters since 2010. This latest issue summarises the main policy relevant outcomes produced by the six projects under the format of "policy briefs", as well as a cross-cutting synthesis established at the final conference. Its broad dissemination aims at mainstreaming the scientific methods, best practices and tools developed by the network.

I have no doubt that these results will serve the European water community in facing the huge challenges of this sector and I hope they will contribute to strengthen exchanges among researchers, water managers and decision makers for a better management of waters in keeping with the European directives.

Jean Philippe Torterotot

Deputy director for research and innovation,

French Ministry of Ecology, Sustainable Development and Energy

Department of the Commissioner-General for Sustainable Development

INTRODUCTION
by the International Office for Water

Since 2006, the International Office for Water has been pushing, prodding and promoting research related to Integrated Water Resources Management (IWRM). While the European Research Area Network (ERA-NET) IWRM-Net (FP6 n°ERAC-CT-2005-026025) finished in 2010, the coordination of the 6 on-going IWRM-Net research projects continued via the Scientific Coordination Project (SCP), i.e. its platform for dissemination and exchange between the scientists, policy makers and water managers.

IWRM-NET SCP was funded by the French Ministry of Ecology, Sustainable Development and Energy (MEDDE) as one of the partners of the original ERA-NET.

The SCP has been a multifunctional platform also providing a secretariat role. Recently, the use of online meeting rooms or 'webinars' was tested as a means to facilitate communication with a range of stakeholders, as they thus do not need to travel to hear about project results. It proved to be a very valuable tool, which can regularly be used with little cost, while remaining interactive. It is a tool that we recommend to be further developed.

Returning to more traditional methods, this newsletter presents a synthesis of all the 6 mentioned projects funded by the IWRM-NET project in the form of 'policy briefs'. The template of the policy briefs was established by the European Water Framework Directive (WFD Common Implementation Strategy (CIS) ad-hoc group on Science-Policy Interfacing (CIS-SPI).

Policy briefs are a means of homogenising the format to communicate to water policy makers about the key points in each project. The wealth of research and information obtained through the projects is summarized in the briefs to provide an overview of what has been discussed and presented with the support of IWRM-NET.

The second part of the newsletter presents the synthesis of IWRM-NET SCP final conference. The aim was to offer the opportunity to the participants to share the key findings of the 6 projects at the interface between science and policy.

We have thoroughly enjoyed the experience and thank all who participated and made the 8 years of IWRM-NET, both with ERA-NET and the follow-on scientific coordination project, such a pleasure to be involved in.

We wish you all the very best and success in your new ventures and hope that our paths will cross again.

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IWRM-NET Partners, VIENNA, 2007

Policy briefs of the 6 research projects

CLIMAWARE

Climate Change Impacts on the Management of Water Resources

Starting date: January 2010
Ending date: December 2012

Funders:
BMBF (GE) 268 036€
MEDDE (FR) 195 000€
+120 000€ for Italian partners

ClimAware

Participating countries/partners:

- **Department of Hydraulic Engineering and Water Resources Management, University of Kassel (GE) - Coordinator**
- CESR: Centre for Environmental Systems Research, University of Kassel (GE)
- IRSTEA: National Research Institute of Science and Technology for Environment and Agriculture (FR)
- EPTB Seine Grands Lacs (FR)
- CIHEAM-IAMB: Mediterranean Agronomic Institute of Bari, Land and Water Resources Management Department (IT)

Web link: http://www.uni-kassel.de/fb14/wasserbau/CLIMAWARE

SCOPE

The impacts of climate change on freshwater resources at the European and regional scales.

OBJECTIVES AND METHODOLOGY

The main objectives of the project have been addressed by combining a European modeling approach with case study analysis and regional (local) knowledge of water demand and water availability considering climate change as well as socio-economic developments.

An integrated assessment (see below) for entire Europe was performed under the consideration of different scenarios and climate change projections. This large-scale perspective allows indicating regions which are potentially vulnerable to climate change and furthermore to identify regional adaptation measures which could be promoted at the EU level. The European modelling was performed by the use of the WaterGAP model which calculates the terrestrial water cycle and the water use on a global 5 by 5 arc minutes grid cell raster.

Furthermore, three case studies were selected across Europe to investigate changes in hydrologic regimes, water availability and sectorial water use. These case studies are focusing on three different water management issues in three different regions.

In the first case study, the influence of climate change on the hydromorphological conditions according to the WFD were evaluated for a section of the Eder River (GE). The objective of this case study was to examine whether the environmental WFD objectives can be achieved in a typical river section considering climate change impacts.

The second case study investigated water management, especially drinking water provision, and flood alleviation in the Seine river basin (FR), which is partly based on the operation of artificial reservoirs. Scenarios were developed linking the impact of climate change on water resources and changes in water demand and its management.

The third case study assesses the quantitative effects of climate change on water balance components and water use in the agricultural sector of the Italian Apulia region, in order to support the adoption of adaptation measures. Actually, in the Apulia region agriculture still remains the primary user of water and the primary economical resource.

CONTRIBUTION TO THE EU WATER FRAMEWORK DIRECTIVE

ClimAware addressed the following WFD articles:

Art. 4: which deals with the environmental objectives to achieve a good status for all surface waters until the year 2015 or at least to prevent any deterioration of the surface water status;

Art. 11: which focuses on the programs of measures to reach the environmental objectives;

Art. 14: which treats information and consultation of the practice of partners and stakeholders.

POLICY RELEVANCE AND FOCUS

The objectives of the ClimAware project are twofold:

- First, to assess the impacts of climate and socio-economic changes and to develop adaption strategies to reduce them according to the most relevant questions in the context in each case study. This supports water managers and other stakeholders on river basin level.
- Second, these results are translated into region-specific recommendations for policy makers on the EU-level for strategic, tactical and operational management depending on the regional water issues.

KEY OUTPUTS

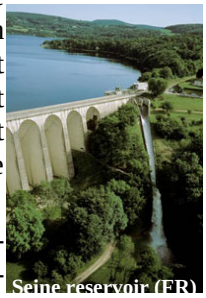
Case study 1 was on the Eder River (GE), where the project examined whether the environmental WFD objectives can be achieved in a typical river section considering the influence of climate change on the hydro-morphological conditions.

Restoration measures that support morpho-dynamic fluvial processes remain to be the best choice for stream restoration. While the finally developing stream morphology may change due to climate change, these measures are not expected to need adaptation as they are presumed to auto-adapt to the changing climate, providing the best choice for an effective WFD implementation strategy. These measures are also seen as the most suitable for the non- or very-minor anthropogenic altered stream situations


Eder River (GE)

Morphostatic measures like the installation and operation of fish passage facilities need to be adaptable for climate-change induced low-flow aggravation which is usually easy to achieve during design and construction as well as in most cases also in an already operating installation.

Case Study 2 was on the Seine River basin (FR). It aimed to provide an analysis framework to water managers for evaluating potential consequences of climate change on the river basin hydrology and dam management, and assessing adaptation strategies to cope with these changes. These adaptation strategies were developed at tactical (adaption of target reservoir filling curves) and at operational (real-time reservoir management) levels.


Seine reservoir (FR)

The result is a centralized real-time controller called Tree-Based Model Predictive Control (TB-MPC), developed in collaboration with TU Delft (NL) and Politecnico di Milano (IT). The objective was to obtain simulated river flows and to define thresholds for both low and high flows in order to assess reservoir management. For the reservoirs'management on the Seine River, this tool uses all the information available in real time, including ensemble weather forecasting, and hence shows a distinct improvement for drought and flood management. The limitation would be that uncertainties on hydrological model were not taken into account.

Case Study 3 in the Apulia region (IT) dealt with agricultural water use and a whole series of measures to adapt and (or) mitigate adverse effects of climate change have been identified.


Apulia Region (IT)

At farm level, farmers adopt different strategies in their farm management: they reduce the irrigated surfaces and shift towards less water intensive techniques. In addition, there is an effect of crop substitution (from high value crops, such as vegetables and vineyards, to less water-demanding crops) and dangerously a serious phenomenon of land abandonment since a substantial area of the region will not be cultivated anymore.

At system level, discussions with local experts in water management highlighted the need for enhancing some of the project consortia management tasks, namely the survey of the irrigation demand, the optimization of the water allocation in view of the future reduced availability, the development of a drought early warning system and infrastructural interventions aiming to increase water availability. The reduction of the irrigation system vulnerability to drought could be achieved by enhancing the interconnection with other sources of water, both conventional

and non-conventional ways to increase water availability. The former requires the development of new storage and delivering infrastructures. The latter needs reliable water treatment plants. Besides, the re-use of reclaimed water needs to deal with cultural barriers related to the willingness of farmers to use this water for irrigation.

Results show that notwithstanding the complex farm strategies adopted, farm income is seriously affected by future climate conditions: reduction for farmers of about 37%. These results show the vulnerability of the socio-economic sustainability and put in question the overall sustainability of the agricultural systems that is supposed to increase productivity to meet food security, even if it depends on the geographical context. It resulted to be crucial to facilitate the adoption of effective adaptation measures by technical assistance (e.g. development of new storage and delivering infrastructures, reliable water treatment plants), knowledge transfer processes (e.g. re-use of reclaimed water) and the integration of the stakeholders technical as and knowledge in a shared strategic vision (e.g. danger of serious land abandonment).

EXPERIENCES – RECOMMENDATIONS

The ClimAware project dealt with the impact of climate change and socio-economic changes on the hydrological conditions and hence the consequences of river flows changes (flood frequency, drought occurrence…).

The project results are developed based on climate and model uncertainties, which necessitate a continuous evaluation and adaptation depending on the real development of water demand and water availability related to the different sectoral water uses (dam management, irrigation practices…).

The chosen case studies are individual examples which may be transferred to comparable problems. Usually it is helpful to validate the comparability and to adjust the results if necessary.

From the European perspective, the majority of the EU needs to prepare for more water scarcity and droughts. Water scarcity is especially a problem in Southern and South-Eastern Europe. Therefore, regional adaptation strategies also need to address water demand management and more efficient use of freshwater resources.

The uncertainty of climate projections and changes in human pressures (i.e. water demand) plays a major role as climate change impacts will be in addition to, or concurrent with, those associated with socio-economic developments. Therefore, all climate change adaptation policies should require actions that are chosen not only on the basis of their effectiveness to current climate variability and human pressures but also under future conditions. By comparing different scenarios it is concluded that socio-economic scenarios dominate the dynamics of water scarcity although even a substantial decrease in water withdrawals does not prevent some regions from water scarcity particularly during the summer season. Therefore adaptation should not be discussed in isolation and the focus of any policy intervention should also be on the socio-economic drivers, such as land use and production patterns. For some regions technical measures that mainly aim to maintain the current state or try to reduce the impacts are probably not sufficient to save water and to diminish vulnerability to water scarcity in the future.

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IMPACT

Developing an Integrated Model to Predict Abiotic Habitat Conditions and Biota of Rivers Application in Climate Change Research and Water Management

Starting date: October 2010
Ending date: June 2012

Funders:
BMBF (GE) 591 182€
Onema (FR) 110 000€
FCT (PT) 99 360€

Participating countries/partners:

- **IBG: Leibniz-Institute of Freshwater Ecology and Inland Fisheries (GE) - Coordinator**
- UDE: University of Duisburg-Essen, Department of Applied Zoology/Hydrobiology (GE)
- CAU: Christian-Albrechts-University Kiel, Department of Hydrology and Water Resources Management (GE)
- CCMar: Centre of Marine Sciences, University of Algarve (PT)
- University Paul Sabatier, Toulouse, ECOLAB (FR)

Web link: http://www.impact.igb-berlin.de/

SCOPE

- Modelling how large scale pressures impact river biota in (restored) river reaches.
- Exploring if environmental change constrain reach-scale restoration.

OBJECTIVES AND METHODOLOGY

The overall aim of this project was to further develop and test an integrated modelling framework to predict the abiotic habitat conditions and to identify the main limiting pressures for biota of rivers.

Based on the work of one of the project partners, such an integrated modelling framework was developed to predict the abiotic habitat conditions, habitat suitability, as well as the species pool available for (re-) colonization of these habitats. This information was used to assess which species potentially can become established in a specific river reach. Within this modelling framework, the effect of large scale pressures (climate and land use change) on river biota and on the effects of reach-scale restoration measures were assessed.

Software tools were readily available for some of the models (e.g. ecohydrological, hydrodynamic models), but some of the models first had to be developed, especially dispersal models for fish and invertebrates and a novel habitat model for invertebrates.

The novel modelling tools and the integrated modelling approach was then applied and tested in two case-study catchments: The lowland, sand-bed Treene River in Northern Germany, and a gravel bed river in south-western France (Célé).

The modelling framework considers for the first time interacting effects of abiotic habitat conditions, dispersal abilities of species, and the species pool available for (re-) colonization.

CONTRIBUTION TO THE EU WATER FRAMEWORK DIRECTIVE

Art. 11: on the programme of measures which was targeted by assessing the effect of large scale pressures on river restoration success including climate change.

POLICY RELEVANCE AND FOCUS

At the operational level, the project provides an approach to more realistically assess the effect of reach-scale restoration measures given the anthropogenic pressures at larger spatial scales and to identify effective measures at the river network and catchment scale. For the first time, this assessment includes missing source populations and impacts of migration barriers.

At the strategic level, the project's modelling framework provides empirical evidence that neither predicted climate change nor land use changes will impact on river discharge and water quality to an extent that principally hampers river rehabilitation and that could not be mitigated.

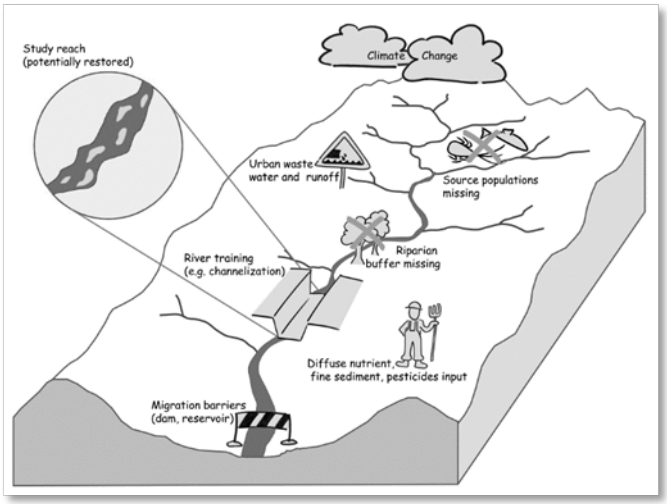
KEY OUTPUTS

- Modelling framework: The modelling framework developed integrates: (i) an ecohydrological model describing catchment scale pressures and processes (e.g. discharge, nutrient loads), (ii) a 2D hydrodynamic model predicting the hydraulic habitat conditions at the reach-scale for discharges modelled by the ecohydrological model for different scenarios, (iii) habitat models assessing the suitability of the hydraulic habitat conditions for biota, (iv) morphological models assessing if the predicted discharge changes significantly affect river morphology, habitat conditions, and in turn biota, (v) species distribution and dispersal models predicting the species pool available for (re-) colonizing the habitats, (vi) interaction models considering the feedback of biota on the abiotic habitat conditions. Finally, information on physical habitat conditions, water quality, and the species pool are combined to assess the effect of the different pressures on biota.
- Novel models: The first GIS-based fish dispersal model (FIDIMO) was developed to predict species-specific dispersal probabilities of fishes, while considering adverse effects of migration barriers and missing source populations (Radinger *et al.*, 2013). Moreover, a novel habitat model for invertebrates (Habitat Evaluation Tool) was developed that is able to predict species abundance besides species presence (Kiesel *et al.*, 2014).
- Case study application: In two case-study catchments, a near-natural study reach was selected as analogue for the habitat conditions of a typical restored reach. The most pessimistic climate change scenarios (mean temperature increase of 3°C and the A2 IPCC scenario, respectively) and detailed land use scenarios on changes in agricultural crops were used to assess the resulting changes in discharge, river morphology, hydraulic habitat conditions, habitat suitability, and biota to (i) compare the potential effect of different pressures, and (ii) investigate if large scale pressures constrain the effect of reach-scale restoration measures.
- Importance of habitat conditions vs. species pool: In the two case-studies, results indicated that restored reaches similar to the study reaches provide similar suitable habitats for all modelled fish species and (re)-colonization of the reaches by fish more strongly depends on the distance to the nearest remnant population and their species-specific dispersal ability. For macroinvertebrates, the lack of specific habitats hampers (re-)colonization of the study reaches besides the lack of remnant source populations.
- Inference of empirical dispersal parameters: Coupling traditional population genetics analyses, multi-specific empirical genetic data at a large spatial scale and genetic data simulated under different competing dendritic meta-population models allowed us to obtain valuable information concerning the overall dispersal capacities (dispersal rates, dispersal directionality and dispersal distances) of four fish species at different spatio-temporal scales.
- Importance of source populations vs. migration barriers: The dispersal models revealed that re-colonization of restored reaches is potentially more strongly affected by missing source populations than by migration barriers. Therefore, it is recommended that river management should focus on source populations which have not been adequately considered in the past, besides restoring river continuity.
- Effect of discharge changes on fish: In both case-study catchments, the climate change scenarios predicted a substantial decrease in discharge, which resulted in modified hydraulic habitat conditions but only caused small to moderate, species-specific changes in the habitat suitability for fish. The habitat model predicted non-linear effects of discharge changes on habitat suitability, both negative and positive. It is concluded that climate change might constrain the effect of river restoration for some fish species but does not limit restoration success in general.
- Effect of changes in nutrient concentrations on invertebrates: In the land use and climate change scenarios, the moderate changes in invertebrate abundance reflect the predicted moderate changes in nutrient concentrations. Most species occurring in the modelled lowland catchment are nutrient tolerant and are predicted to decrease in abundance with decreasing nutrient concentrations.
- Modelling framework applications: The application of the integrated modelling framework in IMPACT has focused on hydraulic habitat conditions for fish and nutrient loads for invertebrates. However, the overall modelling framework is flexible and

allows investigating different research and management options besides its application in climate change research: additional pressures like water temperature increase or pollutants other than nutrients can be considered as additional input parameters in the habitat models. The effect of different restoration scenarios can be modelled, especially comparing measures which are implemented at different spatial scales like local reach-scale instream habitat measures, development of riparian buffer strips at the river network scale, and land use changes at the catchment scale.

EXPERIENCES – RECOMMENDATIONS

The application of the modelling framework showed that abiotic and biotic models can be successfully linked to predict river biota.



Large-scale pressures influencing river biota at the reach scale (study reach)

The following main research needs were identified:

- Need to refine biotic models: the precision of the output of the abiotic models is higher than what presently can be used for the biotic models, and hence the overall output of the modelling framework could be enhanced by refining the biotic models, e.g. more precisely quantify the habitat needs and dispersal abilities of the species (see ③),
- Abiotic models should focus on biologically relevant parameters: model predictions could be enhanced if abiotic models focus more on habitat parameters relevant for biota, especially on sediment sorting and resulting sediment sizes, and organic substrates including macrophytes and their feedback on abiotic habitat conditions ("ecosystem engineers"),
- Limited knowledge on habitat preferences and dispersal abilities: the knowledge on habitat preferences and suitability is still limited, often based to expert judgment, and hence, empirical studies are needed for fish and invertebrates. Moreover, missing empirical data on the dispersal abilities of macro invertebrates limits the applicability of dispersal models.

FURTHER INFORMATION

The relationship between abiotic habitat conditions and their effect on biota is non-linear, i.e. predictions cannot be solely based on abiotic habitat variables, but also on biotic interactions.

Uncertainty of the modelling results is still considerably high and hence, river restoration and the programme of measures should follow an adaptive management approach, i.e. the effect of the measures should be monitored and the measures adjusted accordingly.

Large-scale pressures potentially constrain the effect of restoration measures and should be adequately considered in the programme of measures. In the case-study applications, results indicated that discharge changes due to climate change are of minor importance, and restoration success more strongly depends on large-scale pressures like nutrient loads and missing source populations. However, this might be different in other catchments.

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ICARUS

IWRM for Climate Change Adaptation in Rural socio-ecosystem in Southern Europe

Starting date: September 2010
Ending date: December 2012

Funders:
MINECO (SP) 30 000€
ISPRA (IT) 85 100€
FCT (PT) 78 000€

Participating countries/partners:

- **CMCC: Euro-Mediterranean Centre for Climate Change (IT) - Coordinator**
- UPV: Universidad Politécnica de Valencia - Centro Valenciano de Estudios del Riego (SP)
- EIA-UATLANTICA: Investigação e Administração S.A. / Instituto de Investigação Científicae Tecnológica da Universidade Atlântica (PT)

Web link: http://www.cmcc.it/icarus-iwrm-for-climate-change-adaptation-in-rural-social-ecosystems-in-southern-europe-2

SCOPE

The ICARUS project focused on water and climate change adaptation in agriculture in Southern Europe. An optimal management policy for water resources in Southern Europe was developed through the use of a decision support system.

OBJECTIVES AND METHODOLOGY

The project aimed at increasing the efficiency of water use in agriculture by analysing the different dimensions of sustainable water management and by identifying and assessing innovative adaptation strategies, practices and tools for saving water in irrigated production systems.

Case studies of the project were:

- Jucar river basin (Eastern SP): four different physical conditions (from mountainous areas to plains); great socio-economic contrast (rural or highly urbanized);
- Venice Lagoon Watershed (North Eastern IT): eutrophication issues, and mainly agricultural land use causing pollution;
- Central Alagarve (PT): extreme climatic conditions and insufficiently fertile land, limiting the development of a competitive agriculture.

CONTRIBUTION TO

- The understanding of biophysical, socio-economic, and institutional changes and how they impact on agricultural water management, particularly in a context of more frequent droughts and water scarcity;
- the improvement of decision-making processes by exploiting digital bi-directional communication;
- introduction of climate change perspective into the practice of IWRM, via the evaluation of adoption of climate change adaptation strategies in agriculture.

POLICY RELEVANCE AND FOCUS

In April 2009, the European Commission presented a White Paper “Adapting to climate change”, laying out a European framework for action to improve Europe's resilience to climate change, emphasizing the need to integrate adaptation into all key European policies and enhance co-operation at all levels of governance.

Moreover, the EC Communication on Water Scarcity & Drought (WS&D) set as main objectives, amongst others:

Yet, on the ground rural development policies still lag behind in terms of adoption of a climate change dimension into an IWRM framework

The ICARUS project promoted the integration of climate change adaptation policies into IWRM policies

- Allocating water and water
- Related funding more efficiently
- Improving drought risk management
- Considering additional water supply infrastructures

- Fostering water efficient technologies and practices
- Fostering the emergence of a water
- Saving culture in Europe
- Improving knowledge and data collection.

However, through consultations with several experts, practitioners, stakeholders, and governmental agencies, several limits still emerge for an effective decision-making process which maximize knowledge produced in various sectors and potentials for cooperation of different actors.

The ICARUS project highlighted that through a sound characterization of not only needs and priorities of end beneficiaries (ie. farmers), but also of their business as usual, policy funding can be directed towards the most options for an optimal management of the water resource.

KEY OUTPUTS

The project explored first scenarios of change (climate, socio-economic and land use change), then drivers and processes of change. An array of adaptation options, such as changing crop types, shifting sowing times, and introducing irrigation, in the agricultural sector was finally assessed. Overall, climate scenarios and economic scenarios show that by 2025 rainfall will decrease, temperature increase, and GDP growth will suffer a halt in Southern European regions.

Farmers involved revealed that a great deal of autonomous adaptation is already occurring, which range from improved efficiency in farming technologies, increased irrigation intensity, introduction of irrigation, diffusion of groundwater exploitation, changing crops and/or crop management, and specialization in non-food related agricultural activities, such as energy production from biomass. However, the adoption of the technologies at farmers' level is dependent on a wide array of factors (farmer's age, full or part-time dedication, cropping pattern, generational relief, training, etc.) which shall be taken into consideration when designing ad hoc policies (for more details, see Bonzanigo et al, 2015).

The main output of the project is an online decision support system (mDSSweb, www.netsymod.eu/mdss) for the integrated management of supply and demand for water resources. In the ICARUS project, mDSSweb was applied to involve farmers and irrigation boards in the analysis of possible adaptation strategies for the agricultural system in the case studies, under the condition that water conservation is more and more necessary.

A couple of comments left by farmers and policy-makers on the web platform

"This platform is a powerful tool for collecting opinions and exchanging experiences"

"These results are very useful for maximizing policy-making efforts, from design to implementation efficacy"

Specific strategies for each case study were evaluated according to several criteria, which covered social, economic, and environmental dimensions of the problem at stake, plus perceptions of overall feasibility and long-term durability. The criteria selected with the stakeholders were contribution to farmers' income, employment opportunities, technical effectiveness for improving adaptation to climate change, containment of conflicts over water resources between agriculture and other sectors, overall contribution to rural development, and practical feasibility. mDSSweb is a valuable tool for policy-makers, as it is highly flexible, easily adaptable to different contexts, and its online nature allows the involvement of hundreds of stakeholders, whose view are crucial for the success of policy design and implementation. Moreover, it permits the overcoming of temporal and spatial barriers, simplifies linguistic barriers, and eases knowledge and experience transfer.

EXPERIENCES – RECOMMENDATIONS

The main policy limitations identified by the ICARUS project were discussed with several experts during the project's final conference, "Dialogue on water resources from research to livelihood impacts".

In particular, the potential of models and economic policy instruments is well recognized in the research/academic environment, while it is often considered with scepticism by general public and policy makers. This is often due to gaps in communication between the two spheres, but also to specific problems, such as researchers not considering very important dimensions of local cultural background.

Limits in communication produce a cascade of negative effects, including the lack of trust between science and policy making. Building

trust requires well established interaction mechanisms and time. Often only implementing institutions can create the necessary conditions for long term perspectives, as they have different time constraints than research institutes.

Quite often, the knowledge produced by the academic/research environment is not fully exploited by the potential beneficiaries, for different reasons, including very importantly their limited involvement in research design and implementation, which determines as a consequence that the needs of the latter are not taken adequately into consideration by the former.

In order to be effective, coordination should include methodologically sound and efficient approaches to manage participatory process for the involvement of broad groups of stakeholders, as a prerequisite for improving communication, building trust and increasing impacts.

On the basis of the limitations identified above, ICARUS recommends the following:

- The need emerges to bring to the surface the gap in the communication path from academia to institutions to final users and vice versa. The potential role and usefulness of research products and advanced tools, such as models, should be demonstrated in real world conditions, and their potential for improving business as usual should then emerge, an example being management and communication of uncertainty, which shall not be concealed but instead brought into decision-making practices.
- Platforms for long lasting collaboration and trust building should be established to provide the basis for effective knowledge transfer. The role of long term demonstration cases is paramount, for building trust about for example the potentials of innovative tools or policy mechanisms.
- New research funding mechanisms should carefully consider mechanisms to strengthen the links and increase potentials for cooperation between universities and research centres, institutions and users. There should be no will to make social and economic interests to control scientific activities, but instead to have a voice in identify specific needs and conditions for operational implementation of expected outcomes, since the very early stages of research projects.

Participation is not an option, it is a must as the sense of ownership is fundamental for the success of any development project and policy implementation. Not only pilot and demonstration projects and dissemination activities are very important, but also the potential of Web 2.0 should be fully exploited, as internet is a powerful tool to involve beneficiaries and setup efficient interactions with the academia.

Therefore, the need emerges to identify approaches to improve the coordination and integration of assessment methods. It has been shown that the consideration of efficiency of water use in agriculture should be revised by including the consideration of a much longer chain of connected use for food production, energy, ecosystems, etc. For example, any approach to improve water efficiency should address also the fate of food products, including consideration of the water footprint of the huge amount of food wasted every day, as a part of the integrated cycle of an efficient resource use.

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ESAWADI

Utilizing the Ecosystem Services Approach for Water Framework Directive Implementation

Starting date: July 2010
Ending date: December 2012

Funders:
BMBF (GE) 133 452€
MEDDE (FR) 175 936€
FCT (PT) 47 400€

Participating countries/partners:

- **Asconit Consultants (FR) – Coordinator**
- CREDOC: the Research Institute for the Study and Monitoring of Living Standards (FR)
- Intersus (GE)
- Seeconsult Deutschland GmbH (GE)
- IMAR: Instituto do Mar (Portugal)

Web link: http://www.esawadi.eu

SCOPE

The ESAWADI project has analyzed the added–value of the Ecosystem Services Approach (ESA) for decision making and public participation processes supporting the implementation of Integrated Water Resource Management schemes, in particular economic requirements of the Water Framework Directive (WFD).

OBJECTIVES AND METHODOLOGY

ESAWADI aimed to test the operational contributions of the ESA in integrated water basin management as, (1) a tool for deciding on trade-offs between different policy scenarios; and (2) an educational tool to raise awareness amongst stakeholders, including residents and users, on the importance of ecosystem services and nature protection.

Three cases studies were conducted:

- France - Dordogne River catchment: The emphasis was first put on a thorough description of the impacts of alternative scenarios in relation to hydropeaking management, using the so-called ecosystem services cascade (ecosystems structure then ecological processes which benefit society then ecological services then social and economic uses). Then the educational use of ESA was tested in relation with river hydromorphology issues.

- Portugal - Mondego estuary: The main emphasis of this case study is on estuarine water quality improvements, as a crucial ecosystem service provided by the Mondego estuary. The case study focused on assessing the main pressures driving ecosystem status and the impacts on human wellbeing. It also estimated changes in ES provision under different responses scenarios. This case study used ESA to build alternative scenarios and compared them using a multi-criteria analysis (MCA) tool (based on the MULINO software). Decision makers were presented with a choice of alternatives depending on the conservation objective under consideration,

- Germany - Ems river basin / Hase river sub-basin: The German case study focused on river continuity and ecological health in the Hase river sub-basin (the largest tributary of Ems river). It aimed to identify how the ESA could contribute to the decision-making process concerning policies and measures that promote river continuity in the Hase river sub-basin and, in particular, justification for (i)

	France	Germany	Portugal
Study scale	River Basin District : Adour-Garonne Sub-basin: Dordogne catchment Study focus: Middle stretch of the Dordogne River Study sub-area: 13 municipalities within that area	River Basin: Ems Sub-Basin: Hase Study sub-area: Oxbow in the Town of Bramsche, Lower Saxony	River Basin: Mondego Sub-basin: Mondego Estuary/Lower Mondego/Mondego Study sub-area: Mondego Estuary
Local issues	Issue 1. Trade-offs between hydro-peaking and sustainable river management and effects on ES Issue 2. Effects of river mobility restoration on ES	Issue: Linear and lateral river continuity and ecological health	Issue: Sustainable integrated management of estuarine water resources

exemptions according to Article 4 of the WFD and the "disproportionality of costs" (ii) criterion.

The "Leipzig Approach" was adjusted and applied to the outputs of the workshop with water managers and stakeholders to test disproportionality of costs of measures.

The "Leipzig Approach" was developed in 2008 by the University of Leipzig, the UFZ Leipzig and the Ecologic Institute, on behalf of the German federal states North Rhine Westerphalia, Thuringia and Rhineland-Palatinate. It has been applied in Rhineland-Palatinate to assess disproportionality of costs of measures

Each case study assessed the use of the ESA for implementing the WFD. Based on the information gathered, it was determined whether existing methodologies to address WFD economic requirements could be adapted to incorporate ecosystem services, or whether methodologies already existed.

The German partners tested the Leipzig Approach and the Portuguese the MULINO tool in this perspective. Additionally, several interviews were performed in the German and French case studies with policy makers and water economists (from French Water Agencies and national ministries, German "Länder" representatives, and members of the LAWA Working Group "Economics") with an explicit focus on the WFD economic elements.

CONTRIBUTION TO THE EU WATER FRAMEWORK DIRECTIVE

The project has built on the experiences of the first management cycle of the WFD and targeted the following:

Art. 14: which focuses on the communication and stakeholders' participation in relation to WFD decision process;

Art. 5: which analyses existing water uses, impacts and pressures, for the French case-study;

Art. 9: which assesses and improves the cost-recovery level of water services (including environmental and resource costs);

Art. 11: which estimates the cost-effectiveness of measures and sets of measures at different scales in order to reach the WFD objectives;

Art. 4: which assesses the proportionality / disproportionality of costs associated with proposed measures in order to justify potential exemptions from the WFD environmental objective of achieving good surface water status by 2015.

POLICY RELEVANCE AND FOCUS

The ESAWADI focus is mainly operational (field based) with a strong scientific component and considerations for policy-making needs at the European level. The analysis and recommendations are mainly targeted at water managers and other stakeholders who aim to implement ESA as a supportive tool for IWRM schemes. The project allowed to: 1) identify regional and local stakeholders' expectations, fears and barriers regarding an actual ESA implementation; 2) learn from the testing of different tools and methods; 3) elaborate lessons and recommendations, and 4) allowed to show how ESA can contribute to a better integration of the different European and national policies (Natura 2000, Floods Directive, etc.).

KEY OUTPUTS

Ecosystem services assessment as a concept

- The core and principal strengths of the ESA lie in its structured and systematic approach to

describing the way functioning ecosystems provide benefits to society.

- Consistent with the WFD's stringent demands with respect to "Good Environmental Status" (GES), the ESA should be seen as a systemic approach to optimal ecosystem integrity protection and the sustainable provision of the various services in the long term.

ESA as an educational tool and means of supporting stakeholder participation

- The ESA helps communicate to stakeholders and public alike the issue that ecosystems provide benefits for human society, and improves understanding the impacts of ecosystem deterioration or restoration.

- Educational efforts have to be made to present this new approach, make the messages and concepts understandable to the general public, and integrate scientific inputs.

- Once stakeholders have grasped the meaning of ecosystem services they can contribute a lot to an accurate identification, characterization and valuation of ecosystem services in relation to the watershed. They can provide convincing illustrations and wordings, useful for negotiations and further communication. However, improving communication among stakeholders and with water managers requires time and willingness from stakeholders to talk to each other, with and without ESA.

ESA as a decision support tool

- ESA's main contribution to decision making is to provide a broad and comprehensive (ecological and socio-economic perspective) view of the issues at stake. ESA is a powerful way to set the stage since it allows a systematic and thorough identification of concerned groups, possible conflicts, as well as synergies and trade-offs in terms of benefits and costs.

- The analysis of conflicts between ecological processes and the different uses may require a very precise identification of the places and periods of potential conflicts (to the level of detail of specific months or weeks in the year).

- A full and scientific quantification/ monetization is usually not required or possible; if attempted it should be based on sufficient technical data and manpower/financial means to provide relevant results.

- In combination with traditional support tools (Cost Benefit Analysis, MCA, etc.), ESA can support the production of qualitative, semi-quantitative and quantitative data through field investigations, literature review and discussions with stakeholders.

Due to the existent uncertainty, the legitimacy of a decision needs to be the result of a participatory approach where stakeholders select/validate the options selected and trade-offs.

Relevance of ESA for WFD economic requirements

At a European and national policy-making level, great expectations are placed on the ESA to allow member states to better fulfill the WFD economic requirements. The research shows that the comprehensive economic approach of the WFD provides a particular challenge to most water managers. Therefore, their main concern is that ESA will introduce more work and constraints.

The ESA may at least act as a support tool providing qualitative insights on ecosystem services and trade-offs. ESA could play this role at the various steps of the economic analyses and at varying scales, the level of investigation and quantification being adjusted to the available resources:

For Article 5 on the analysis of existing water uses, impacts and pressures: an analysis in terms of ecosystem services at the basin scale can improve the connection between pressure assessment, water bodies' status and water uses, thus improving the characterisation of the River Basin District and providing the data on ecosystem services required for further analysis.

For Article 11 on identifying potential measures and Programme of Measures: the ESA can be a useful tool to include in cost-effectiveness analyses, in so far as effectiveness is not only limited to achieving GES, but that additional benefits created through water protection measures can also be taken into account. Through the integration of ESA into such assessment, these additional benefits could be illustrated and integrated into a more comprehensive analysis of the costs and benefits of measures. In addition, ecosystem services provision can be used as a kind of "second criterion" in choosing between potential measures using semi-quantitative

methods and/or as a purely qualitative description of ecosystem services which sets the framework under which economic analyses would be carried out.

For Article 4 to assess the disproportionality of costs: ESA could be used to check that the full range of benefits and stakeholders concerned are identified and integrated in the analysis. Besides, ESA can be used as a second criterion to incorporate qualitative data for acquiring a broader understanding of impacts that measures would have.

For Article 9 on cost recovery for water services: the ESA can be used as a support for environmental and resource costs assessments, or at least for the identification and characterization of these costs. At the same time, since the consideration of cost recovery is restricted to water services, this excludes some of the activities that strongly impact ecosystem services provision. If, however, the definition of water services is widened, the concept of ecosystem services could be of more significance to this article.

Besides, the ESA can help demonstrate the advantages of the Programme of Measures and encourage local operators and stakeholders to implement it. The preservation or increase of services can be included in the assessment of the PoM and orient the way in which measures like Payment for Ecosystem Services are implemented.

LIMITATIONS IDENTIFIED

Although ESA is sometimes presented as a kind of "panacea", it does not solve *per se* any existing methodological difficulties (data availability, scale issues, complexity of ecological processes, and valuation of the impact of measures, etc.). Besides ESA does not resolve any of the debates on the validity of result regarding economic valuation. The same challenges remain than with the traditional methods (contingent valuation, hedonic pricing, willingness to pay, benefit transfers, etc.).

EXPERIENCES – RECOMMENDATIONS

The ESAWADI project tested different ways of implementing ESA in a real operational context. It developed guidelines and a kind of practical six step global approach including:

- Analysing the context for setting objectives and methodology of ESA **:** Part of the difficulties encountered while implementing the ESA may be due to typical process challenges such as a lack of clarity in the aims and objectives of the implementation of the ESA at the outset, as well as adaptation to the actual context including data limitations.
- Identifying, characterizing and selecting relevant ecosystems services
- Analysing the link between ecological functions, ecological status and ecosystem service provision: The core step of ESA.

Several options for simplifying the complex interactions between ecological and socio-economic river basin processes are possible, these choices need to be made with due consideration to the ESA objectives (e.g. defining goals and priorities at a larger scale, assessing the effects of a policy or measure on ecosystem services, discussing of the value of ecosystem services with the general population, etc.). In any case, it is important to always keep the perspective of the river basin and to qualitatively describe the complex interrelations between the different components of the river ecosystem.

- Valuing ecosystem services in qualitative, quantitative or monetary terms
- Using ESA in final decision making process
- Organizing people/stakeholders participation, all through the process, as a component of the other tasks

The development of the ESA as a tool for IWRM/WFD implementation calls for a coordinated approach where:

- Most importantly, water managers and practitioners at regional and local level test and document experiments of this approach.
- Scientists elaborate sound methods and tools to implement ESA, in relation with practitioners and respond to methodological difficulties - more than extra research, the need is to assess how to do the best with existing knowledge:

It is necessary to improve and/or develop tools and methodologies which do not aim at full monetization/quantification, but instead incorporate ecosystem services in a semi-quantitative way, or which combine quantitative and qualitative elements in one decision matrix, or improve on existing ones (such as the Leipzig Approach);

These tools and methodologies should allow fruitful discussions and negotiations with decision-makers and others.

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WATER CAP & TRADE

Water markets scenarios for southern Europe: new solutions for coping with water scarcity and drought risk

Starting date: December 2010
Ending date: June 2014

Funders:
Onema (FR) 262 370€ MINECO (ES) 41 529€
Comunidad. de Madrid (ES) 50 700€
ISPRA (IT) 49 616€

Participating countries/partners:

- **BRGM: French Geological Survey (FR) - Coordinator**
- Actéon (FR)
- CEMAGREF (FR)
- University of Bologna (IT)
- Universidad Polytechnica de Madrid (SP)
- Universidad de Cordoba (SP)

Web link: http://www.capandtrade.acteon-environment.eu/

SCOPE

Investigate if and how economic instruments aiming at reallocating water between users could be integrated into water management policy in the European context.

OBJECTIVES AND METHODOLOGY

The main objective of the Water Cap & Trade project was to assess the technical, economic and social relevance of Individual Transferable Quotas (ITQ) for improving quantitative water management in Southern European countries. Implementing this instrument requires (i) defining a sustainable water resource exploitation limit (global quota or cap), (ii) apportioning this global quota among users (i.e. allocating individual quotas), and (iii) creating an institutional framework for allowing users to exchange ITQ (water market) on a temporary or permanent basis.

From an economic perspective, the objective was to better understand how economic instruments aiming at reallocating water between users could be integrated into water management policy in the European context. The method consisted in exploring 1) the efficiency issue through economic modeling, 2) the acceptability issue through participatory approaches, 3) the institutional dimension through an analysis of transaction costs and 4) the policy implementation process, through policy simulation or policy exercises. By design, the project mainly looked at water markets from an economic perspective.

The project was based on several case studies in France, Italy and Spain. Interactions with stakeholders, water planners and policy makers were significant in the three countries, either at local, regional or national level.

CONTRIBUTION TO THE EU WATER FRAMEWORK DIRECTIVE

Art. 4: which deals with the environmental objectives to achieve a good status for all surface waters until the year 2015 or at least to prevent any deterioration of the surface water status;

Art. 9: recovery of costs for water services.

POLICY RELEVANCE AND FOCUS

From a policy perspective, the project results should contribute to the development of new visions of how water markets could be integrated into national water policies in Europe. Let us recall that, in its "Blue print to safeguard Europeans water", the European Commission leaves open the possibility for using this instrument:

"water trading is another instrument, used mostly outside the EU, which could help to improve water efficiency and overcome water stress, if a sustainable overall cap for water use is implemented. Water trading entails relatively significant administrative costs and,

in principle, only makes sense among water users in a defined river basin. Although it would not be helpful to set up such a system at EU level, the Commission proposes developing CIS guidance to help the development of water trading in the Member States that choose to employ it".

KEY OUTPUTS

One of the main contributions consists in showing the variety of instruments, which hide behind the term "water market". It also shows that conditions required for establishing water markets are not met in a number of socio-economic and environmental contexts. However, where these conditions are met, their implementation could generate significant benefits for the society.

EXPERIENCES

In order to improve water markets in Spain the consortium considered the following issues to be key: water regulation should move towards a more flexible, agile and dynamic management system, where there is more transparency and more information available. A formal and effective separation of water rights and allocations is recommended (that follows the Australian system). Water exchanges should be based on the water consumed, avoiding the use of diverted volume or unused water rights and the adoption of regulations for inter-basin and inter-regional trading, with the objective of reducing the political interference and arbitrariness.

Farmers declare that Water user associations (WAUs) are the preferred agent to intermediate in the market suggesting that farmers cooperation is perceived as a safeguard for proper management of the water resources. A key role should be attributed to Water Users' Association to develop agricultural water market. Such farmers' self-organizing institutions should be enhanced as a system to improve governance following a scheme of nested levels of decision making in the water resources management. In this sense, a community-based approach is encouraged.

In France, investigations conducted as part of this project have mainly focused on water market scenarios within agriculture and the evidence from the case study suggests that preconditions to establishing such agricultural water markets are not met. In basins characterized by tensions over water uses, resource augmentation (inter-basin transfers, small scale reservoirs) often remains an affordable solution that will be preferred to trading in the medium term; this situation will last as long resource augmentation will continue benefiting from public subsidies. Overall, we consider that the water scarcity condition is thus not met.

- The global "cap" is still contested, in particular in groundwater basins where insufficient scientific knowledge underpins its calculation. Potential market participants would thus prefer investing time and money in lobbying activities aiming at increasing the cap rather than engaging into water trading.

- Individual water quotas which are currently being established in some French basins and allocated to farmers are not properly defined (weak legal foundation). Quotas are also not properly enforced (illegal abstraction points and metering problem). In addition, the "use it or lose it" rule represents a serious barrier to trade.

Basins where demand outweighs available resources are those where storage and transfer infrastructure is inexistent or limited. There, yearly water allocation is highly uncertain (inter-annual and intra-annual variability), which reduces the potential for trading. In basins equipped with multipurpose reservoirs, water trade could possibly take place between hydropower, agriculture and urban users. Such water market scenarios should be investigated in future research.

In Italy, the social/political context in which water markets are discussed is generally opposed to the establishment of water markets. The 2011 referendum on the introduction of private capital in the ownership of the water utilities further exacerbated this situation and made it difficult to build scientific discussions on the topic.

However, due to the recent drought events, it seems that stakeholders closer to the agricultural sector are exploring the whole set of possible institutional arrangements for the management of water irrigation, including water markets.

- Water markets need a set of technical and legal conditions that are not met in the Italian context. From a legal perspective, in the Italian legislation water is a publicly owned resource. Water use rights are requested and granted

through concessions and water remains a non-tradable item. Water markets would thus require a substantial change in the definition of the content of the concessions.

- Moreover, one of the preconditions for water markets is the establishment of a "cap" on water uses. In the current situation, most of the concessions are not monitored on a quantitative basis, so that there is no legal definition of the cap (though in many areas there exist a de facto cap in the irrigation season). Also, in many instances there is no monitoring on the status of the resource, so that is not possible to quantify a reasonable cap. These technical deficiencies are to be covered before any institutional reform towards the introduction of water markets in Italy.

RECOMMENDATIONS

Three conclusions can be derived from the consultation of farmers and institutional stakeholders.

- First, there is still a long way to go before the preconditions to water trading are met: level of water scarcity, scientific knowledge, water entitlements' definition, positions of principle, and rules to establish initial allocation volumes should still evolve before envisaging the implementation of tradable water quotas in France.

- Secondly, ground-water trading schemes are expected to have a limited potential (in terms of trading activity) with trade taking place only in large and homogeneous groundwater units, and where farming systems are highly diversified.

Thirdly, there will be a real challenge to choose the optimal regulation level of the trading mechanism, with a trade-off between (i) many trading rules to limit economic, social and environmental risks and (ii) as few regulation as possible to propose a realistic and manageable trading mechanism and to enhance trading activity.

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WATER2ADAPT

Resilience enhancement and water demand management for climate change adaptation

Starting date: September 2010
Ending date: October 2012

Funders:
BMFB (DE) 168 579€ MINECO (ES) 62 000€
ISPRA (IT) 74,000€

Participating countries/partners:

- **FEEM: Fondazione Eni Enrico Mattei (IT) - Coordinator**
- BC3: Basque Centre for Climate Change (ES)
- CALS: Chamber of Agriculture of Lower Saxony (DE)
- Seeconsult Deutschland GmbH (DE)

Web link: http://www.feem-project.net/water2adapt/

SCOPE

Water2Adapt was an applied-research project which focused on the social and economic implications of water use under scarcity, the efforts to set up efficient and socially equitable prices for water and water services, and the policy responses at river basin scale to water scarcity and droughts (WS&D).

In particular, Water2Adapt analysed the impacts of WS&D, exacerbated by human-induced climate change and land use changes, on communities and regional economies in three representative River Basins Districts (RBDs) in Europe: in Spain (Ebro), Italy (Po) and Germany (Weser).

OBJECTIVES AND METHODOLOGY

Water2Adapt, as a small-scale European project, aimed at producing policy-relevant knowledge and recommendations for water demand management at RDB scale for the appropriate implementation of the EU Water Framework Directive (WFD).

The Water2Adapt project was born from the frustration about the poor understanding of the full effects of droughts and water scarcity on social welfare and the recognition of the role of water management for climate adaptation.

Small in size and exploratory in nature, the project has been ideally suited to locally explore the web of interconnected impacts triggered by WS&D. The project collected evidence and contributed to filling the knowledge gaps, setting the stage for an evidence-based drought management approach.

For the major drought events selected, the project investigated the economic losses and social hardship inflicted by, and system's resilience to WS&D in rural and urban contexts; analyzed the impacts of climate change on water availability and demand; assessed the performance of WS&D policies and measures.

CONTRIBUTION TO THE EU WATER FRAMEWORK DIRECTIVE

Art. 1: contributes to mitigating the effects of floods and droughts;

Art. 5: review of the environmental impact of human activity and economic analysis of water use;

Art.11: programme of measures;

Art. 13: river basin management plans.

POLICY RELEVANCE AND FOCUS

The Water2Adapt project started from the recognition that the far-reaching economic, social and environmental impacts of droughts and water scarcity are not known in sufficient detail. At first, the European Commission's Communication on Water Scarcity and Drought (EC, 2007) provided unclear boundaries between water scarcity and drought, mixing trends, risk and variability.

Later on, the Commission's Review of the Policy on Water Scarcity and Droughts (COM(2012)672) highlighted that small progress has been made in the implementation of the seven policy options of the 2007 Communication. In addition, the Blueprint to Safeguard Europe's Water resources (COM(2012)673) has laid out new roadmap for an improved water and drought risk management in Europe, but the benefits are still not evident.

KEY OUTPUTS

The results of the project are set to inform the basin-wide climate adaptation strategies and drought action plans. Moreover, they shed light on challenges and potential of an European concerted action in the field of drought, recently reviewed as a part of the Blueprint for Safeguard Europe's Water resources (COM(2012)673).

The project highlighted that:

- The economic costs of drought and water scarcity are often ill-conceived, underestimated and incomplete. Climate variability is endogenous to agriculture, hydroelectricity generation and other water uses. The drought-related losses should be estimated as the difference between the value generated by a socially optimal (re-) allocation of (drought-reduced) water resources compared either to customary or efficient (if not the same) allocation of water under the average climate conditions. The scope of the economic assessment of droughts shall detect the wasteful practices and pave the way to designing (more) efficient, equitable and sustainable water management schemes

- The social impacts of drought are difficult to disentangle form the impacts of other economic shocks (financial and economic crisis) and climate-independent economic and societal transformations. Severe droughts may further amplify inequalities in social conditions of vulnerable and marginalised households and communities. Drought risk management should inform the development and welfare policies set to preserve livelihood, social cohesion and essential service provision.

- It is most likely that human-induced climate change will alter water availability, increase the risk of intense droughts to societies that are ill-prepared to cope with, and increase the gap between long-term water availability and demand in areas that already experience water scarcity. Climate adaptation strategies should be designed at river basin scale, providing a coherent set of scenarios of expected changes in water availability and demand, and the cost effectiveness/benefit ratio of water demand measures. In Mediterranean countries, the more volatile rainfall pattern may have serious repercussion on energy security, in particular on hydro- and thermoelectricity production. Renewable energy policies should increasingly favour renewable sources and electricity generation techniques that require less water.

EXPERIENCES- RECOMMENDATIONS

The Water2Adapt Project provided policy recommendations for each analysed RBD. From among the policy areas identified in the 2007 Communication, the results indicated that: i) putting the right price on water is a priority of the Southern Europe case studies; ii) the introduction of volumetric water prices in Italy and Spain for the agriculture sector could reduce potential water stress during scarcity; iii) the improvement in water supply infrastructure is a policy recommendation considered by both the German and Spanish case studies; iv) improving the governance at RBD level is an essential requirement in the Italian case study; v) fostering water efficiency technologies and practices could be achieved through water saving in buildings (Italy), waste water reuse and rainwater retention (Germany), reduced water leakage in both civil supply and agriculture (Italy and Spain); vi) innovative economic-policy instruments such as water transfer and water markets are considered as potential solutions against increased water competition between sectors such as energy and agriculture; and finally, vii) all case studies have identified the necessity to include climate change scenarios in the development of water management plans for appropriate inter-sector water allocation.

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Final Conference Synthesis Brussels, 21 & 22 October, 2014

This part proposes the synthesis of the IWRM-NET SCP final conference. It focusses on the debates held after the presentation of the research projects funded by IWRM-NET. Detailed information on the 6 projects presented can be found in the previous sections of this document dealing with policy briefs.

IWRM-NET-SCP final conference was held in Brussels on the 21st and 22nd of October 2014 in cooperation with the Water Joint Programming Initiative (Water JPI[1]) The aim was to bring opportunities for scientists, water managers, knowledge brokers and policy makers to access and discuss the research outputs of the 6 projects.

The conference was divided in two main sessions. After the introduction by Jean-Philippe Torterotot, deputy director for research and innovation, Ministry of Ecology, Sustainable Development and Energy (FR), the first session addressed water and aquatic environment management: innovative solutions for adaptation to climate change; the second session focused on the socio-economic aspects of water and aquatic environment management, introduced by Gilles Neveu, director of innovation, International Office for Water.

SESSION 1: WATER AND AQUATIC ENVIRONMENT MANAGEMENT: INNOVATIVE SOLUTIONS FOR ADAPTATION TO CLIMATE CHANGE

INTRODUCTION

Jean-Philippe Torterotot reminded the objectives of the conference to bring together the partners and co-partners from the research projects, the funders of the research and other scientists alongside to water stakeholders at different levels. The good timing to access research outputs after the launch of the Blueprint to safeguard Europe's water resources and before the second cycle of river basin management planning of the Water Framework Directive (WFD) was acknowledged. The real need for interactions between the stakeholders and the researchers was presented as highly important as stated by an internal evaluation within the French ministry of ecology on water policy and governance. This interaction was one leitmotiv of the CIS-SPI (Science policy interface for water framework directive implementation. Activity conducted from 2010 to 2012 by France and the European commission) activities to promote the Science-policy interface (SPI) principles on water management.

DISCUSSION AND DEBATES

During the first session, the CLIMAWARE, IMPACT and ICARUS projects were presented by the project coordinators and researchers. After the presentations the 1st discussion panel discussed 'what tools, strategies or approaches can help water managers to adapt to climate change'. A series of sub questions[2] was initially proposed to the panelists[3] to start the discussion.

Key feature: knowledge based solution

- Need for a very dense monitoring in space and time
- Need for more demonstration at the local scale and cost sharing of innovation transfer
- Modelling needs wide range of empirical data and requires to select the species that will be modelled
- Research outcomes should remain public for a long time after projects end

To answer the question on Innovative adaptation strategies and measures: which scale is adequate, for which type of activities and what modelling tools are useful to understand climate change impacts and test adaptation measures, Antonio Loporto started by

1 See: http://www.waterjpi.eu/

2 Sub questions addressed to the panelists of session I: (i) What indicators can help European regions implementing adaptation measures to climate change? (ii) Innovative adaptation strategies and measures: at which scale? For which type of activities? (iii) Modelling tools to understand climate change impacts and test adaptation measures? (iv) What can be expected from local scale restoration measures given the pressures on larger scales? (v) How to accommodate the changes in supply (scarcity/drought) and demand in the context of climate change?

3 The panel gathered Antonio Lo Porto, IRSA (IT), Régis Thépot, Seine Grands Lacs (FR), Achim Pätzold, LLUR (DE), Stephan Theobald, University of Kassel (DE), Jochem Kail, Leibniz-Institute (DE) and was facilitated by Tanya Waarners, Centre for Ecology and Hydrology (UK)

reminding that water managers use modelling tools and one key component of these tools is the availability of monitoring data.

Key feature: stakeholder's involvement

- As a source of information: to select measures to be tested
- As the potential end users of the tools: to ensure the tool fits their needs
- As key actors to apply measures, which leads to political insights to deal with related water price, incomes, land management (etc.) issues

One difficulty lies in the fact that what is requested by the WFD is not necessarily adapted to water management at the local scale, for which very dense monitoring in space and time is needed. Based on the experience of IMPACT, the question of modelling and restoration lead to the need of empirical data to understand the link between the presence of species and the environment parameters. Empirical data allows to calibrate and validate models.

Research has produced a wide range of tools (on smart irrigation, GIS approach with JPS, DSS, etc.), but the innovation transfer is often blocked by a lack of demonstration. The farmers need to see that these modelling tools are adapted to their specific environment thanks to applied examples. The second need lies in the cost sharing. The Common Agriculture Policy should take care of this issue to improve the effective use of available technology.

ICARUS project is one example of providing support to the stakeholders (i) to farmers to foresee the adaptation measures impact (ii) to the authorities to foresee the water demand that can be associated in the future with the agricultural production.

The question of '**what can be expected from local scale restoration measures given the pressures on larger scales?**' was also intensively debated. Achim Pätzold shared his experience and feedbacks as a German agency member and involved in the project IMPACT. He explained that even if local scale measures can be quite effective to improve ecological quality, they remain highly dependent on the larger scale. The circumstances and the pressures that operate at larger scale determine in the end whether local scale restoration will be a success in terms of good ecological status. Both local and large scales restoration measures need time to become efficient, which is hard to assess at the level of the research project. That is why political arguments are necessary to provide information to researchers on the large scale measures' targets and objectives.

The question of public raising awareness is determinant to tackle the medium term environmental issues. Regis Thépot, director of Seine-Grands-Lacs, reminded that in 40-45 years the average Seine flow in Paris should be 30 % less in summer time. Even if 10 million of inhabitants are concerned, the citizens and politicians do not care. The work on participation, trust, communication, feedback, perception and build modelling tools regarding these issues is important. Results and data produced by the research projects contribute to the public raising awareness and should remain available for years. As important those results have to be summarised for policy makers.

The discussion ended with a general statement even a paradox on the WFD presented by Antonio Loporto: the measures of programmes have more often a direct impact on chemical status and do not directly target the good ecological status; which makes it hard to assess if WFD objectives are achieved.

GENERAL OVERVIEW

Finally, Philippe Quevauviller, scientific officer at DG enterprise, shared his thoughts and comments to provide a scientific perspective and synthesis of the session. As a project on climate change, CLIMAWARE leads to the conclusion that climate change impact is very different among different regions, which confirms previous findings and expectations. The question of choosing one single tool to assess different parts of Europe is hence questionable. IMPACT highlights the intercalibration issues and raises the needs to understand how climate models have different types of approaches and uncertainties. This approach has to rely on strong validation mechanisms of models as a step towards

Key feature: local vs large scales

- The local scale to implement measures is effective but…
- Remains highly dependent of the larger scale
- Combining the two contributed to environmental issues raising awareness

decision making tools. ICARUS really shows the added-value of an integrated approach to manage and understand climate change impacts. Even more, the project is one demonstration of farmers' involvement in a very practical way which allows the research to provide sufficient elements to water managers. As for the considerations on WFD, the monitoring issues face the financial crisis. Despite the economic context and the difficulties of implementation, WFD remains a unique process in the world that benefits from an on-going integration effort.

Finally, ERA-NET has a potential of providing demonstration capacities of methods and tools in support of the WFD implementation as shown by the results of the projects funded by IWRM-NET. This experience gained at regional level has a great potential in terms of expertise sharing at EU level and returns of experiences back to European level (e.g. via working groups of the WFD Common Implementation Strategy).

SESSION II: SOCIO-ECONOMIC ASPECTS OF WATER AND AQUATIC ENVIRONMENT MANAGEMENT

INTRODUCTION

Gilles Neveu, International Office for Water, Director of innovation opened the second day by reminding the context, objectives and outputs of IWRM-NET-SCP. The project aimed at creating and supporting the scientific community composed by researchers involved in IWRM-Net funding initiatives, at promoting interdisciplinary and facilitating scientific exchanges and synergies, and at supporting the dissemination of the results. Meetings were organised among projects to ensure the monitoring and the management. The communication and dissemination were led using different tools like conferences and workshops with water managers, presentations during the INBO (International Network of Basin Organisations) meetings. Intermediary and final outcomes of the projects targeting a wide audience (researchers, professional of water management) throughout Europe were channeled through newsletters and webinars. Policy briefs for the projects using the template created by the Science Policy Interface activity of the Common Implementation Strategy were prepared. And the Social Network European Water Community set up by IWRM-NET was tested.

One lesson learnt dealing with the conference objective is that dissemination targeting the policy side requires a strong change of the habits. IWRM-NET-SCP supported it working on specific format of dissemination activities, reviewing dissemination documents with a non-scientific point of view to open up the results to potential innovation that could be taken forward by water managers. Low cost tools (i.e. webinars, social network) were provided. All these activities request a certain amount of time to be fulfilled or used, which is inevitably related to a budget issues. One recommendation out of IWRM-NET SCP would be to recognise two main dissemination channels and allocate dedicated budgets to scientific dissemination (made by the scientists) and policy/users dissemination that could be taken over by knowledge brokers.

DISCUSSION AND DEBATES

During the second session, the project coordinators and researchers presented ESAWADI, Water2Adapt and Water Cap and Trade. The 2nd discussion panel focused on 'What tools for water managers in valuing water'. A series of sub questions[4] were initially proposed to the panelists[5] to facilitate the debates.

Firstly panelists reacted on the presentation of the projects. Ray Earl opened the debate reflecting on the challenge of bridging the gap between those who work on the field and those who are very knowledgeable in research. Sustainability, resilience and robustness are three features which have challenged the WFD implementation. The spectrum of research dealing with economy is expected to tackle very different issues such as early warning concerning water scarcity, pollution system, water floods, or to provide best management

[4] Sub questions addressed to the panelist of session II (i) How to use economic instruments and models for water management policy in Europe? (ii) How to make the concepts of socio-economic resilience operational at the river basin scale? (iii) Which role for ecosystem services approach to support the implementation of IWRM?

[5] The panel gathered Lucia Fiumi, ARNO RB Authority (IT); Bernardo Mazzanti, ARNO RB Authority (IT); Ray Earle, Eastern RB District (IE); Maggie Kossida, NTUA (GR); Philippe Blancher, ASCONIT (FR); Lorenzo Carrera, FEEM (IT) and was facilitated by Jean-Daniel Rinaudo, BRGM (FR)

practices with tangible results. In any case, raising public funds for research requests to bring along politicians and the general public with a good communication strategy.

To pave the way between the WFD and Integrated Water Resource Management, adaptation and mediation are central to include energy related water issues, take on board innovation, and tackle climate change issues. The time dimension of ecosystem services payment and return on investment is essential.

Key feature: *water* economy

- Can refer to resource assessment that may end by pricing water
- Can refer to the public choices for measures implementation funded by public authorities
- *Water* Economy is embedded in political, environmental and ecological dimensions

Bernardo Mazzanti acknowledged the ideas and issues provided by the projects in relation to planning activities for the 2nd cycle of river basin management plan. For example, the estimation of water loses due to drought event provided by Water2Adapt is very useful to quantify the risk of absence of a drought management plan.

Key feature: water a specific resources

- Ethical and cultural dimensions are structural to water
- Pricing water is inevitability dependent on social acceptability which varies from one region to the other
- Research provides arguments to understand economic mechanisms to all the stakeholders

At the level of the river basin, the water market is very interesting but it is probably too early to integrate it as a measure in the 2nd plan. Lucia Fiumi completed her colleague's point of view by underlining how water scarcity and drought have changed the context of the WFD implementation by raising the water economics issues at a high stake level. WFD orientates water managers to try to introduce mechanisms that bring water efficient use. ARNO river basin authority's experience shows that efficiency on water resources management is possible only through updated water balance knowledge (tested by PAWA project). At that early stage, it is possible to share with the actors the quantitative management indicators and also perform economic assessment of the measures to optimize water allocations.

How economics contribute to the development of river basin plans and what are communicational issues with implementers?

As water is embedded within ethical and cultural issues, water pricing is a very sensitive issue. Social acceptability varies from one country to the other and from one category of stakeholders to the others. This has an impact in terms of policy and price/usages (as opposed to treated water, drinking water, navigable water, etc.). The current Irish situation is a very accurate example. As Ray Earl explained 100 000 people marched against paying anything for drinking water. The cost of water management is also important.

According to ARNO river basin authority's experience, one key aspect is to keep the right message for the stakeholders and be as transparent as possible. A lot of money is spent on monitoring which allows the realisation of programme of measures. But choices should be consciously made among all the measures linked together, being aware of the return on investment for each euro spent.

Key feature: time and investment

- Public money has to be invested in a transparent way showing how long it will take to reach the goal
- Market is an interesting approach but more time is needed to better understand which mechanisms could be applied based on which arguments
- Market as a solution should remain simple

Maggie Kossida explained that WFD and other directives recognise Economic Policy Instruments (EPI) as a way to build economic arguments for water management. The experience of the on-going EPI Water project (FP7) reminds that EPI try to create incentives to change behaviour, which implies the involvement of stakeholders and regional authorities. The change of behaviour following can be expressed by a solidarity mechanism leading to a social tariff for water for families with low income as witnessed by Water2Adapt.

Philippe Blancher reminded that economics is not against environment. As demonstrated by Claude Henry in the 80's, economic evaluation can demonstrate that a project is not economically interesting. On the same line, ESAWADI showed that economic arguments come anyway in the discussion on water issues at basin level whatever the environmental sensibility of the person interviewed is. Basic economy is also moral and political.

Economic resilience as explained by Lorenzo Carrera is not only the capability of the system to recover but also to accommodate, to be prepared to the potential effect of a hazard. Three main measures were given to support economic resilience:

- increase knowledge about the system and the bound effects of hazards: it includes all measures about knowledge management, monitoring, and also governance;
- increase efficiency of water uses: it requires to understand that policy makers need reliable downscale climate models to foresee the future water availability and also socio-economic models to understand the future water demand;
- coordinate actions in terms of water management and resilience dimension.

Key feature: economic resilience

Three main measures to support economic resilience:

① increase knowledge about the system and the bound effects of hazards

② increase efficiency of water uses

③ coordinate actions in terms of water management and resilience dimension

The Irish situation brought another perspective to the resilience question. As Ray Earle explained the condition to produce drinking water is linked to the treatment of the source of water, which is getting more expensive in terms of energy, of chemical uses, of uncertainty, partly because of the monitoring required for the protection of public health.

The long term global changes brought by climate change require to stick to a holistic vision that helps linking the different time scales and understanding the measures impacts. The measures in front of climate change are not new. The challenge is more about debating to prioritise the measures according to political, social choices and set strategies.

Which role for ecosystem services approach to support the implementation of IWRM?

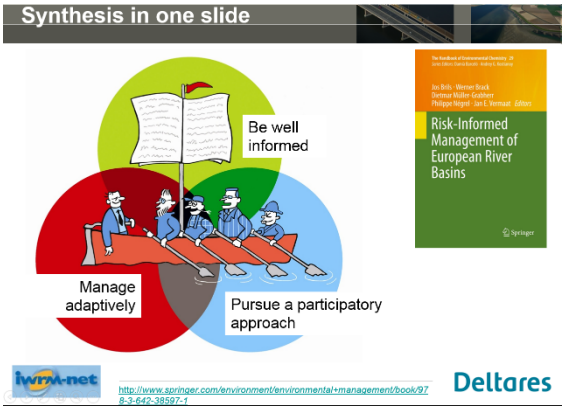
From the point of view of the Eastern River basin district of Ireland, one key issue to work on the social acceptability of concepts (i.e. ecosystem services, economics instruments) is to provide concrete example; to show how people life will change or not and related benefits. Too much science loses people. Science and experts in communication are both required. Dublin city has been retained as the United Nations biosphere, which provides an effective illustration of ecosystem services approach.

The ARNO Italian river basin authority linked the ecosystem services with the cost recovering implementation and highlighted the lack of knowledge for the 1st management plan. Guidance are under development at the European level and national one have been prepared by the Ministry of environment. The implementation of ecosystem services payment is difficult to put into practice.

The ecosystem services approach seems to be one really good option to tackle water related economics issues and complete the classical economical tools. Nevertheless, the concept as promising as it can look suffers from a lack of shared definition and standard rules for implementation. It is also challenged by the same difficulties than classical tools to cope with a wide spectrum of stakeholders.

GENERAL OVERVIEW OF THE CONFERENCE

The general overview of the conference was given by Jos Brils. Firstly, a synthetic approach of the projects and related debates of



Jos Brils, PowerPoint presentation

the two days was given using the three key principles for risk-informed river basin management identified by the EC FP6 project RISKBASE[6].

- Be well informed: session I provided a lot of information about understanding of ecosystem functioning and responses to climate change (CC). Session II focused more on how this information connects to the social system, i.e. to the management and related policy making system;
- Manage adaptively: The first step was to write the river management plan (RBMP). The second step deals with the measures implementation followed by the monitoring, which provides information on how to adapt and revise the next plan. The WFD revision cycle is 6 years. But why wait so long to permit the implementation of adaptive solutions in the meantime?
- Pursue a participatory approach: a lot of things regarding this key-principle have been said over the two days. A first summary can be: "learn together to manage together". The system does not only depend on water managers to achieve a good chemical and ecological status. Other stakeholders' involvement is essential (e.g. cooperation with farmers). The challenge is to implement a 'learning-by-doing' process that should be based on experimentation. This relates to the co-creation of knowledge, not mentioned during the conference, but which is very much related to this participatory principle.

Furthermore, ecosystem services (ES) is a quite new concept that can be very supportive to IWRM and WFD implementation. New concepts – like ES – are still difficult to be understood and accepted at the local management level, even more because they are not used in the official language of the WFD. Even if not everybody is convinced yet, the ES concept seems to be meant to last as it is, for example, widely used in the Horizon 2020 context in relation with issues that are perceived as urgent by society, i.e. grand challenges like jobs, energy, safety and health. And ES is a core concept in EC biodiversity policy. It would help further acceptance of the ES concept a lot if the clear relationship between ES and these grand challenges were more explicitly stressed to the water policy makers and managers.

Be well informed

We need more monitoring, but seriously hampered by financial crises (Philippe Quevauviller's Session 1 synthesis)

Analyse link between ecological functions, status & Ecosystem Services (ES) provision - ESAWADI

ES Approach can help demonstrate advantages of PoM - ESAWADI

ES Approach elicits scientific as well as local knowledge - ESAWADI

Knowledge base ES and use of ES approach needs to be strengthened - ESAWADI

You also have ecosystem disservices - ESAWADI

Put the right price on water / volumetric water pricing needed. Everywhere? – Water2Adapt

Include CC scenarios in RBMP development for appropriate water allocation – Water2Adapt

Water trading entails high administration costs and only makes sense in a defined River Basin - Water Cap and Trade

EU recommended to develop non-compulsory CIS guidance for water trading - Water Cap and Trade

There is a whole suite of instruments behind 'water market' - Water Cap and Trade

Formally & effectively decouple water rights and allocations - Water Cap and Trade

Individual water quotas not properly defined and enforced (France) - Water Cap and Trade

Establish a cap on water uses (Italy)– but 'one-size does not fit all' - Water Cap and Trade

Monitoring on water resources status is lacking (Italy) - Water Cap and Trade

Still a long way to go before pre-conditions water trading are met - Water Cap and Trade

Lack of time and resources to conduct in depth comparative (case) analysis - Water Cap and Trade

Jos Brils, PowerPoint presentation

[6] See: Brils J, Brack W, Müller D, Negrel P, Vermaat J (Eds)(2014) Risk-Informed Management of European River Basins. Springer, 395p

Secondly, the RISKBASE principles were used to provide a specific conclusion to Esawadi, Water2Adapt and Water Cap and Trade. Considering the principle "be well informed", one item was added, related to the conclusions made at the CIS SPI event held in 2013: connecting and comparing the urgency of reaching WFD objectives to urgency of economic issues like job creation: how urgent do we perceive achieving of the WFD objectives in that context?

For the "manage adaptively" principle, comments were shared on the scale of the WFD implementation. At the local level, it is impossible to fully implement the WFD. Other directives also have to be implemented, that at some points are contradictory to the WFD goals, such as EU transport policy, that is pro changing of hydromorphology to facilitate transport by water, while the WFD aims at restoring hydromorphological changes. This is just one example demonstrating why we have to be adaptive in implementing of the WFD.

The question of scale was again raised for the "pursue a participatory approach" principle. A continuous, meaningful engagement is what people want, which is different from the public consultation as requested under the WFD.

Manage adaptively

Need more pilots and continue ERA-nets (Philippe Quevauviller's Session 1 synthesis)

There is existent uncertainty in – and sometimes concerns to – using ecosystem services (ES) Approach (ESA) - ESAWADI

Test and document ESA experiments - ESAWADI

Practical tools … based on resilience and adaptive capacity - Water2Adapt

Will volumetric water pricing indeed reduce potential water stress? - Water2Adapt

Move towards more flexible, agile and dynamic water regulation - Water Cap and Trade

Don't talk about 'water trading', but 'voluntary exchanges' (learned-by-doing) - Water Cap and Trade

Next time involve also a lawyer in study for legal aspects? - Water Cap and Trade

"I like to apply all recommendations as best I can" (River Basin manager in Panel)

"We try to include new concepts in our RBMP updates" (River Basin manager in Panel) □

Need for adaptable water prices in case of scarcity? (Panel-public discussion)

'Resilience' is slowly being taken up, River Basin practice adapts to that (Panel discussion)

WFD is adaptive piece of policy as it includes 11 directives! (River Basin manager in Panel)

Jos Brils, PowerPoint presentation

Pursue a participatory approach

Need more pilots and continue ERA-nets (Philippe Quevauviller's Session 1 synthesis)

Becomes reality (Philippe Quevauviller's Session 1 synthesis)

ES approach to be used in close cooperation with/involving stakeholders - ESAWADI:

- Thus results make better sense to them
- Negotiate with stakeholders who undergo negative impacts
- Due to existent uncertainty, participatory decision making needed

Participatory development of inter-sector water allocation plans? - Water2Adapt

Elaborate policy recommendations together with the stakeholders - Water2Adapt

Different stakeholders, different perspectives towards water markets - Water Cap and Trade

Water trading only makes sense AMONG water users in a defined River Basin - Water Cap and Trade

Establish Water Users Associations (WAUs) to safeguard proper use - Water Cap and Trade

A (farmers) community based approach is promoted - Water Cap and Trade

Interdisciplinary approaches of economic instruments - Water Cap and Trade

Collective water exchange works some places, other, comparable ones not - Water Cap and Trade

People want to be empowered (River Basin manager in Panel)

Jos Brils, PowerPoint presentation

Finally, the following synthesis of what had been presented and discussed about the Ecosystem services approach (ESA) was shared with the audience.

Ecosystem Services Approach (ESA)

Need more pilots and continue ERA-nets (Philippe Quevauviller's Session 1 synthesis)

ESA is structured, systematic, broad & comprehensive: that is its strength - Water2Adapt

It is a powerful way to 'set the stage' - Water2Adapt

It's a support tool, helps achieving ecosystem integrity & protection - Water2Adapt

Water managers express concerns using ESA: more work & constraints? - Water2Adapt

Guidance and education needed on how to implement ESA in practice - Water2Adapt

- to be tailored to specific needs and actual context
- to be done stepwise, following common sense (ESAWADI approach)
- and keep the river basin perspective in mind

make it concrete (River Basin manager in Panel)

Full ES quantification & valuation not always needed - Water2Adapt

In IWRM/WFD context a (semi) qualitative ESA may also be useful - Water2Adapt

ESA is still in 'storming & forming' (infancy) phase, not yet in 'norming' one - Water2Adapt

EU wide 'harmonization' of ESA needed? - Water2Adapt

Timing: possibly 3rd cycle WFD best opportunity to implement ESA - Water2Adapt

ES I not same as environmental services - Water2Adapt

Missed the word 'sustainability' in ALL presentations (River Basin manager in Panel)

Still huge questions on applicability of Payment for ES (River Basin manager in Panel)

Jos Brils, PowerPoint presentation

CONFERENCE CLOSURE

The conference was closed by Enrique Playán (CSIC –ES-, Coordinator of the Water JPI) who introduced the Water JPI and its 1st Strategic research and innovation agenda. The PowerPoint presentation is available on IWMNET-SCP website[7].

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[7] www.iwrm-net.eu

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