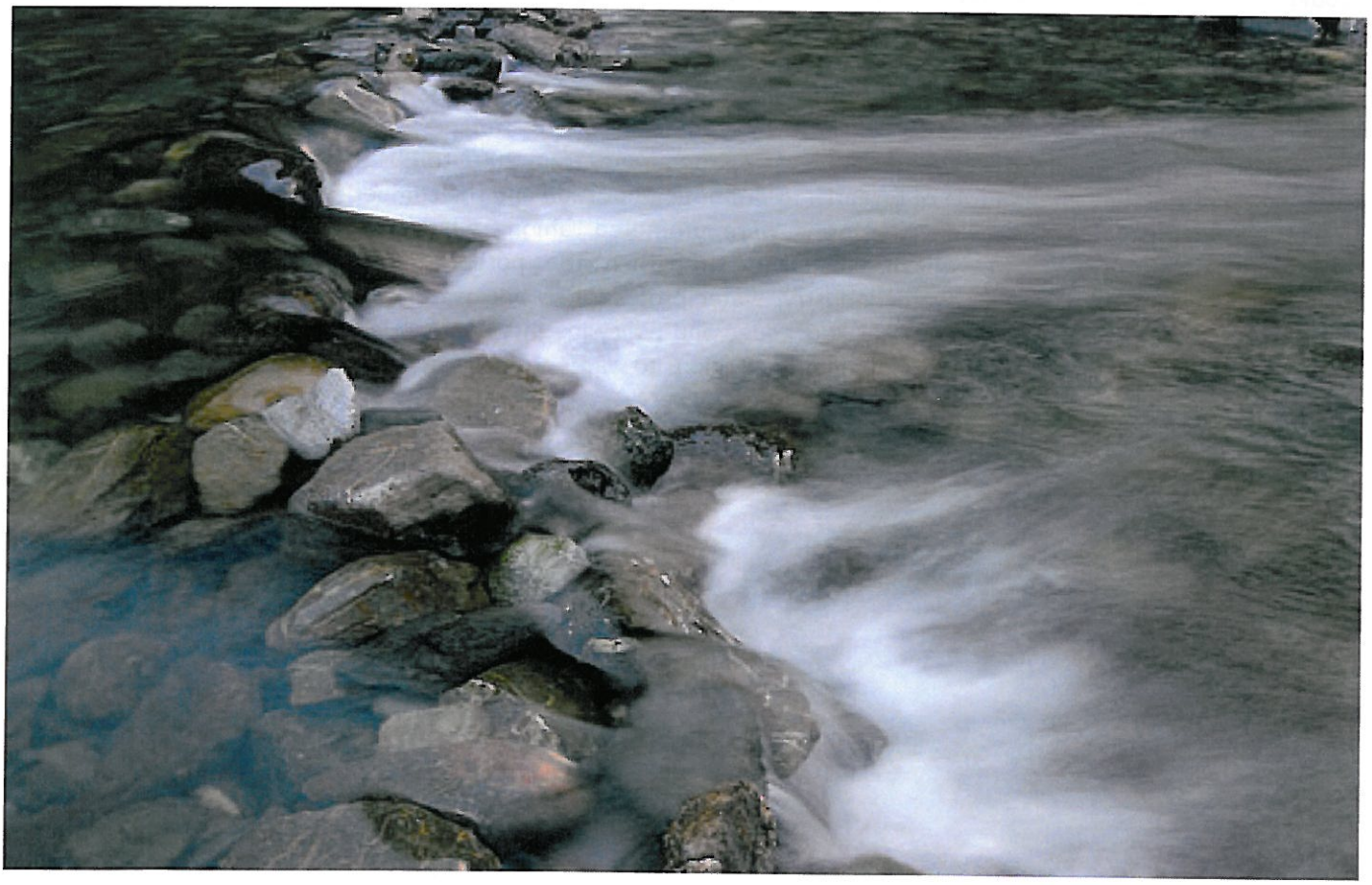
EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

THE CHALLENGE

Water is a precondition for human, animal and plant life, as well as a necessary resource for the economy. Consequently it is essential to learn how to better manage this important resource to make sure the exploitation is not detrimental. Problems such as pollution, over-exploitation of natural resources, damage to the aquatic ecosystems, climate change, and security aspects are challenging the sustainability of European water systems and urge us to new and better investments. In this context, integrated watershed management is fundamental and helps us to protect environment but also to prevent from natural hazards. In fact, healthy watersheds will improve the quality of water supply, reduce flooding problems and raise opportunities for a sustainable and environmental education. As this issue transcends national boundaries, measures must been taken at the European and international level to ensure the effective protection of the citizens.



Natural resources management

Policy Relevance

The integrated river basin management is based on a strong political and legislative framework: the Water Framework Directive (WFD) and the European Union groundwater legislation. The WFD is the operational tool for water protection since 2000 and aims to set out clear deadlines to improve water management until 2027. The groundwater legislation presents the different steps that the Member states should follow to achieve good results in groundwater management by 2015. Additionally, the watershed management research contributes to the European Union Water Initiative (EUWI) that plays a part into the safe drinking water components and sanitation of the United Nations Millennium Development Goals.

Research History

Water research has been a major component of successive European Commission research Framework Programmes, primarily in the environment field. European Commission funded research on water covered a very wide spectrum, spanning from hydrology, to ecology, to technologies and to integrated aspects. The European Commission has been supporting research on water related issues since the late 1980's via its multiannual framework programmes for Research Directorate. In the Fifth Framework Programme, FP5 from 1998 to 2002, a very large programme was established through a "key action" on water, with emphasis on integrated approaches for sustainable water management, support to water policy and management of global change. A major financial effort was also put in the support to the implementation of the WFD. Some projects focused on assessment methods applicable to a wide range of European eco-regions. Some others looked at the understanding of water quality issues in various surface water bodies to give policy recommendations. In the Sixth Framework Programme (2002-2006, the focus of the environmental research activities on water was slightly moved towards new concepts and tools for the mitigation of global change impact on water resources in Europe and worldwide. The specific needs for water policies led to the selection of a group of projects addressing the WFD, but also of some Integrated Projects (IP) with very high policy relevance. The focus was on interdisciplinarity, with research themes like integrated management strategies and the link between hydrology and the climate process. Finally, the Seventh Framework Programme, from 2007 to 2013, is mainly characterised by the recognition of the fundamental role of research to promote innovation and the competitiveness of European, industry. A group of industry-led Technology Platforms were promoted, among which the Water Supply and Sanitation Technology Platform (WSSTP), which aim is to strengthen the potential for technological innovation and competitiveness of the European water industry, water professionals and water research institutions. FP5 and FP6 research projects have provided important knowledge and policy insights of the role of water for our welfare. FP7 is focused on the prevention and the development of solutions to water problems and on the impact of climate change on water systems.

Projects	
BRAHMATWINN: Twinning European and South Asian River basins to enhance capacity and implement adaptive integrated water resources management approaches	EUROWET: Integration of European Wetland research in sustainable management of the water cycle
EUROCEANS: European network of excellence for Ocean Ecosystems Analysis	CENES: Water Scenarios for Europe and for Neighbouring States
EUROLIMPACS: Integrated Project to Evaluate the Impacts of Global Change on European Freshwater Ecosystems	WADE: Floodwater Recharge of Alluvial Aquifers in Dry land Environments

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

BRAHMATWINN

AT A GLANCE

Title: Twinning European and South Asian River basins to enhance capacity and implement adaptive integrated water resources management approaches

Instrument: Specific Targeted Research or Innovation Project, FP6

Total Cost: 3.651.480 €
EC Contribution: 2.871.494 €

Duration: 43 months
Start Date: 1/06/2006

Consortium: 17 partners from 10 countries

Project Coordinator: Friedrich-Schiller-University (FSU-Jena) (Germany)

Project Web Site: http://www.brahmatwinn.uni-jena.de

Key Words: Integrated Water Resources Management (IWRM), Integrated Water Resources Management (GCC), GCC Mitigation and adaptation, scenarios,

THE CHALLENGE

BRAHMATWINN will enhance the capacity to carry out a harmonised integrated water resources management (IWRM) approach as addressed by the European Water Initiative (EWI) in headwater river systems of alpine mountain massifs impacted from climate change. It will also enhance the capacity to transfer professional IWRM expertise, approaches and tools based on case studies carried out in twinning European and Asian river basins. The project addresses all important IWRM issues in a balanced way, including conflict resolution in the trans-boundary twinning Upper Danube River Basin (UDRB) and the Upper Brahmaputra River Basins (UBRB) in Europe and South Asia.

PROJECT OBJECTIVES

BRAHMATWINN will try to make a comprehensive system assessment and change detection by a set of recognised IWRM indicators. It will also try to provide analyses of driving forces, pressures, state, impact, and response of system components with respect to vulnerability to impact by climate change in adherent "what-if?" scenarios. Other objectives are the transfer of professional expertise of tested holistic approaches and technologies, and the development of adaptive IWRM options for mitigation of climate change and anthropogenic impacts in alpine macro-scale river basins by means of a IWRM system (IWRMS) and accounting for the uncertainty of future climate change related "what–if?" scenarios. Finally, the project developments will be communicated to the BRAHAMATWINN stakeholder community.

METHODOLOGY

These main project goals will be jointly realised by holistic case studies applying innovative technologies, integrated approaches, techniques, and experiences in the twinning UDRB and UBRB. These studies will comprise research and development activities that

address such impacts for water-soil resources management in the two macro-scale trans-boundary basins having significant water storage in snow and glacier covered alpine mountain headwaters. Such activities will additionally develop and apply integrated assessment approaches by means of remote sensing, GIS and modelling. They will also establish an Integrated Water Resources Management System (IWRMS) toolset by compiling tested European approaches and tools to water resources management as well as regional expertise and experience. Finally, they will disseminate and contribute to the capacity building and implementation of harmonised IWRM plans within the twinning basins.

Expected Results

BRAHMATWINN elaborates on the vulnerability of present IWRM and river basin management with respect to impacts from Global Climate Change (GCC). It will develop tested approaches and technologies for adaptive IWRM and provide knowledge and capacity building in respect to a scientifically based sustainable IWRM that will contribute towards the targets set out in the Millennium Development Goals. The project will offer an integrated holistic approach towards IWRM that utilises synergetic integration methods from socio-economic as well as natural science and technologies from remote sensing and Geoinformatics. It will also suggest future climatic change scenarios for the twinning basins derived from macro-scale Global Circulation Model (GCM) predictions. BRAHMATWINN will provide additionally a comprehensive river basin assessment and regionalisation by means of the Response Units. Furthermore, it will provide a sustainable IWRMS toolset for spatial geo-data processing by means of remote sensing, GIS, information management, hydrological modelling and multi-criteria decision support. Finally it will issue a recommendation of integrated key indicators of both a physical and socio-economic environment.

PROJECT PARTNERS	
Friedrich-Schiller University, Jena, DE	The Royal University of Bhutan, (Bhutan) BT
Ludwig-Maximilian University, Munich, DE	Institute for Tibetan Plateau Research, (China) CN
ETH Zürich, (Switzerland) CH	Center for Agricultural Resource Research, (China) CN
University of Salzburg, AT	H.G. Geodata Solutions GmbH (SME), DE
University of Vienna , AT	Vodni Zdroje (SME), (Croatia) HR
University of Southampton, GB	Johann-Wolfgang Goethe University Frankfurt, DE
University of Dundee, GB	Indian Institute of Technology Roorkee, (India) IN
University of Oslo, (Norway) NO	Codematix GmbH, DE
International Centre for Integrated Mountain Development, (Nepal) NP	

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

EUROCEANS

AT A GLANCE

Title: European network of excellence for Ocean Ecosystems Analysis

Instrument: Network of Excellence, FP6

Total Cost: 40.000.000 €

EC Contribution: 10.000.000 €

Duration: 48 months

Start Date: 1/01/2005

Consortium: 61 partners + 5 Associated from 25 countries + 3 Associated

Project Coordinator: CNRS France (science), FIST S.A. France (administration)

Project Web Site: http://www.eur-oceans.eu/index.php

Key Words: "Network of Excellence", "Anthropogenic forcing", "Climate Change", Biogeochemistry, "Ecosystem end to end", "Ecosystem approach to marine resources", "integration", "Marine Science"

THE CHALLENGE

The overall networking objective of EUR-OCEANS is to achieve lasting integration of European research organisations on global change and pelagic marine ecosystems and the relevant scientific disciplines. Presently, the EUR-OCEANS Principal Investigators (PIs) are scattered in 61 Member Organisations, located in 25 countries. The PIs belong to three research communities, which have traditionally worked independently on pelagic ecosystems, biogeochemistry and ecosystem approach to marine resources. The initial integration within EUR-OCEANS will consist in bringing together research organisations and excellent researchers, through the Joint Programme of Activities of the 4-year EUR-OCEANS Network (2005-2008).

PROJECT OBJECTIVES

The overall scientific objective of EUR-OCEANS is to develop models for assessing and forecasting the impacts of climate and anthropogenic forcing on food-web dynamics (structure, functioning, diversity and stability) of pelagic ecosystems in the open ocean. Initial integration will be achieved through directed action including the PhD and post doctoral program, sharing of facilities, mobility programs and networked database. Cutting edge science will be additionally promoted through such targeted actions as the Integration Projects. EUR-OCEANS will assure durable integration beyond 2008 through the establishment of the EUR-OCEANS multi-site Consortium beginning January 1, 2009.

METHODOLOGY

The Joint Programme of Activities of EUR-OCEANS comprises integrating activities on networking, data, and model integration. Furthermore, it comprises jointly executed research, organised around three

broad modelling tasks (together with observations and experiments) on pelagic ecosystems end-to-end, biogeochemistry and ecosystem approach to marine resources. Moreover, EUR-OCEANS include activities that spread excellence, targeted at three different groups: researchers, socio-economic users of the knowledge resulting from the Network's research activities and European public outreach through an aquaria network.

Expected Results

The expected results of this Network of Excellence will be the EUR-OCEANS multi-site Consortium to sustain the activities and ensure durable and lasting integration of the EUR-OCEANS Network of Excellence. The Consortium will facilitate and promote the long-term harmonization of the efforts of European marine research institutes and universities that sign the agreement. This harmonization will also ensure the future pre-eminence of European research institutes within the world oceanographic community

Project Partners	
Institut des Sciences de la Mer et de l'Aménagement du Littoral, (Algeria) DZ	Centro de Investigación Oceanográfica en el Pacifico Sur-Oriental (COPAS), Universidad de Concepcion (COPAS), (Chile) CL
Université Libre de Bruxelles (ULB) BE	Université de Liège (ULg), BE
Vrije Universiteit Brussel (VUB), BE	Danish Institute for Fisheries Research (DIFRES), DK
National Environmental Research Institute (NERI), DK	University of Aarhus (UAAR), DK
Tartu Uelikool, Eesti Mereinstituut (MEI), EE	Finnish Institute of Marine Research (FIMR), FI
France Innovation Scientifique et Transfert (FIST S.A.), FR	Commissariat à l'Energie Atomique (CEA), FR
Centre National de la Recherche Scientifique (CNRS) , FR	Institut de Recherche pour le Développement (IRD), FR
Institut Français de Recherche pour l'Exploitation de la MER, FR	SOPAB-BREST (Océanopolis), FR
Alfred-Wegner Institut für Polar- und Meeresforschung (AWI), DE	Institut für Ostseeforschung Warnemünde (IOW), DE
Max-Planck-Gesellschaft zur Förderung der Wissenschaften, DE	Universität Hamburg (Uni-HH), DE
Universität Bremen (Uni-HB), DE	Leibniz- Institut für Meereswissenschaften (IFM-GEOMAR), DE
Hellenic Centre for Marine Research (HCMR), GR	Consiglio Nazionale delle Ricerche (CNR-IAMC), IT
Consorzio Nazionale Interuniversitario per le Scienze del Mare, IT	Istituto Nazionale di Geofisica e Vulcanologia (INGV), IT
Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, IT	Stazione Zoologica 'A. Dohrn' (SZN), IT
Latvian Fish Resources Agency (LATFRA), LV	Institut National de Recherche Halieutique (INRH), (Morocco) MA
Rijksuniversiteit Groningen (RuG), NL	Nederlands Instituut voor Ecologie (NIOO), NL
Universiteit van Amsterdam (UvA) , NL	Royal Netherlands Institute for Sea Research (NIOZ), NL
Universitetet i Tromsoe (UiT), (Norway) NO	Norwegian University of Science and Technology (NTNU), (Norway) NO
Universitetet i Bergen (UiB) , (Norway) NO	Havforsksningsinstituttet (IMR), (Norway) NO
Norwegian Polar Institute (NPi) , (Norway) NO	Institute of Oceanology Polish Academy of Sciences (IO PAS), PL
Sea Fisheries Institute (SFI (MIR)), PL	Instituto Nacional de Investigação Agrária e das Pescas, PT
P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences (SIO), (Russia) RU	University of Cape Town (UCT), (South Africa) ZA
FUNDACIÓN AZTI - AZTI FUNDAZIOA (AZTI), ES	Consejo Superior de Investigaciones Cientificas (CSIC), ES
Instituto Español de Oceanografia (IEO) , ES	Universidad de Las Palmas de Gran Canaria (ULPGC), ES
Universidad de Vigo (UVIGO), ES	Göteborg University (UGOT), SE
University of Bern (UNIBE), (Switzerland) CH	Tunisia Faculty of Science of Bizerta (FSB), (Tunisia) TN
Middle East Technical University, Institute of Marine Sciences, (Turkey) TR	Institute of Biology of the Southern Seas (IBSS), GB
University of Essex (UESSEX), GB	Natural Environment Research Council (NERC), GB
Plymouth Marine Laboratory (PML) , GB	University of Southampton (USOU), GB
Imperial College of Science, Technology and Medicine (ICL) , GB	The Centre for Environment Fisheries and Aquaculture Science, GB
The Scottish Association for Marine Science (SAMS) , GB	Institut Mauritanien de Recherches Océanographiques et des Pêches (IMROP), (Mauritania) MR
Ministry of Fisheries and Marine Resources (MFMR), (Namibia) NA	Instituto del Mar del Peru (IMARPE), (Peru) PE
The Centre of Marine Sciences of the Algarve (CCMAR), PT	Atlantic Research Institute of Fisheries and Oceanography, (Russia) RU

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

EUROLIMPACS

AT A GLANCE

Title: Integrated Project to Evaluate the Impacts of Global Change on European Freshwater Ecosystems

Instrument: Integrated Project, FP6

Total Cost: 19.154.659 €
EC Contribution: 12.647.141 €

Duration: 60 months
Start Date: 1/02/2004

Consortium: 36 partners from 19 countries

Project Coordinator: UCL (UK)

Project Web Site: eurolimpacs.ucl.ac.uk/

Key Words: freshwater ecosystems, climate change, multiple stressors, interaction effects

THE CHALLENGE

Climate is changing rapidly, beyond the range of previous natural variability. Natural ecosystems, already under stress from land-use change and pollution, now face additional pressures from climate change, both directly and through interaction with other drivers of change. These pose serious threats to human society as the availability and quality of freshwater determines the functioning of every ecosystem. Ecosystems are so complex that predicting and managing the ecological consequences of global change is a task that requires great expertise, new methods and comprehensive, new approaches.

PROJECT OBJECTIVES

Euro-limpacs seeks to improve understanding of how global change, especially climate change in its interaction with other stresses (land-use change, nutrient loading, acid deposition, toxic pollution) has altered and will alter the structure and functioning of European freshwater ecosystems. The project aims to encapsulate this understanding in the form of predictive, testable models. To support the application of this knowledge in a management context the project also aims to identify key structures or processes (indicators of aquatic ecosystem health) that clearly indicate impending or realised global change through their loss, occurrence or behaviour. Euro-limpacs also aims to identify better approaches for the re-naturalisation of ecosystems and habitats in the context of global change that will lead to the successful fulfilment of the Water Framework Directive (WFD) in achieving good ecological status in freshwater habitats.

METHODOLOGY

Advanced time-series analysis of long-term data-sets will be used to identify processes and relationships operating on different time-scales. Palaeoecological methods will be used to identify decadal-scale trends,

Natural resources management

the impact of natural climate variability and reconstruct past hydrochemical and ecological conditions at key sites throughout Europe. Space-for-time substitution using wide ranging spatial datasets will be employed to relate climate features to ecological consequences. New data and new techniques, such as stable isotope analysis, will be used to reconstruct features of ecological function, especially food-web interactions. Direct experimentation will be used extensively, including whole catchment and lake manipulations, large-scale replicated field mesocosms and microcosms in controlled laboratories. Results will feed into a range of specialised models which will be developed and used throughout the project. Models will be chained or linked together and used with climate scenarios to simulate hydrological, hydrochemical and ecological response to changing climate at the catchment scale.

Expected Results

Euro-limpacs will increase understanding of the direct impacts of predicted climate change on aquatic ecosystems. It will provide new information on the consequences of interactions between climate change and other stressors and pollutants (e.g. nutrient loading). This will help to develop, for the first time, the tool-kit needed to simulate hydrological, hydrochemical and hydroecological process interactions between freshwater ecosystems and assess the potential impact of global change at the catchment scale. A unified system of ecological indicators for monitoring freshwater ecosystem health, and new methods for defining reference conditions and restoration strategies will also be developed. Euro-limpacs will provide policy makers, conservation and regulatory organisations and other end-users with useable models, decision support systems and other appropriate tools to respond to the interactions between climate and other changes, in the best interests of conservation of the goods and services provided to the community by its freshwater systems.

Project Partners	
University College London, Environmental Change Research Centre (ECRC), GB	National Environmental Research Institute, Department of Freshwater Ecology, DK
ENTERA, DE	Charles University, Prague; Hydrobiological station, Blatna, CZ
University of Duisburg-Essen, Centre for Microscale Ecosystem, Institute of Hydrobiology, DE	HYDROMOD Scientific Consulting, DE
University of Reading, Aquatic Environments Research Centre, GB	Institute for Environmental Studies, NL
ALTERRA Green World Research, Team of Freshwater Ecology, Wageningen, NL	University of Leuven, Department of Biology, Laboratory of Aquatic Ecology, BE
Natural Environment Research Council, GB	Masaryk University Brno, Department of Zoology & Ecology, CZ
Spanish Council for Scientific Research, ES	University of Barcelona, Department of Ecology, ES
Swedish Environment Research Institute, SE	University of Iceland, Institute of Biology,(Iceland) IS
Norwegian Institute for Water Research, (Norway) NO	University of Granada, Department of Animal Biology, ES
Swedish University of Agricultural Sciences, Department of Environmental Assessment, SE	Centre for Environmental Research Leipzig-Halle, Department of Conservation Biology and Natural Resources (CNBR), DE
Finnish Environment Institute, FI	Russian Academy of Sciences, Water Problems Institute, (Russia) RU
University of Innsbruck, Institute of Meteorology and Geophysics, Institute of Zoology and Limnology, AT	University of Rennes, Research Unit 'Ecosystem Functioning and Biological Conservation', FR
University of Liverpool, GB	Utrecht University, Institute of Biology, Landscape Ecology Group, NL
Centre National de la Recherche Scientifique and Université of Toulouse, "Laboratoire Dynamique de la Biodiversité", FR	University of Bucharest, Department of Systems Ecology and Sustainable Development, RO
Consiglio Nazionale delle Ricerche: Water Research Institute (IRSA) – Institute for Ecosystem Studies (ISE), IT	Trent University (Ontario, Canada), Environmental and Resource Studies, (Canada) CA
Macaulay Land Use Research Institute, GB	Czech Geological Society, CZ
Swiss Federal Institute of Environmental Science and Technology, Departments of Water Resources, Drinking Water, Limnology, Surface Waters, (Switzerland) CH	University of Natural Resources and Applied Life Sciences, Institute of Water Provision, Water Ecology and Waste Management, Department of Hydrobiology, AT
Greek Biotope/Wetland Centre, Soil and Water Resources Department, GR	Hydrobiological Institute, Academy of Sciences of the Czech Republic, CZ

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

EUROWET

AT A GLANCE

Title: Integration of European Wetland research in sustainable management of the water cycle

Instrument: SSA FP6

Total Cost: 530.000 €
EC Contribution: 530.000 €

Duration: 16 months
Start Date: 1/01/2004

Consortium: 2 partners from 2 countries

Project Coordinator: BRGM (FRANCE)

Project Web Site: http://eurowet.brgm.fr/

Key Words: wetlands, hydrology, ecology, biogeochemistry, socio-economics, law and policy

THE CHALLENGE

Considerable scientific knowledge and technical experience have been gained within Europe in diverse aspects of wetland science and management including hydrology, biogeochemistry, ecology, socio-economic valuation and policy analysis. However, the results of research and management experience were still too fragmentary and not sufficiently orientated to problem-solving. Some were simply inadequately framed to be transferred to, or used by, stakeholders and policy-makers. Simultaneously the general outcome of the scientific research has been increased awareness of the significance of wetlands in delivering goods and services important for human welfare including quality of life, biodiversity conservation and maintenance or enhancement of environmental quality. Despite this, wetlands continue to be degraded and lost throughout Europe without adequate consideration of the wider benefits to be achieved from more effective management.

PROJECT OBJECTIVES

The EUROWET's key objective is the synthesis of the current state of the art of wetland research. Wetland experts have been invited to reinforce and synthesise the knowledge on wetlands by actively participating in strategic conference sessions. Thematic papers have been prepared in the areas of hydrology, ecology, biogeochemistry, socio-economics and law and policy. A critical review of European wetland research will be published (in press, see Eurowet website).

Dissemination was a key part of the project and has ensured the impact of the project outputs across the various potential user communities in Europe. A dissemination strategy was developed as part of the workshop. This gave an identification of target groups of end-users, the information they required and the appropriate medium for the transfer of this

information. Relevant outputs were produced by this strategy for distribution to users at various levels (see Eurowet website).

Methodology

The final goal of the project was to integrate the substantial multidisciplinary European research in wetlands and to help attain a sustainable management of the water cycle. This was achieved by the translation of science at the national and European levels into practical guidance for end-users and by a comprehensive review, expert assessment and a well-focussed dissemination strategy.

Through the project, wetland experts of different European countries and candidate countries were invited to reinforce and synthesise the knowledge on wetlands by actively participating in a strategic conference sessions. In the months prior to this, high level experts were contracted to prepare their thematic working papers before the conference. Thematic papers were prepared in the areas of hydrology, ecology, biogeochemistry, socio-economics and law and policy. These have been reviewed at the workshop and subsequently a critical review of European wetland research published.

Another key aim of the expert workshop was to produce the structure and key contents of the Technical Guidance to reinforce the Horizontal Guidance being prepared as part of the Common Implementation Strategy (CIS) of the WFD. Full account was taken of the ongoing development of Horizontal Guidance on Wetlands for the CIS of the WFD. The guidelines made reference to the outputs of this process, particularly obligations regarding wetlands and the potential use of wetlands to meet the aims of the WFD. As the project was truly pan-European in its scope experts and end-users from these countries were fully integrated into the project and the unique wetland types and socio-economic situations in these countries were taken into account.

Expected Results

The production of a technical guidance manual to assist in integration of wetlands within the Water Framework Directive (WFD) was one of the goals accomplished through the expert workshop. During the Conference, the structure and key contents of the Technical Guidance to reinforce the Horizontal Guidance produced as part of the Common Implementation Strategy (CIS) of the WFD have been decided. This Technical Guidance includes further consideration of the hydrological, ecological and socio-economic role of wetlands in the delivery of societal benefits and policy requirements (to be downloaded from the website).

The five themes form an intimately-linked complex of elements shaping the composition and functioning of wetlands. Thus, though hydrology is indeed the single most important physical factor affecting the type and composition of wetlands and the nature of the processes within wetlands, each of ecology, biogeochemistry, socio-economy and law/policy also has a very marked impact on the wetland. Thus, *hydrology* marks out the wetland ecosystem from those that are clearly terrestrial or aquatic. *Ecology* is concerned with the way that organisms are influenced by physicochemical conditions (e.g. hydrology and biogeochemistry) and also the interactions between individuals, populations and communities. *Biogeochemistry* shapes the nutrient regimes and fluxes, interacting with hydrology to define wetland type. *Socio-economic* factors have determined the management, use and value placed on wetlands over human history, helping to create distinctive wetland types such as traditional flood meadows and constructed wetlands for wastewater treatment. The *law and policy* increasingly determine the context for the management of wetlands in terms of water, nutrients and exploitation, and are decisive in the choice between conservation/protection and degradation/exploitation of the wetland.

At the ecosystem level, hydrology and biogeochemistry become absolutely amalgamated with ecology, and the anthropogenic factors of socio-economy, law and policy are inextricably linked to the understanding of the wetland and its functioning. Wetlands are truly an inter-disciplinary issue, not only requiring linkages between technical subjects such as hydrology, ecology and chemistry, but also needing integration with social sciences such as economics and sociology to understand the human dimensions of wetlands.

Project Partners

BRGM, 45100 Orleans, FR

RHIER (Royal Holloway Institute for Environmental Research), GB

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

GENESIS

AT A GLANCE

Title: Groundwater and Dependent Ecosystems: New Scientific and Technological Basis for Assessing Climate Change and Land-use Impacts on Groundwater (GENESIS)

Instrument: Integrated Project, FP7

Total Cost: 9.170.600 €
EC Contribution: 6.997.200 €

Duration: 60 months

Consortium: 25 partners from 17 countries

Project Coordinator: Norwegian Institute for Agricultural and Environmental Research (Bioforsk)

Key Words: Ground Water Directive, ground water systems, water resources, land use, water management, agriculture, pollution, leaching, nitrate, pesticides, groundwater dependent ecosystems, modelling, climate change, management, socio-economy and legal aspects.

THE CHALLENGE

Groundwater resources are facing increasing quantitative pressure from land-use and consumption pressures. In some areas, groundwater levels have been reduced, resulting in negative impacts on water quantity and quality and important ecosystems relying on groundwater. In many areas, groundwater has been contaminated by diffuse loading resulting from land-use activities (e.g. agriculture) or point sources (e.g. industry). There is a strong need to reduce input of pollutants to prevent groundwater pollution. Additional threats from climate change are unknown, highly interwoven and complex.

PROJECT OBJECTIVES

The objective of GENESIS is to integrate pre-existing and new scientific knowledge into new methods, concepts and tools for the revision of the Ground Water Directive and better management of groundwater resources.

The research will link the present knowledge to an integrated model from sources of pollution to the recipient ecosystem. The project will improve the understanding of pollutant leaching from different land-uses both in time and space considering also uncertainty. It will also develop a better understanding of how ecosystems depend on groundwater.

The research will help to understand how changes in land-use and climate affect the groundwater and dependent ecosystems, and develop better cost-efficient management and monitoring tools and transfer the research results to stakeholders and end-users for better management.

Natural resources management

Methodology

The project is multidisciplinary with focus in hydrology, water resources, hydrogeology, agronomy, soil science, modelling, economy, sociology and legal aspects. The work in GENESIS is organised in eight activities.

The first activity harmonizes monitoring practices between partners. The main scientific research work on groundwater and ecosystems processes will be carried out in the activities 2-7. This comprises studies on water flow paths with isotopes, pollutant transport and leaching processes, groundwater ecosystems, modelling, management and engineering. Case study aquifers and ecosystems will be studied in different climatic regions with various land use pressures.

Expected Results

GENESIS will provide various tools to assess land-use and climate impacts on ground water and related ecosystems. The tools will be based on better scientific basis on groundwater flowpaths, biogeo-chemical processes, methods to observe and reduce pollution, ecosystem interactions, and integrated management.

GENESIS will provide better solutions to identify groundwater pollution changes, develop methods to assess the points for pollutant trend reversal, and generate knowledge on how to protect groundwater dependent ecosystems. This sets the basis for future and better groundwater management.

Project Partners	
Norwegian Institute for Agricultural and Environmental Research (Bioforsk), (Norway) NO	University of Oulu (UOULU), FI
Joanneum Research Forschungsgesellschaft mbH (JR), AT	Swiss Federal Institute of Technology Zurich (ETH), (Switzerland) CH
Luleå University of Technology (LTU), SE	Universitatea din Bucuresti (UNIBUC), RO
GiS-Geoindustry s.r.o. (GIS), CZ	University of Science and Technology (AGH), PL
Wageningen University and Research Center (Alterra), NL	München Gesundheit Umwelt (HMGU), DE
Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz (EAWAG), (Switzerland) CH	Institute National de la Recherche Agronomique (INRA), FR
Università Cattolica del Sacro Cuore (UCSC), IT	University of Kent (UKC), GB
Integrated Global Ecosystem Management Research and Consulting Co. (iGEM), Turkey (TR)	Athens University of Economics and Business-Research Centre (AUEB-RC), GR
Democritus University of Thrace (DUTh), GR	Cracow University of Technology (CUT), PL
University of Neuchâtel (UNINE), Switzerland (CH)	University of Ferrara (UNIFE), IT
Universidad Politecnica de Valencia (UPVLC), ES	University of Dundee (UNIDUN), GB
University of Zagreb- Faculty of Mining, Geology and Petroleum Engineering (UNIZG-RGNF), HR	Helmholtz Zentrum für Umweltforschung GmgH (UFZ), DE
Swedish Meteorological and Hydrological Institute (SMHI), SE	

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

RIVERTWIN

AT A GLANCE

Title: A regional model for integrated water management in twinned river basins

Instrument: Specific Targeted Research Project, FP6

Total Cost: 2.964.140 €
EC Contribution: 2.460.160 €

Duration: 36 months
Start Date: 1/3/2004

Consortium: 11 partners from 6 countries and 1 international organisation

Project Coordinator: University of Hohenheim (Germany)

Project Web Site: http://www.rivertwin.org

Key Words: integrated modelling, water resources management, EU Global Water Initiative

THE CHALLENGE

Water resources in the European Community, as well as in developing countries, are under increasing pressure from the continuous growing demand for sufficient quantities of good quality water for all purposes. For example, due to the extremely dry summer in 2003, even in humid regions like Central Europe, the river levels approached critical values, compromising power plants, naval transport and freshwater ecosystems. Consequently, in 2000 the European Commission adopted the EU Water Framework Directive (WFD) and in 2003 launched the "EU Global Water Initiative", which proposes to apply the principles of the WFD to other continents. The ultimate goal of the WFD is to reach and maintain a 'good status ' for all of Europe's surface and ground waters, taking into account ecological and economic aspects.

PROJECT OBJECTIVES

The RIVERTWIN project supports the goals of the EU Global Water Initiative by adjusting, testing and implementing the integrated regional model MOSDEW for the strategic planning of water resources management in twinned river basins. The regional model assists planning authorities and decision makers to assess the impacts of economic and technological development, and the effects of global climate and land use changes on the long-term availability and quality of water bodies. MOSDEW is based on a Geographic Information System, which integrates ecological (water availability and quality) and economic aspects (water demand and water use) of water management in a user-friendly software.

METHODOLOGY

The integration framework MOSDEW has been developed in the basin with highest data density and availability, the Neckar basin in Germany. Then it was

transferred to two other river basins of 15.000 and 50.000 km^2 with contrasting ecological, social and economic conditions: the Chirchik basin in Uzbekistan and the Ouémé basin in Bénin Republic. The framework integrates models to assess water availability and water quality, freshwater biodiversity, water demand, agricultural production and economic evaluation.

Results

The model promotes sustainable, integrated water management through balancing economic constraints and ecological requirements. In addition the project enhanced the mutual transfer of know-how and technology between European and Third World countries. It developed integrated scenarios of economic growth, land use and climate change in cooperation with stakeholders in order to assess the implications for water management. Finally, RIVERTWIN provided capacity building in Uzbekistan and Benin through training of end users in model development and application.

Project Partners	
University of Hohenheim (UHOH), DE	Institut National de Recherches Agricoles (INRAB), BE
University of Stuttgart (USTUTT), DE	Université d´Abomey-Calavi (UAC), BE
Stockholm Environment Institute (SEI), SE	Direction de l´Hydraulique (DH), BE
Centre for World Food Studies (SOW), NL	Scientific Information Center – Interstate Water Coordination Commission of Central Asia (ICWC-SIC), UZ
Aristotle University of Thessaloniki (AUTH), GR	Terra Fusca, Stuttgart (TF), DE
Schneider & Jorde Ecological Engineering (SJE), DE	

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

SCENES

AT A GLANCE

Title: Water Scenarios for Europe and for Neighbouring States

Instrument: Integrated Project, FP6

Total Cost: 10.301.005 €
EC Contribution: 6.993.477 €

Duration: 48 months
Start Date: 1/11/2006

Consortium: 23 partners from 15 countries and 2 international organisations

Project Coordinator: Finnish Environment Institute (Finland)

Project Web Site:
http://www.environment.fi/syke/scenes

Key Words: water resources, scenario development, modelling, participatory process

THE CHALLENGE

The future of Europe's waters will be influenced by a combination of many environmental, social, political, and policy factors, such as global change, population growth and decline, land use change, economical and technological developments. Political developments, such as the enlargement of the European Union and relationships between EU member states, accession countries and non-member states, will also have an impact on Europe's waters. Methods are required to provide a reference for strategic planning, alert policymakers and stakeholders as well as to allow river basin managers to test water plans in order to face European challenges linked to water resources.

PROJECT OBJECTIVES

SCENES is a multi-faceted integrated project that aims to address the complex questions about the future of Europe's water resources. The approach aims at combining and balancing the many dimensions of Europe's water futures, including hydrological, ecological, economic, cultural, social, climatic and financial dimensions. SCENES operates on multiple scales including analysis at the pan-European, regional, and pilot scales and on their interactions. The overarching objectives of SCENES are firstly to improve different methodologies for developing scenarios of Europe's waters and to develop and analyze a set of comprehensive scenarios of Europe's fresh waters up to 2025 and 2050 through a participatory process. Furthermore, SCENES aims at evaluating the socio-economic, environmental and ecological impacts of the different water scenarios, and increasing the stakeholder awareness on the water scenarios. Finally, SCENES will initiate an on-going process in Europe of scenario development.

Methodology

The work in SCENES is organised following the DPSIR framework. The work package on drivers and pressures compiles and specifies driving forces and pressures that are needed as input to the development of scenarios. The work package for scenario development, together with the modelling activity, provides alternative future states of the European waters. The Story and Simulation approach utilised comprises scenario development techniques in panel work, such as Fuzzy Cognitive Mapping and global water resources modelling. In the consequent work package expected impacts caused by the various futures for waters are assessed using indicators. Finally, the pan-European participatory processes for scenario building is organised, the comprehensive and complex results of the project is synthesized and disseminated to specific users and the general public. The case study work provides data consolidation, scenario evaluation, and impact assessment for pilot areas.

Expected Results

SCENES will provide input to the development of water-related policies in Europe, and indirectly, to water-related standards and regulations. On European scale, SCENES will identify and address key policy questions that have to do with the future of Europe's water resources. For example, we expect that European Commission (EC) agencies, such as the various Directorates and the European Environment Agency, will be able to use information from SCENES scenarios. Through the four SCENES case study regions, we have an opportunity to generate region-specific and region relevant information. A direct way to bring SCENES results forward to both pan-European and regional key stakeholders (ca. 250 persons) goes through their participation in the SCENES panels. The use of state-of-the-art techniques in water use, water availability and water quality modelling on appropriate spatial and temporal scales together with consolidated data sets from across Europe allow us to disentangle the effects of various drivers and stressors.

Project Partners	
Finnish Environment Institute (SYKE), FI	Middle East Technical University (METU), (Turkey) TR
University of Kassel, Center for Environmental Systems Research (CESR), DE	Technical University of Crete (TUC), GR
International Institute for Applied Systems Analysis (IIASA), AT	Budapest University of Technology and Economics (BUTE DSEE), HU
Madrid Polytechnical University (UPM), ES	Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences (RISSAC), HU
Stichting Deltares (WL Delft), NL	Research and Development Institute for Environmental Protection (ICIM Bucharest), RO
Natural Environment Research Council, Centre for Ecology and Hydrology (NERC), GB	South Russian Regional Centre for Preparation and Implementation of International Projects (CPPI-S Ltd), (Russia) RU
Wageningen University and Research Centre (ALTERRA), NL	Institute for Hydraulic Engineering and Land (IHELR), (Ukraine) UA
Warsaw Agricultural University (WAU), PL	Institute for European Environmental Policy (IEEP), GB
Baltic Environment Forum (BEF), LV	Wageningen University (WU), NL
Tallinn University of Technology (TUT), EE	Natural Resources Centre (NRC), (Russia) RU
National School for Forestry and Environment (ENGREF),FR	KIWA Water Research B.V. (KIWA),NL
International Center for Advanced Mediterranean Agronomic Studies, Mediterranean Agronomic Institute of Bari (CIHEAM-BARI), IT	

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

TWIN2GO

AT A GLANCE

Title: Coordinating Twinning partnerships towards more adaptive Governance in river basins

Instrument: Coordinated Action, FP7

Total Cost: 999.021 €
EC Contribution: 999.021 €

Duration: 24 months
Start Date: 01/06/2009

Consortium: 8 partners from 6 countries

Project Coordinator: Institute of Environmental Systems Research at University of Osnabrück (Germany)

Project Web Site: not yet available

Key Words: twinning basins, integrated water resources management, adaptive governance, climate change

THE CHALLENGE

The Integration and new approaches to manage risks in the light of increasing uncertainties require transformation processes in institutional resource regimes and management style. Different approaches have been developed and proposed to deal with this complexity and with the ambition of ensuring a sustainable use of the resource. The failure of governance systems has been identified as being one of the most important reasons for the increased vulnerability of populations to water related disasters. Successful governance in river basin management depends on adaptive institutions that are able to cope with complexity and uncertainty and to face new challenges such as climate change.

PROJECT OBJECTIVES

Over the past years, the EU has funded several projects that undertook research on specific integrated water resources management (IWRM) issues in case studies carried out on twinned river basins from Europe and from developing countries. The aim of Twin2Go now is to review, assess, synthesize and consolidate the outcomes of these projects in order to make them transferable and applicable to other basins, and to disseminate the project results effectively to relevant authorities, stakeholders and end-users. In order to achieve this aim, Twin2Go will elaborate a methodology that allows comparative analysis and synthesis of the outcomes of the diverse projects. The consolidated outcomes will feed into best practice guidelines for the adoption and implementation of sustainable water resources management plans. All synthesis activities will involve stakeholders from the projects and basins including all relevant levels of target groups and high level decision makers in water policy. Twin2Go will focus its activities on the thematic priority 'adaptive water governance in the context of climate change' and

Natural resources management

cluster past and ongoing twinning projects along their target regions (Latin America, Africa, NIS, South and South East Asia).

Methodology

In order to facilitate a comparison of past and ongoing work not only in the selected projects and river basins, but also on the framework conditions (social, economic) within which these projects are performed, a methodology for comparative analysis will have to be elaborated. This methodology is intended to support the comparison between the ongoing projects and/or river basins and synthesise their lessons, which will allow opening new perspectives for water managers and stakeholders in Europe, Asia, Latin America and Africa. Such analyses support what can be called a "diagnostic" approach which develops tools to analyse problems embedded in context and supports the development of context specific solution instead of advocating simplistic panaceas. In the conceptual context, the methodological framework of Twin2Go will fall back on approaches of adaptive management, institutional development, social learning and adaptive governance.

Expected Results

Twin2Go will elaborate a diagnostic approach that allows analyzing the results of past and on-going projects and initiatives with regard to improved water governance and adaptation to climate change. From existing project results, appropriate context-sensitive approaches for improving adaptive water resources management will be drawn also taking into account similarities and differences in circumstances as elaborated in the diagnostic approach. Twin2Go will formulate best practices and tools for implementing adaptive water governance and for improving the up-take of research results by relevant authorities, stakeholders and end-users based on experiences, successes and failures in existing projects and initiatives. Twin2Go will disseminate consolidated results to policy at the multiple level where decisions are taken while also making them available to stakeholders, implementing authorities and end-users, and thus to ensure best exploitation of existing research.

Project Partners	
University of Osnabrück, Institute of Environmental Systems Research, DE	DHI Institut for Van dog Miljo Forening, DK
Adelphi Research gGmbH, DE	Friedrich-Schiller-Universität Jena Institute for Geography, Department of Geoinformatics, DE
Environmental Protection and Water Management Research Institute, HU	EcoPolicy
Soresma, BE	Unit for Social and Environmental Research, Chiang Mai University, TH

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European Research Area

INTEGRATED WATERSHED MANAGEMENT

TWINBAS

AT A GLANCE

Title: Twinning European and third countries' river basins for development of integrated water resources management methods (TWINBAS)

Instrument: STREP, FP6

Total Cost: 2.155.388 €
EC Contribution: 1.389.893 €

Duration: 41 months
Start Date: 1/1/2004

Consortium: 8 partners from 7 countries

Project Coordinator: IVL Swedish Environmental Research Institute (Sweden)

Project Web Site: http://www.twinbas.org

Key Words: Integrated water resources management, climate change, hydrological modelling, water quality modelling, public participation,

THE CHALLENGE

A key feature of integrated water resources management (IWRM) is that solutions are no longer analysed from the perspective of only one area, e.g. water availability. Instead, problems in different water fields are analysed in a coherent manner. The water sector is often fragmented, with many institutions being involved in water management at various levels, but not always working in a co-ordinated way. In countries within the European Union water authorities with an overall responsibility and a legal framework have been formed under the Water Framework Directive (WFD). In countries outside the EU however, the situation may be more difficult.

PROJECT OBJECTIVES

The central objective of TWINBAS has been to fill gaps in knowledge and methods in order to enable implementation of a harmonised IWRM approach that addresses the European Water Initiative. By twinning five river basins: the Okavango in southern Africa, the Biobío in Chile, the Nura in Kazakhstan, the Norrström in Sweden, and the Thames in the U.K. and tying together water researchers with key expertise on these rivers, a critical mass of experience and knowledge has been mobilised.

An important part of the objective has been to build the capacity to carry out IWRM in all the five river basins, building on European approaches to water resources management with the Water Framework Directive in focus, as well as on third countries expertise and experience.

METHODOLOGY

A number of research tasks on hydrology, modelling of pollution flow, impact assessment, socio-economics, scenario analyses and action efficiency have been carried through. Based on existing analysis on climate

change the effects on the hydrological regime, on water availability and water quality have been modelled, and the ecological, societal and economical consequences analysed.

Within the project monitoring programmes were initialised and the data collected were essential for carrying out other project tasks, e.g. hydrological modelling, pollution pressure and impact analysis, classification of water bodies, and vulnerability assessment.

Public participation is an important task in IWRM. In TWINBAS a consistent and efficient structure for stakeholder involvement, consultation and public access to information has been developed.

Characterisation and risk assessment of water bodies within the river basins is also a major task in IWRM. One of the main parts of the characterisation is analysis of pollution pressure and impact. Depending on what were considered to be the main pressures, different approaches to economic analysis were taken in each of the five basins.

Change effects and vulnerability assessment were studied in the basins. Forcing behind changes in a rivers water resources are both climatic and anthropogenic in nature. The potential changes that might occur in all the basins in 50 and 100 years time were modelled.

Results

Twinning has significantly raised the competence level of the third country partners, as well as that of stakeholders and end-user water authorities in all involved countries. In some areas, the European partners have benefited from ambitious development work carried out by third country partners.

TWINBAS has by collaboration with the major public stakeholders in each basin and each partner country significantly contributed to the transfer of research results and methods to major stakeholder institutions in the countries of the twinned river basins.

Advances in research and knowledge have been achieved in several fields, such as improved hydrological modelling and pollution pressure modelling, methods for and results on impact of climate and societal change on water flow and pollution, as well as improved knowledge on the economics of water use and action cost-effectiveness. Throughout the project stakeholders from 'grassroots' to national authorities have been involved in discussions on research methods, results and abatement measures.

In spite of diverse existing structures for water management in the twinned river basins all partners found the European Water Framework Directive a good framework for development of methods and tools for implementation of integrated water resources management.

Project Partners	
IVL Swedish Environmental Research Institute, SE	Almaty Institute of Power Engineering & Telecommunications (AIPET), (Kazakhstan),KZ
DHI Water and Environment, DK	Centre for Ecology and Hydrology (CEH-W), GB
Department of Civil and Environmental Engineering, University of Southampton (SOTON), GB	The Institute for Water Research, Rhodes University(IWR) (South Africa), ZA
National Commission for the Environment, Bio Bio Region (CONAMA) (Chile), CL	Centre for Environmental Sciences, EULA, University of Concepción (Chile), CL

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European Research Area

INTEGRATED WATERSHED MANAGEMENT

TWINBASINXN

AT A GLANCE

Title: TWINBASIN XN

Instrument: Coordination Action FP6

Total Cost: 1.700.000 €
EC Contribution: 900.000 €

Duration: 48 months
Start Date: 01/2004

Consortium: 17 partners from 15 countries

Project Coordinator: International Office for Water (France)

Project Web Site: http://www.twinbasin.org

Key Words: Integrated Water Resource Management, Water Framework Directive, Basin Organizations, Twinning

THE CHALLENGE

The twinning regarding "integrated water resources management at river basin level" means establishing a link between two (or more) basin organisations to foster exchanging of knowledge, learning from each other and discussing similar problems.

Basin Organisations were implemented in varied legal forms and in various regions of the world, in order to solve sectorial problems, to avoid conflicts, to prevent pollution. Many twinnings were undertaken between Basin Organisations to foster the exchange and to improve practices related to IWRM. Nevertheless, in many cases, these Twinning agreements have not really been implemented above the "political" event organised for the signature of the Agreement and related Communication campaign. Often, only few missions are really implemented. And eventually, when twinning exchanges really take place, the positive results generally gained from these experiments are confined at the level of directly involved structures and dissemination step is not sufficient, when existing.

PROJECT OBJECTIVES

Twinning between Basin Organisations is a mean to obtain concrete results to stimulate and support IWRM. By facilitating direct exchanges on best practices, and as well on failed experiments, twinning can help Basin Organisations to improve their effectiveness by a greater technical, scientific and institutional expertise, benefiting from peers opinion which manage a basin in another geographical, political or economic context

It is a tool for enhancing their human resources capacities, for collecting and disseminating the shared knowledge for the common benefit of all.

Natural resources management

The main objective of a Twinbasin project was to promote twinning exchanges and to capitalise gained experience, and thus to promote capacity building of river basin organisations, to improve their expertise, and to help them, through twinning, to overcome water management problems.

Methodology

In a first step, Twinbasin helped in identifying needs and focusing on priorities. The identification of needs can be done according to the level of exchange required: political, executive, management, decision-making, operational the topic to be tackled with: institutional, legal, economical, technical, communication; and the deepness of wished exchanges.
Second step was to identify organisation to get twinned with: There are many types of Basin Organisations, some of them existing for several decades, and a lot in a development process; they present a great diversity of legal statutes, institutional arrangements, economic schemes, etc. None of these examples can be regarded as a model; each country must conceive its own system and it is always a tailor made process.

Eventually, for each selected topic, an Action programme needs to be established for the Twinning exchanges, detailing Objectives; Expected outputs; Missions' duration; Foreseen period; Expert(s) profile(s); Local counterparts; Performance indicators; Financial arrangements.

Expected Results

By direct exchanges, twinning helped the Basin Organisations to improve their effectiveness: they can profit from peers, regarding administrative, technical and institutional matters, or a quicker diffusion of the research outputs in the real life.

More than 40 twinning agreements (25 expected) were signed involving more than 70 Basin Organisations during the project.

The promotion and facilitation of exchanges of personnel (mobility) between Basin Organisations, for hands-on training, and the promotion of peer to peer support were key activities of the project ; More than 175 missions were led during overall project duration.

TwinbasinXN provided the Information Technology Infrastructure for allowing exchanges, supporting the dissemination of information on the project and the knowledge management component of the project.

The average support made by Twinbasin for each twinning has been of 5.000 Euros, covering less than 40% of direct expenses engaged. For such a reasonable investment, benefits have been much higher.

Project Partners	
International Office for Water, FR	Jara Tirta I Corporation, (India) IN
Agence de l'Eau Seine Normandie, FR	African Network of Basin Organisations, (Niger) NE
International Network of Basin Organisations, FR	Basin Agency Algerois-Hodna-Soumman, (Algeria) DZ
Confederación Hidrográfica del Júcar, ES	Sebou Hydraulic Basin Agency, (Morocco) MA
Secretaria de Recursos Hídricos / Ministerio do Meio Ambiente, (Brazil) BR	Organisation pour la Mise en Valeur du Sénégal, (Senegal) SN
Global Water Partnership, SE	Comisión Nacional del Agua, (Mexico) MX
Techware, IT/BE	National Agency APELE ROMANE, RO
African Water Issues Research Unit, (South Africa) ZA	Interstate Coordination Water Commission – Aral Sea (Uzbekistan) UZ
National Water Authority, HU	

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European Research Area

INTEGRATED WATERSHED MANAGEMENT

WADE

AT A GLANCE

Title: Floodwater Recharge of Alluvial Aquifers in Dryland Environments

Instrument: Specific Targeted Research or Innovation Project, FP6

Total Cost: 2.605.295 €
EC Contribution: 1.700.000 €

Duration: 42 months
Start Date: 1/07/2004

Consortium: 12 partners from 7 countries

Project Coordinator: Consejo Superior de Investigaciones Científicas-CSIC (Spain)

Project Web Site: http://www.wade.es

Key Words: groundwater recharge, floods, water resources, IWRM

THE CHALLENGE

A principal source of water in arid environments around the world is related to floods in ephemeral rivers. Though floodwater itself is not considered a sustainable water resource, floodwater infiltrating alluvial aquifers always represented the backbone of traditional water supply in arid areas. Even with this intensive reliance on these sources, at present, there is no available methodology to quantify the processes that control this recharge and its long term quantities that in turn affect the sustainability of this water resource. Both natural ecosystems and human societies depend on this scarce water source to maintain life in arid lands.

PROJECT OBJECTIVES

The key objective of the WADE project is to develop and apply an innovative method of investigating the occurrence of floodwater resources, in time and space, to quantify the sustainable water yield of selected ephemeral streams and to formulate integrated water management strategies for their use. Research experience on water resource management in selected basins of Spain (Andarax River, Almeria) and Israel (Arava valley) are twinned with two selected African countries, namely Namibia (Kuiseb River) and South Africa (Buffels River, Namaqualand), which suffer from permanent aridity and water scarcity.

METHODOLOGY

The WADE Project was set up to quantify: the processes controlling the water recharge and long-term recharge quantities (decade to century scales) that determine the sustainability of these water resources. The monitoring system included multilevel, flexible TDR probes measuring infiltration rate and flow paths in the subsurface (up to 15 m in depth) during recharging floods, and water level devices for the flood stage and groundwater level variations. Long-term recharge estimation was reconstructed from geological evidence

of former floods in the alluvial sediment record linked with the groundwater isotopic composition. The available water resources and demand for water was analysed in the context of policy and institutional frameworks for effective implementation of IWRM in the studied ephemeral rivers.

Expected Results

All monitoring stations recorded flood events and collected data during the project duration. Flood water infiltration and ground water recharge was primarily dependent on the flood duration, width of the active flowing channel and alluvial composition (grain size distribution). Measured infiltration fluxes range from several millimeters to several centimeters per hour, depending on sediments properties. Recharge was controlled also by aquifer properties not only by flood properties. The integrated surface-groundwater model has been used to derive nomograms relating flood magnitude, frequency and duration per year to total recharge. The interaction between human use and the natural system (alluvial aquifer) modified the groundwater recharge process and sustainable yield can be increased by a moderate and balanced increase of the groundwater use. An integrated flood-groundwater model has been developed and can be used by water providers (e.g. Namwater), Municipalities (Walvis Bay, Namakhoi, Kamiesberg), and other stakeholders. Water service delivery that focuses primarily on physical planning at the broader scale is not sustainable. In practice, water resource planning and management should be accomplished at low administrative levels (community and municipal levels), within a participatory process involving users, planners and policy makers at all levels.

Project Partners	
Consejo Superior de Investigaciones Científicas , ES	Institut National de la Recherche Scientifique, (Canada) CA
Hebrew University of Jerusalem, (Israel) IL	Ben Gurion University, (Israel) IL
HYDROISOTP gmbh, DE	Ministry of Agriculture, Water & Rural Development, Namibia, (Namibia) NA
Desert Research Foundation of Namibia, (Namibia) NA	Surplus People Project, (South Africa) ZA
University of Edinburgh, GB	Kamiesberg Municipality, (South Africa) ZA
University of Cape Town, (South Africa) ZA	Nama Khoi Municipality, (South Africa) ZA

EUROPEAN COMMISSION
European Research Area

INTEGRATED WATERSHED MANAGEMENT

WISER

AT A GLANCE

Title: Water bodies in Europe: Integrative Systems to assess Ecological status and Recovery

Instrument: Collaborative Project FP7

Total Cost: 9.022.069 €
EC Contribution: 6.984.092 €

Duration: 36 months
Start Date: 1/03/2009

Consortium: 25 partners from 17 countries including one international organisation

Project Coordinator: University of Duisburg-Essen (Germany)

Project Web Site: http://www.wiser.eu

Key Words: Water Framework Directive, indicators, uncertainty, rivers, lakes, coastal and transitional waters, recovery

THE CHALLENGE

European surface waters are impacted by multiple environmental stressors and water uses which adversely affect their ecological quality. Since 2000, the Water Framework Directive requires to improve the ecological status of all surface waters. Therefore, improved assessment methods to identify degree and causes of degradation and methods to design recovery schemes and to predict their success are required. Many countries still lack sufficient assessment methods, particularly for certain freshwater ecosystem types (e.g. lakes) and organism groups (e.g. fish). Numerous projects to restore degraded water bodies have been started; however, knowledge on their effects on freshwater organisms is still incomplete.

PROJECT OBJECTIVES

WISER will develop tools for integrated status assessment with a focus on lakes, coastal and transitional waters and will evaluate recovery processes for rivers, lakes, coastal and transitional waters. WISER aims at developing assessment methods for organism groups (fish, invertebrates and aquatic flora) and ecosystem types (lakes, coastal and transitional waters) for which sufficient methods are still lacking. WISER will further contribute to making existing assessment methods better comparable, i.e. to the intercalibration of assessment methods European countries are presently undertaking. To support the development of recovery schemes WISER will model the effects of nutrient reduction and hydromorphological improvement on the ecological status of freshwater and coastal water ecosystems, taking the simultaneous effect of climate change into account. A special focus will be on estimating uncertainty in bioassessment and in modelling ecosystem response to restoration.

Natural resources management

Methodology

WISER will both evaluate existing data and will perform new field exercises. The development and intercalibration of assessment methods will mainly be based on existing data, using more than 90 databases which have been built in previous and ongoing projects. A wide variety of statistical and modelling techniques will be employed, linking biological data to the degree of degradation as determined by environmental variables. Individual assessment methods will be developed for phytoplankton, macrophytes, invertebrates and fish in lakes and in coastal/transitional waters. The response of different organism groups to degradation will be compared. The estimation of uncertainly in bioassessment will be based on field investigations with parallel samples. Response to nutrient reduction and hydromorphological improvement will be modelled on large geographic scales and for case studies, e.g. catchments. There will be a close interaction with water managers and Environmental Agencies.

Expected Results

WISER will produce a wide range of products, including new assessment methodologies, databases, models and software. Key results will be new methods for assessing lakes and coastal/transitional waters with phytoplankton, macrophytes, invertebrates and fish, and an intercalibration with existing methods. These results will support the implementation of European directives in the field of environmental protection, in particular the Water Framework Directive. A generally applicable software tool for estimating uncertainly in bioassessment will be generated. WISER will identify measures of restoration and will predict the recovery of aquatic flora and fauna. The results will provide water managers with knowledge and tools to develop and refine river basin management plans.

Project Partners	
University of Duisburg-Essen (UDE), DE	ALTERRA Green World Research, (ALTERRA), NL
Norwegian Institute for Water Research (NIVA), (Norway) NO	Universität für Bodenkultur Wien (BOKU), AT
Natural Environment Research Council–Centre for Ecology and Hydrology (NERC), GB	Estonian University of Life Sciences (EMU), EE
AZTI-Tecnalia Foundation (TECNALIA-AZTI), ES	University College London (UCL), UK
University of Hull (UHULL), UK	Institute for Ecosystem Studies (CNR-ISE), IT
Aarhus University (AU), DK	Stichting Deltares (DELFT), NL
French Research Institute for Agricultural and Environmental Engineering (CEMAGREF), FR	Institute of Marine Research–University of Coimbra (IMAR), PT
Swedish University of Agricultural Sciences (SLU), SE	Institute of Oceanology Bulgarian Academy of Sciences (IO-BAS) BG
European Commission Joint Research Centre (EC-JRC)	Trinity College Dublin (TCD), IE
Institute of Environmental Protection (IEP), PL	University of Salento (USALENTO), IT
Forschungsverbund Berlin e.V. (FVB), DE	University of Bournemouth (BourneU), UK
Finnish Environment Institute (SYKE), FI	La Sapienza University of Rome (UNIROMA1), IT
Consejo Superior de Investigaciones Cientificas (CSIC), ES	