



United Nations  
Educational, Scientific and  
Cultural Organization



International  
Hydrological Programme



ecohydrology  
programme

# Ecohydrology for **sustainability**



International Hydrological Programme  
Division of Water Sciences

# The Ecohydrology Programme

UNESCO's IHP Ecohydrology Programme is focused on an integrated understanding of biological and hydrological processes at a catchment scale in order to create a scientific basis for a socially acceptable, cost-effective and systemic approach to the sustainable management of freshwater resources.

## THE AIMS OF THE PROGRAMME ARE TO:

- advance the integration of social, ecological and hydrological research; and
- generate outcomes that enable the development of effective policies and practices.

## THE CONCEPT OF THE PROGRAMME IS TO:

Enhance the designation of water both as an abiotic resource and as a service, delivered by ecosystem processes; identify, quantify and improve the critical linkages for environmental sustainability.

- Ecological and hydrological understanding can be used to enhance the overall integrity of ecosystems by a process of dual regulation.
- Dual regulation is a two way process whereby established nutrient cycling, fluvial and energy flow, modify biota and biota simultaneously regulate flows.
- Integration of socioeconomic and cultural considerations into the process will enhance the dynamic relationships between hydrological, social and ecological systems.

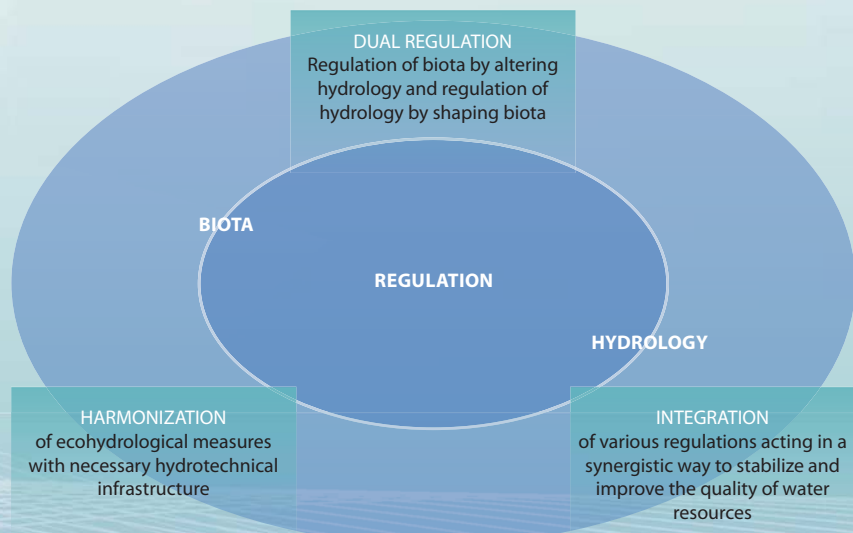
## ECOHYDROLOGY PRINCIPLES

The ecohydrology theory is based upon the assumption that sustainable water resources management can be achieved by:

- Reversing degradation and regulating the evolutionarily-established processes of water and nutrient circulation and energy flows at a catchment scale;

- Enhancing the carrying capacity of ecosystems against human impact (resilience, robustness, biodiversity, ecosystem services) for societies;
- Using the water biota interplay as water management tools.

## Key principles of ecohydrology



© Zalewski ERCE, Poland

# The mission

The Ecohydrology Programme (EHP) has been formulated as a key theme of the Seventh Phase (2008-2013) of the International Hydrological Programme's (IHP) action oriented and policy relevant knowledge generation, sharing and technical capacity building. This theme is contributing to a better understanding of water as both an abiotic resource and as a service delivered by ecosystems. The EHP aims to exemplify trans-disciplinary, cost-effective solutions to water related issues in a variety of ecosystems and climatic zones.



*Epol Falls, Davao City, Philippines.*  
© Ruth Gamboa



*Pasture irrigation in higher rainfall areas* © Dick Pasfield

# How we work

## DEMONSTRATION

The Programme has developed criteria to recognize sites where sustainable, innovative and transdisciplinary water management practices based on ecohydrology principles are implemented. At the same time, the new Demonstration Projects call was launched in 2010 to identify opportunities to demonstrate the application of the ecohydrology approach to solve issues surrounding water, environment and people. These sites are being featured in scientific research and training activities under the programme.

## GENDER AND SOCIAL CULTURAL BIODIVERSITY

The Programme is aiming to bridge the gap between the hydrology, social and ecological/environmental sciences by exploring community cultural values and in so doing reframe the policy discourse in language that is more appropriate to the purpose of engaging the 'grass-roots' community in the eco-social action planning processes as a basis for social change.

## INTEGRATION AND UPSCALING

We are investigating the key intersections between socio-economic sciences and the

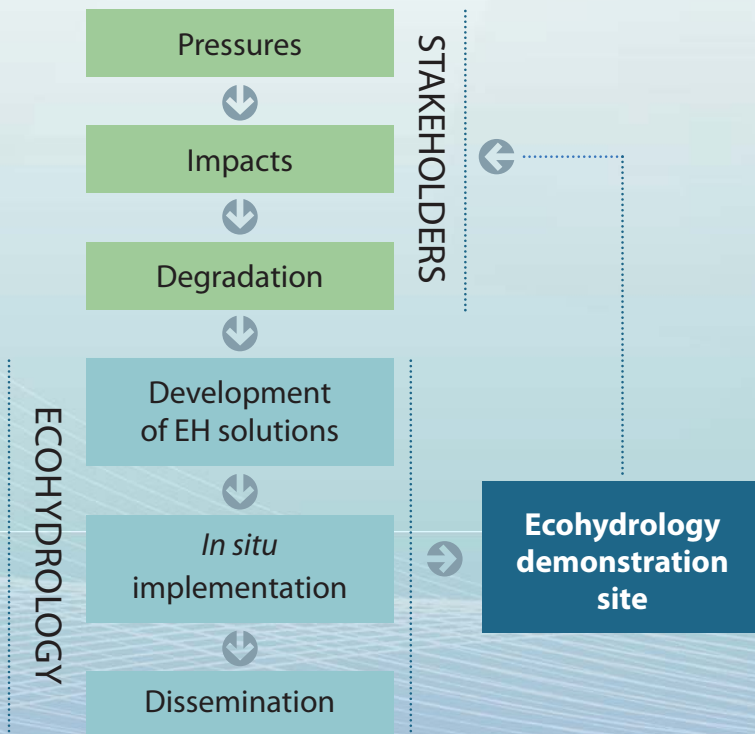
hydrological/ecological cycles. In developing ecohydrology from its core beliefs and principles, using the systems approach, there has been a conscious effort to assimilate new paradigms and critical thinking into it. The strategy for enhancing ecohydrology science includes:

- Understanding the past efforts
- Integrating various disciplines
- Harmonising societies priorities by increasing the carrying capacity of an ecosystem
- The formulation of a vision for sustainable water ecosystem.

## MODELLING AND VISUALIZATION

The Programme is working on tools to inform and support water managers and planners in making integrated water resource management decisions using the ecohydrology approach. This effort is aiming to cross boundaries between disciplines such as water systems, economics and social science to promote integration to develop software tools for solving real problems.

### Ecohydrology demosites 'role'



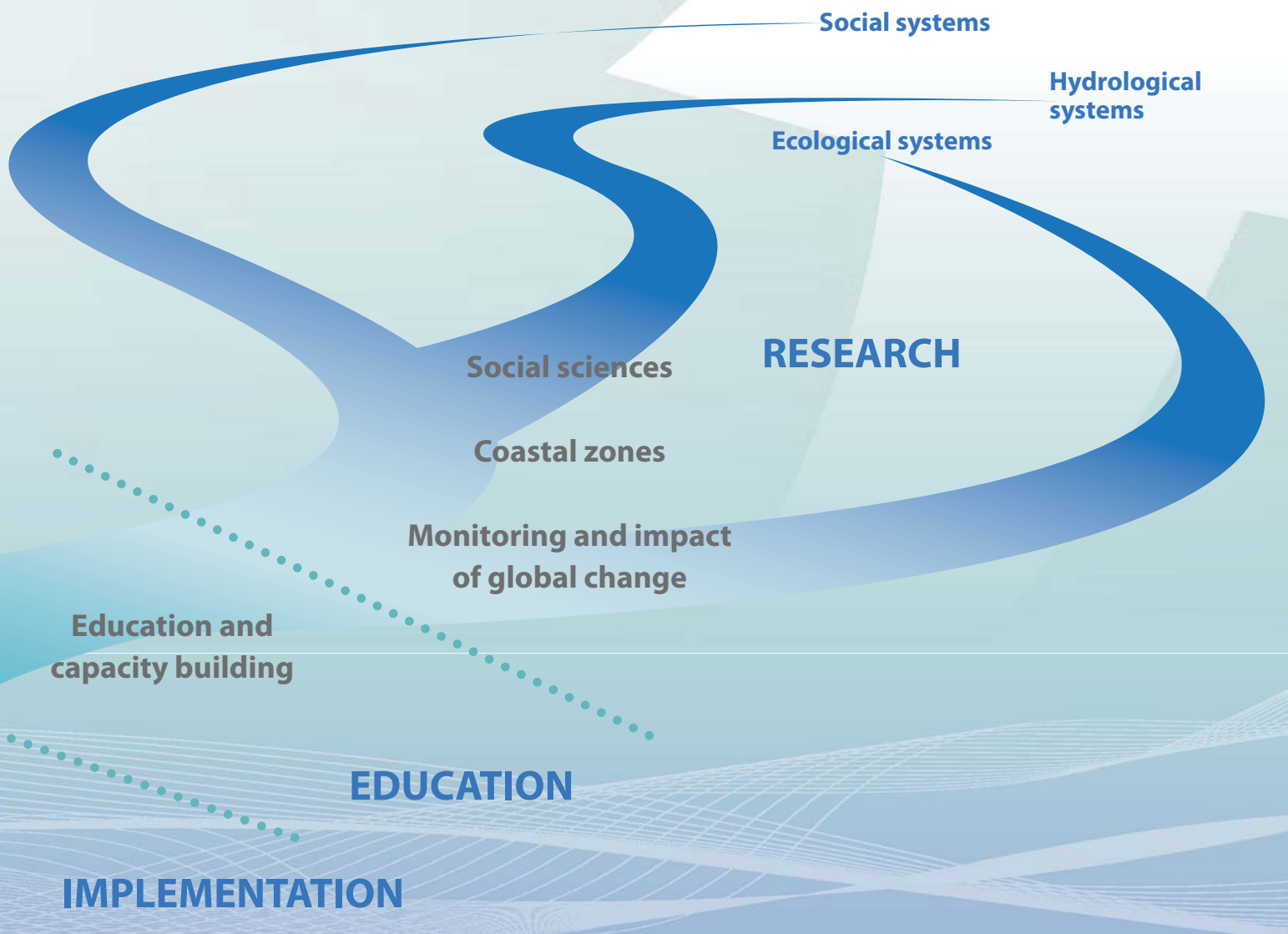
## EDUCATION AND CAPACITY BUILDING

The Education and Capacity Building in Ecohydrology includes development of a modular curriculum of academic courses and practitioner trainings to enhance ecohydrology knowledge and implementation on the ground. The Erasmus Mundus Master of Science in Ecohydrology is a good example of their approach. More information about this activity is at [www.ecohyd.org](http://www.ecohyd.org)



Community information day for the East Kimberley Reference

© Dick Pasfield

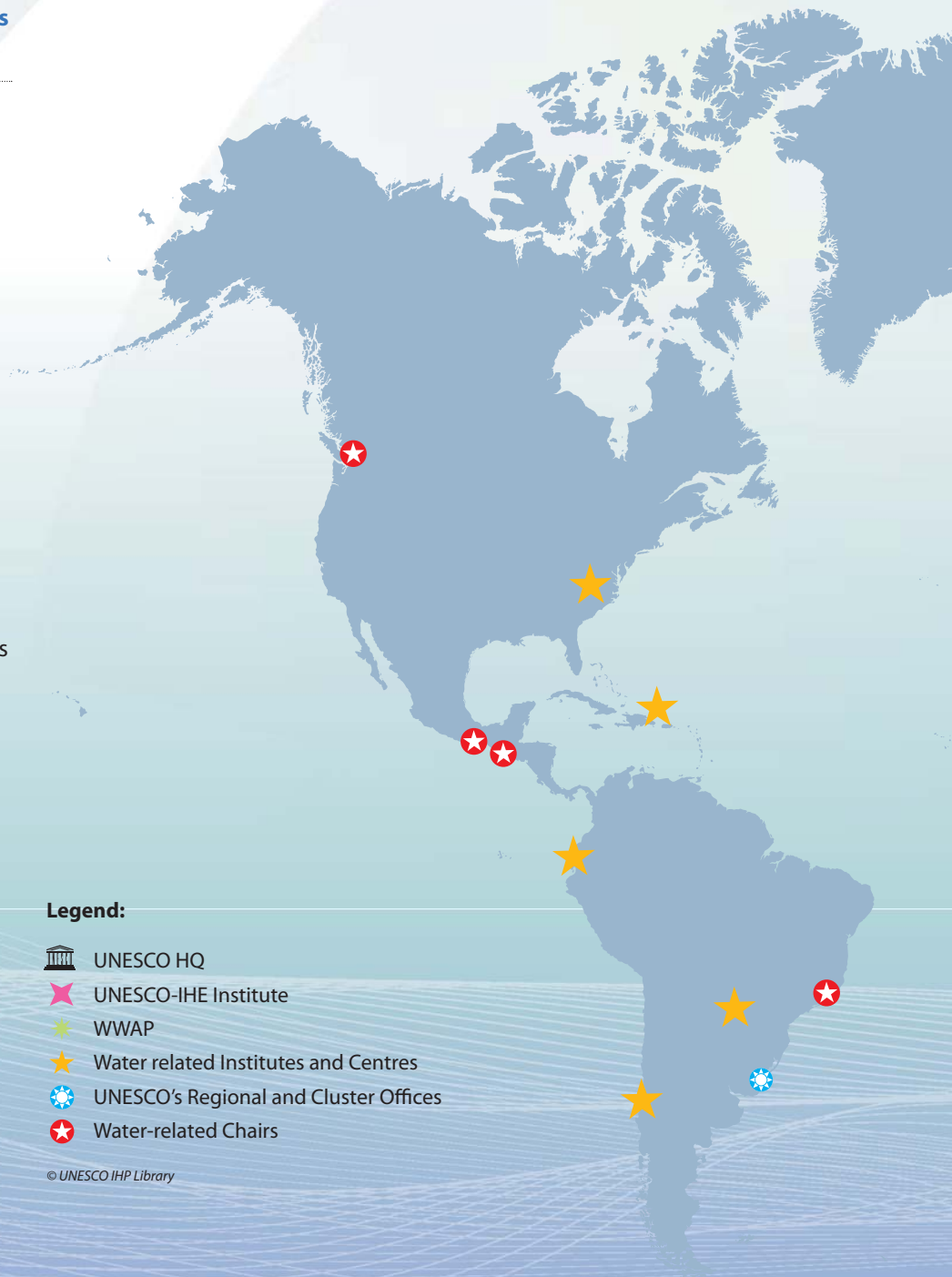


# Demonstration Projects Network

The main purpose of a network of Demonstration Projects is to showcase how to identify, quantify and improve the critical interrelationships between water, biota and social systems for sustainable water management, following the principles of the concept of UNESCO's IHP Ecohydrology Programme.

## The Ecohydrology concept should operate in Demonstration Projects at four levels:

- 1 Information (monitoring, collecting of empirical data, defining interactions and hydrology-biota-society feedbacks),
- 2 Knowledge (defining patterns, describing and explaining processes),
- 3 Wisdom (ability to formulate policy, principles for action, problem solving by system solutions, stakeholders involvement, education, implementation),
- 4 Cooperation for solving problems (willingness of different stakeholders to effectively contribute actively to the implementation of the Ecohydrology approach in the demonstration site – this will ensure cooperation among all sectors and the achievement of the demonstration site goals).



**There are three key objectives of this network:**

**1** Synthesize knowledge gaps for addressing ecohydrological issues related to water ecosystems under pressure.

**2** Showcase how better knowledge of the biological and hydrological interrelationships in aquatic ecosystems can promote the long term sustainable carrying capacity of ecosystems and thus contribute to more cost-effective and environmental-friendly water management.

**3** Demonstrate systems solutions and technology transfer opportunities through North-South and South-South linkages by working closely with the UNESCO IHP Water Family (shown below).



UNESCO-IHP Water family

# Global reference projects

Show best practice in EH principles (dual regulation, integration) and serve as a model for other projects.

## Ecohydrology based urban water management and city planning for human health and sustainable development. City of Lodz, POLAND

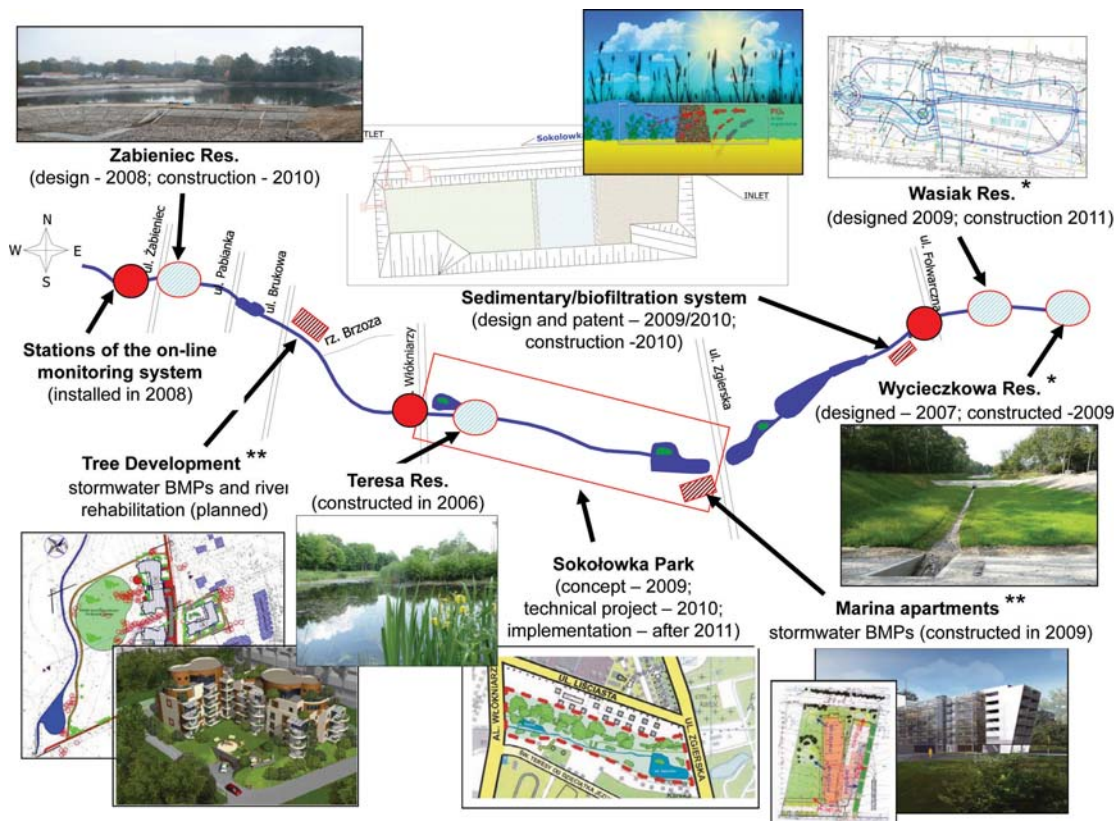
Quality of life and health in cities becomes more and more critical nowadays, due to increasing human and urban populations, aging water infrastructure, decreasing resources and their quality and super-imposing global changes. According to the ecohydrology theory, cities are considered as ecological systems, where fundamental processes such as

water circulation, matter and energy flow are extremely intense. Regulating interrelations among them following the ecohydrology principles, can reduce environmental degradation, provide affordable cost-efficient solutions to water issues, enhance the capacity of ecosystems against human impact and assure ecosystem services.

Such an approach has been tested in Lodz, Poland. Transdisciplinary research provided a basis for developing and implementing ecohydrological system solutions

for water resources management. These included a number of intervention related to rehabilitation of an urban river (figure below) and closing nutrient cycles by re-using of sewage sludge as a fertiliser for production of green energy for the City. Creation of the Lodz Learning Alliance (multi-stakeholders platform) empowered implementation and upscaling of innovative solutions to the city scale ("blue-green network").

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*Demonstration Project on Ecohydrology – interventions in the Sokołowska river valley. The development and implementation was supported by the EU SWITCH Project (GOCE018530) and the City of Lodz Office. Part of the interventions is a bottom-up private initiative resulting from the dissemination of knowledge and know-how through the Lodz Learning Alliance.*

*Wagner, I., Zalewski, M. 2011. System solutions in urban water management: The Lodz (Poland) perspective. [In] Howe, C., & Mitchell C. (eds.). Water Sensitive Cities. IWA Publishing, London. 231-245*



**Development and implementation of the Ecohydrology concept for reduction cyanobacterial blooms in a man-made reservoir. Pilica River Catchment, POLAND**

The demonstration project on the Pilica address four spatial levels: the river, its catchment, the floodplains, and a lowland reservoir. The main activities will focus on: Continuation of the research and implementation of hydrobiomanipulation; Continuation of the research of enhancing the absorbance capacity of floodplain nutrients and pollutants; Identification of hot-spots for eutrophication in the Pilica catchment; Enhancing the potential for nutrient assimilation, through biodiversity and productivity in small rivers and streams, by creating an intermediate complexity of land/water ecotones; Cooperation with ILTER and LTER Europe;

Establishment of Multi-Stakeholder Platform; Education at national and international level based on the educational sites for ecohydrological technologies existing already in the Field Station of the UL; and, dissemination of the result and information about the project.

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**Sustainable estuarine zone management for control of eutrophication, toxic blooms, invasive species and conservation of biodiversity. Guadiana estuary, PORTUGAL**

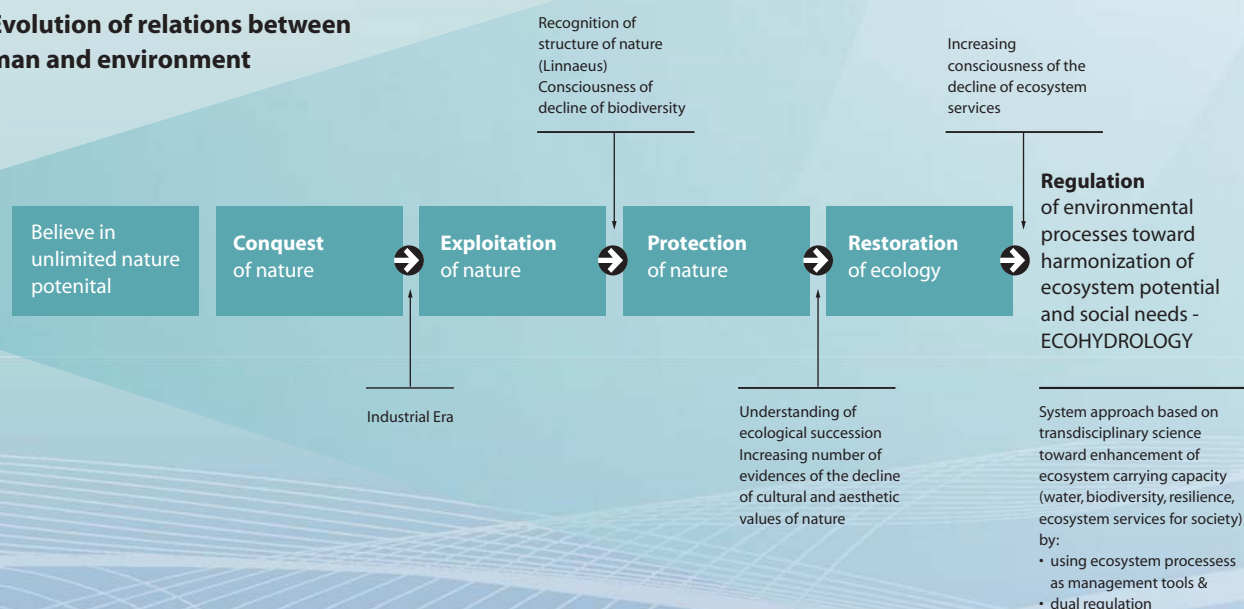
The Guadiana estuary and adjacent coastal area in southeast of Portugal establishes the border between Portugal and Spain and is included in the Guadiana HELP basin. The Guadiana estuary is affected by a

large dam – the Alqueva dam – that modified the hydrological regime and ecological functioning of the estuary and adjacent coastal area. Associated with the dam there is also an increase in the irrigation area at the basin, with consequences to nutrients and pesticides loads.

The area is dominated by Mediterranean and climate change scenarios predict increasing and long lasting droughts for this area. The objective of the Guadiana demosite is to develop and demonstrate the approaches based on the Ecohydrology dual regulation concept that can be implemented to sustain the ecological functioning of the Guadiana estuary and coastal area.

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**Evolution of relations between man and environment**

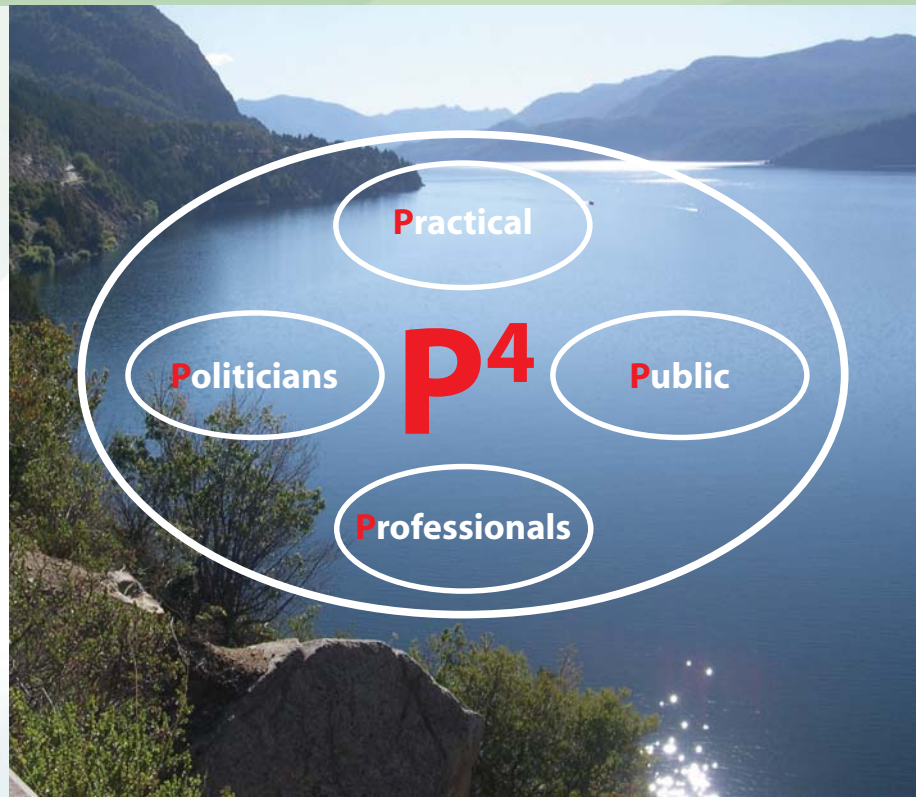


# Operational Projects

## Improving land use policy at Lacar Lake Watershed based on an Ecohydrological approach. San Martín de los Andes, Neuquén, ARGENTINA.

The major point for Lacar Demosite (LDS) is the sustainable management of a representative basin of Andean Patagonian region where the main problem is the impact of land transformation on water quality and environmental services. The aim of the LDS is the reduction of soil erosion, the mitigation of floods in urban areas and the improvement of ecosystem services, based on Ecohydrological ideas and principles, and using phytotechnologies. Advances are presented for LDS showing that regulation of surface hydrology (water runoff; nutrients and sediments loads) at the watershed scale, through land use, vegetation cover and phytotechnologies, improve the aquatic ecological processes and the ecosystems services (water quality, landscape aesthetic values).

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*Inclusion of people as co-managers* © Marcelo Gaviño

## Management of regional water resources linking with managing of wetland biodiversity in the suburban area of metropolitan Beijing, CHINA

In this demo project, the suburbs of metropolitan Beijing with a key water eco-system protection function has been selected as the study location which experiences period of drought annually. Researchers will develop a regionally spatial and temporal distributed eco-hydrology model integrated water cycle process model and wetland vegetation response model that will simulate the regional environmental change of the past 30 years under various impacts of climate, agricultural, and ecology.

The objective of the research is to reveal the process and mechanism of regional hydrological changes over a 30-year scale in this area. The demo topic is an interdisciplinary showing for hydrology and ecology, and integration with modern Information technology. It will enrich and perfect the eco-hydrology theory. It is of great significance

to establish a regional sustainable development pattern for balance of regional development and protection of aquatic natural resources with scientific water resources management.

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*Wild Duck Lake Wetland (WDLW), Beijing China. Continuous drought and excessive groundwater withdrawal, greatly degradate the ecosystem.* © Demin Zhou



**Ecohydrological analyses in the lowland river catchment Kielstau, GERMANY, for sustainable water resources management and education in rural landscapes**

Ecohydrological river basin models, hydraulic models and GIS-based approaches were used to assess the catchment water balance and nutrient loads, to model the stream channel processes and to depict the influence of abiotic changes on the habitat quality. This catchment is used to focus the monitoring and modelling strategies on sustainable water resources management according to the ecohydrology concepts. Ecohydrological measures concern improving water quality, reducing erosion, demonstrating effects of land-use and management practices on water and nutrient balance at a catchments scale and the optimization of aquatic habitats. The Kielstau catchment is used as an education and demonstration site for three international master courses at CAU Kiel.

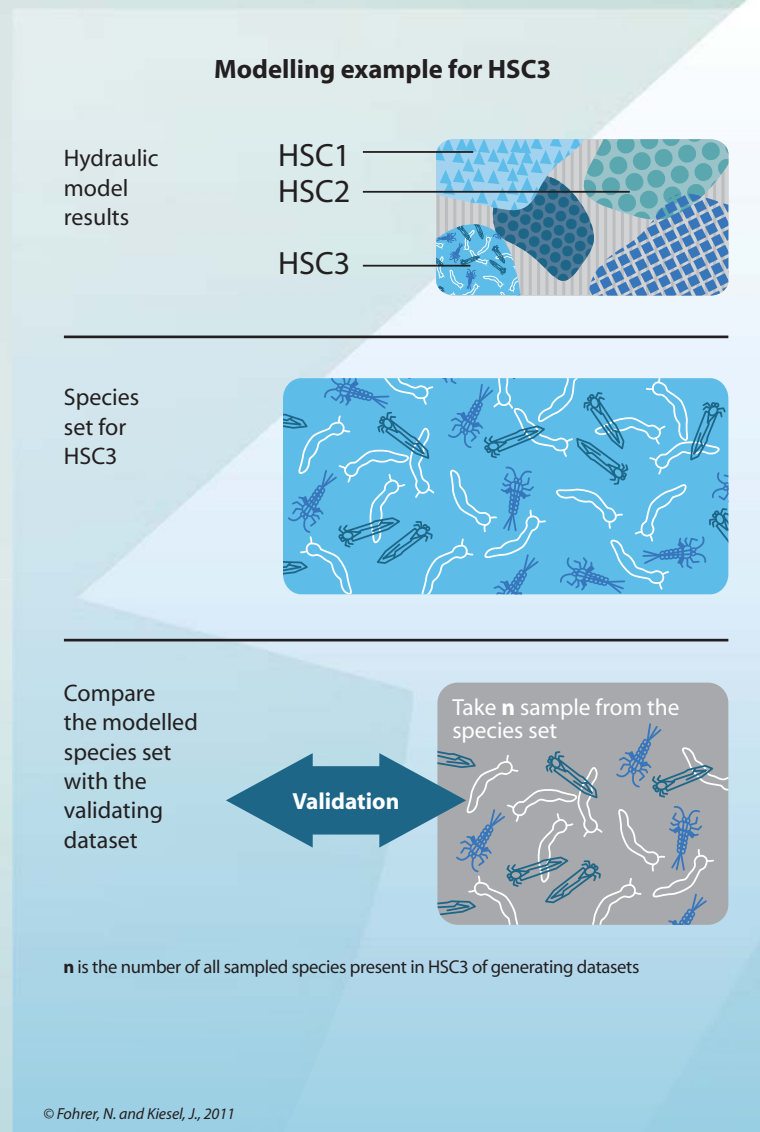
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Field work in Germany © Fohrer, N. and B. Schmalz, 2010

**Watershed management in Northeast CHINA: hydrological processes, vegetation optimization and sustainability**

This demonstration project will monitor and investigate the changes of eco-hydrological processes, discharge of catchments, vegetation restoration, soil quality improvement, as well as social and economic benefits through integration of soil and water conservation practices at a typical watershed in Northeast China. The objectives are to identify how the



anthropogenic activities, especially agricultural practices affect water circulation, topsoil removal, transport and deposition, and stakeholders, and to demonstrate the best soil and water management to achieve sustainable water use, food security, ecological protection, and optimized functions of ecosystem services at catchment scale in farming area of Northeast China.

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# Operational Projects



Flowers destined for European supermarkets – the largest ecosystem service from Naivasha

© David Harper



A floating mat of *Eichhornia crassipes* (water hyacinth), one of the many alien species which has reduced the services from the Naivasha ecosystem © David Harper

## **An initiative to move the Naivasha Basin towards sustainable use: Payment for Ecosystem Services from the European supermarket buyers of flowers from Lake Naivasha, KENYA.**

Lake Naivasha's waters (together with those flowing in and out by rivers and groundwater) are not "fit-for-purpose". The entire basin has too many users, taking too much water, with the result that the lake is shrinking. It is shallower, warmer, full of sediment and low in oxygen. The industry that is the most visible, horticulture on the lake shores, receives the most blame for the lake's state. However, that industry is only partly to blame – a succession of alien introductions and arrivals have wrecked havoc with the ecosystem.

The favoured customers – supermarkets – of the horticultural industry are highly susceptible to criticism regarding the sustainability of their suppliers. Part, but only part, of this criticism has been addressed by growers seeking "Fair Trade" status with partner supermarkets promoting it.

Now, two European supermarkets, from Germany and Switzerland, have provided support for wetland ecosystem restoration, community capacity building about sustainable water use and the development of intervention methods to achieve 'water friendly farming'. The next two years will see the original ecohydrological restoration proposals developed under the EYH programme in 2004 implemented and tested.

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Natural Naivasha after papyrus re-growth, Kenya © David Harper



**Sustainable water resources management plans in the Tiber river basin for environment protection, minimum instream flows regulation and the Trasimeno Lake ecosystem preservation. ITALY**

The analysis of the Tiber river basin pointed out how, during the last 20 years, there has been indiscriminate and irrational use of the water resources at the basin scale. What in the past was just a feeling, was brought up by severe droughts. This situation is also worsened if the issue of water quality is taken into consideration

especially in ecosystems like the Trasimeno lake. This project is strictly linked to the principles and goals of ecohydrology in fact it foresees to effect the Tiber basin ecosystem starting from the evaluation and regulation of the instream flows. This project integrates the communicative and divulgate aspects that can boost the final outreach. More over, the support of the University can guarantee a didactic outcome for all stakeholders.

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*Upper Tiber River in July 1996, Italy © Department of Civil and Environmental Engineering, University of Perugia*

**Integrated Catchment Management of Putrajaya Lake and Wetland, MALAYSIA**

Putrajaya lake and wetland catchment are located in Putrajaya Federal Territory within the Langat River Basin area of Malaysia. The management, planning, approval, monitoring and enforcement jurisdiction over all land development and human activities in this catchment area authorized by the Putrajaya Corporation. The Lake is an urban lake, created right in the middle of Putrajaya, the newly developed Government Administrative

Center of Malaysia, which was planned to be developed into a "City in a Garden" with the 600 hectares Putrajaya Lake and Wetland as its focal point. It is a largest constructed wetland in the tropics and one of the constructed wetlands and lake of national importance in Malaysia. It is an integrated lake and wetland catchments management system and needs a serious and systematic management approach and control in order to sustain the catchment area of Putrajaya.

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# Evolving Projects

## **Ecohydrology in action: Addressing changing hydrology, ecological condition and community attitudes to water at the Ord River, WESTERN AUSTRALIA**

Nearly 100 years ago Australia's leaders envisaged a large dam in the vast, remote and largely unpopulated Kimberley region. 70 years later the Ord River Dam was built, creating Australia's largest man-made reservoir. But visions of unlimited water for irrigation have not eventuated. Instead, new community values emerge and development is now more balanced

with other objectives, including environmental conservation, recognising indigenous culture, eco-tourism and social equity. The relationship between water and the ecosystems it supports is critical, not only to water managers but to future social and economic development in the region. This project aims to capture lessons about the opportunities and challenges of applying the principles of Ecohydrology in a rapidly changing catchment.

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*Hydro power generated at the Ord Dam lake Argyle © Dick Pasfield*

## **Developing fit-for-purpose tools to address complex social, ecological and economic issues in water planning, AUSTRALIA**

Critical water reforms in Australia are implemented mainly through catchment-based water plans. This project worked with communities and government to take up the challenges posed by the planning process in South Australia, Queensland and the Northern Territory within vastly different hydrological, ecological, social and cultural contexts. Priority challenges that were addressed included building community confidence in the planning process; providing effective methodologies for identifying Indigenous values in water; and integrating socio-economic,

cultural and ecological considerations in water allocation decisions. Amongst the tools developed were participatory groundwater visualisation models addressing specific community needs, rated by participants to be 'best-practice' for community consultation. Innovative agent-based models that identified environmental, social and economic values in wetlands provided visual methods that were highly regarded. Rigorous evaluation of these tools provides confidence to those considering their use. Reports, practical guides and information on tools used elsewhere can be found at [www.waterplanning.org.au](http://www.waterplanning.org.au)

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### **Ecohydrology of Western Sydney AUSTRALIA – developing solutions for environmental-friendly water management in peri-urban landscapes**

Western Sydney, with 1.8 million people, is expected to grow significantly over the next 20 years with the addition of another half a million people. This growth is expected to have a significant impact on the existing limited water resources, and environment in the region. Policy makers require catchment management

guidelines based on multidisciplinary research and involvement of communities if this level of growth is to be achieved keeping in view predicted climatic changes, without an ecological disaster occurring. In this demonstration site the principles of ecohydrology will be evaluated, which will bridge the knowledge gaps between economic growth and the hydrologic function of rivers and waterways.

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### **Integration of eco-hydrological processes demonstration research in Heihe River Basin, Northwest of CHINA**

This project will focus on the typical landscapes in inland basin of China--Heihe river basin, and will establish scientific observations -test, data-simulation research platform, as well as to reveal the eco-hydrology system interactive of processes and mechanisms in inland river basin, to promote comprehensive analysis and

prediction capability for the evolution of inland river basin water - ecological - economic system. Also, it is contemplated to develop a mechanism from farmer to local government that provides scientific basis and technical support for the inland river basin water security, ecological security and sustainable development.

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*Peri-Urban interest activities* © Basant Maheshwari

# Evolving Projects

## Linkage of wetland ecology and hydrology with the support of information techniques for assessing the degraded inland fresh water wetland habitat in Sanjiang Plain, Northeast CHINA

One key objective of this research is for presenting the marsh wetland degradation occurred within the study area in the past 30 years. Furthermore, the integrated eco-hydrological analysis is done for a better understanding of the moisture characteristics of the

wetland plant habitats, from which we can predict the possible ecological consequence caused by a hydrological alteration.

Ultimately a better assessment of wetlands and their wiser use can be approached for the purpose of the maintenance, health and repair of damaged ecosystems in the future.

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## The airship-based system for wetland classification and mapping



[The airship](#) © Demin Zhou

[The aerial photography system](#) © Demin Zhou

## Study of irrigation management practices and impacts of soil salinization in Manas River Valley, Northwest CHINA

The irrigated area of Manas River Valley in Northwest China is an example of the successful reclamation of massive land affected by shallow ground water levels and salinization. To determine the effect of irrigation management practices on soil salinization, soil profiles representing various soil types were sampled.

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### **A methodology to estimate compensatory runoff in COSTA RICA, RANA-ICE study**

The RANA-ICE methodology is a combination of “look up”, discussion-based approaches and biological response modeling and can be characterized as a hybrid methodology combining the “best” of existing methods. The methodology integrates hydrological, biological, and socio-economic information, related to river sections where the impact of hydropower developments is

envisaged. Natural hydrological patterns are studied first and different water use demands are identified, including those of the ecosystem, to determine a minimum acceptable flow satisfying these demands. These demands are used as constraints and are evaluated against different flow regulation scenarios to recommend the environmental flow pattern that provides a sustainable use of water resources.

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*Field trip work by experts © Anny Chaves*

### **Central American Integration under the Trifinio Plan: Study of integrated management of natural capital in El Salvador, GUATEMALA and HONDURAS**

The problems facing the region are: loss of forest and productivity, high rate erosion and sedimentation, flooding, landslides, reduced carrying capacity of the aquifers that feed the trinational basin, land use change, landscape fragmentation, water pollution problems. In this

sense it is of crucial importance to identify more potential resources such as: the flora, fauna and water for sustainable management and promote community organization with a clear social orientation. The integrated management of the region is a responsibility shared by the three countries, becoming an example in Central American integration process.

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# Evolving Projects

## **Development of advanced ecohydrology tools for the sustainable management of coastal wetlands: The case of Nestos River lagoons. GREECE**

The project attempts to develop an ecohydrology tool, aiming to aid any coastal lagoon manager to improve the environmental conditions of the lagoon system. Improvement of flushing characteristics inside the lagoon is achieved by the appropriate design of the

lagoon's tidal inlet, controlling the exchange processes of the system with the open sea. This ecohydrology tool will be applied in the Nestos River coastal lagoons, to assess the changes needed to improve water, salt and nutrient fluxes with the open sea, leading ultimately in environmental and fishery exploitation improvement.

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*Mangrove rehabilitation in the estuarine mudflats near the mouth of the Davao river, Philippines. Local communities have reported that the rehabilitated mangroves have dual benefits; they have helped to filter plastic wastes, thereby reduce pressures on corals reefs, and the mangroves have improved the habitat for local fish stocks. © Declan Heame*

## **Improved ecosystem management to control eutrophication at the Saguling reservoir and relevant hydro-meteorological disasters by wetland construction and river flow regulation. West Java Province. INDONESIA**

Interrelated activities are proposed with a basis of ecohydrological approach. Basically it is the identification and reinvention of nature's capacity for self purification and rehabilitation. A wetland construction and river water regulation will be set up at the demo site. The

demo site promotes improved natural capacity of the ecosystem in delivering its ecosystem services, controlling eutrophication, regulating hydrology and reducing sensitivity of the hydrological system from seasonal and extreme climate variability. Social assessment will be conducted for improved people participation in the planning and implementation of the project, and improved governance system.

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**Adaptive water management in response to hydro-climatic change effects on ecosystem services and biodiversity of the Swedish Norrström drainage basin. SWEDEN**

The overall aim of the research is (i) to study the ecological and evolutionary responses of water-related ecosystem services and biodiversity to hydro-climatic and land use changes, and (ii) to assess the capacity within societal organizations at both the national and international level to deal

with such ecological and evolutionary responses. The particular strength of the proposal is its cross-disciplinary structure, connected to a multidisciplinary strength of research at combined landscape and drainage-basin levels. Research will focus on spatial processes and how to connect social and ecological processes between different spatial and temporal scales.

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Swedish Norrstrom Drainage Basin: Panorama photo of Riddarfjärden © Lars Aronsson

**Integrating watershed management activities with the protection of coastal coral reef ecosystems in MICRONESIA**

The high islands of Palau and the Federated States of Micronesia have been experiencing the degradation of coastal coral reefs of ecological, economic and cultural value largely due to land-based activities within adjacent watersheds. Initial efforts have demonstrated that science can inform communities on the effects of poor land use practices on their coastal resources, and that local stewardship efforts in mangrove and wetland protection, as well as improved methods for reducing erosion and sedimentation, can reverse the trend from degradation to recovery. The proposed project will support efforts to improve prevention and mitigation activities, and monitor their efficacy, while building local capacity to address coastal resource stewardship in a culturally appropriate manner.

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**Understanding ecohydrological connectivity in multiple catchments to conserve groundwater, protect surface water and contain risks in a globalizing city. PHILIPPINES**

At present, whatever lean set of ecohydrological information the city has, those information has been used extensively to support some key environment-related policies. Two examples are the ban on aerial spraying and the no-touch 'policy' in Tamugan River. But validation of some of the findings and more information remains to be accomplished. Thus, this project aims to conduct a comprehensive assessment of the interactions of the hydro-ecosystems across the eight river basins.

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# Emerging Projects

Different projects within the network: Emerging projects

## **Assessing performance of ETP (Effluent Treatment Plant) using Duck weeds and activated sludge management system and sustainably managing limnology to develop hydro ecological regime. BANGLADESH**

The ETP project will be constructed using activated sludge management system and duckweed based system at Hajir Bazar of Valuka Upazilla, district of Mymensingh adjacent to FM Yarn dying Company Ltd to use the treated water for irrigation purposes and make the rivers and

water bodies in the area. The organic fertilizer from eco-friendly sludge management process will be used for duck weed production and its application to agricultural fields for increased crop yields. The planned Environmental management Committee under the project (deals with hydro-ecological conservation) will do the regular monitoring and observation of the demonstration and hydroecological flora and fauna.

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*Redgums* © Ian Overton

## **Restoration of Victoria Pond: Restoring wetland habitat in historic George Town, Great Exuma for sustainable management to control eutrophication and enhance near shore fish habitat. BAHAMAS**

Victoria Pond is the centre of historic George Town; providing natural beauty, and waterfront access. The Pond has suffered from the lack of coordinated management and poor coastal development practices, and is now polluted and

overgrown with invasive plants. The Pond is clogged with trash and presents a public health threat with rats, mosquitoes, and leaching of raw sewage. Local residents wish to participate in environmental stewardship. Public-private partnerships can restore the island landscape to enhance tourism, fisheries and quality of life in the settlement.

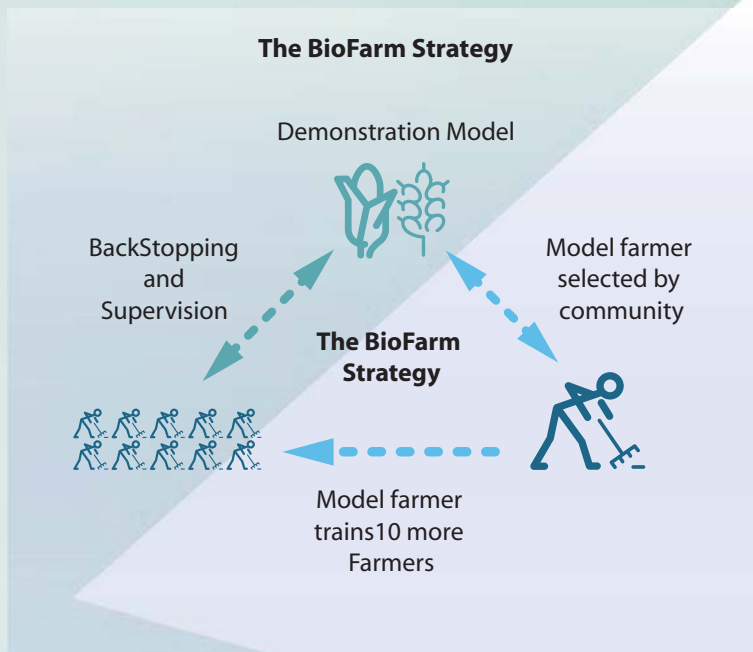
Key contact: **John A. Bowleg**  
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**Capacity Building in Ecohydrology and promotion of eco-farming practices at YEHA Institute Farmers' Academy, ETHIOPIA**

Through capacity building in Ecohydrology and the promotion of eco-farming practices, it will improve living conditions for the rural population and to care for the environment.

- Demonstration sites on eco-farming which utilise biotechnologies for cleaning water resources.
- Objective is to provide training for sustainable livelihoods and care for local environment. Provide practical training for needs of small scale farmers.
- Training farmers, 'learning by doing'. Catalyst approach by bringing forward model farmers as role models.
- Supported by Biovision, Switzerland.

Key contact: **Dr Getachew Tikubet**  
 Email: [bea@ethionet.et](mailto:bea@ethionet.et)



Result training & adoption of bio-farming by 100,000 farmers © Getachew Tikubet



Stakeholders' opinion in Ethiopia © Getachew Tikubet

**Integrated Water Resources Management as tool to control impact of small-scale diamond mining operations in selected communities in the Eastern Region of GHANA**

The proposal aims at getting all stakeholders, viz. the Government through technical and financial support for small-scale diamond miners; the District Assembly through the monitoring and evaluation of diamond mining activities; and, sourcing of funds to rehabilitate the environment

through organized activities with the help of identifiable groups (such as societal and church groups) in the communities.

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# Emerging Projects

**Caring for Cikapundung River by Reforestation, fetiver plantation, biopores, relocation of squatter, settlements along the River banks, long storage, communal septic tank and eco-technology to treatment grey water and effluent of communal septic tank for sustainable water supply for Bandung City. INDONESIA.**



*Typha Angustifolia as a media of Eco-technology*  
© Ratna Hidayat

The management of the basin in the upstream will be important through reforestation which will insure the availability of water, nurturing water springs for agricultural lands, cooling down the heat in climate change situation by absorbing carbon discharge, and providing alternative livelihood to displace farmers by engaging in apiary, orchid nursery or livestock breeding.

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**Study of avian community during wetland restoration of Zhalong Nature Reserve in CHINA**

Zhalong wetland has still in the status of lack of water, and environment disturbance still exist, irrigation plays only a certain degree of positive role, wetland restoration is a long term work.

Key contact: **Dr Zou Hongfei**  
Email: [hongfeizou@163.com](mailto:hongfeizou@163.com)

**Rehabilitation of Balagunan Watershed to restore biodiversity and flood control in Carmen, Davao del Norte. PHILIPPINES**

In this demo project, the reforestation is badly needed to restore back the forest vegetation in the upland areas and communities of Sto. Tomas, Davao del Norte. The denudation of the forest area in Balagunan, Sto. Tomas, Davao del Norte contributed a lot of problems especially periodic floodings in the lower areas particularly at Carmen, Davao del Norte. This will surely affect not only human beings but also the biota living along streams and coastal/marine areas due to situation and pollution by destroying estuaries and marine habitats.

Key contact: **Rogelio C. Montero**  
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*The Vallacuera floodplain* © Josu Elso

**Restoration of Fluvial Territory in the lower reaches of Aragón and Arga rivers (Navarra-Spain), as a means to increase biodiversity and reduce flood risk and damages. SPAIN**

This project aims to significantly enhance the biodiversity of the Lower Reaches of Aragon and Arga Rivers, area of greater population density of European mink (*Mustela lutreola*) in Western Europe, by working on the species' conservation status improvement and restoring the fluvial ecosystems that the species depends on. The implementation of the Fluvial Territory concept is proposed as a way to preserve the biodiversity, obtain the Good Ecological Status and successfully combine it with the people's interests in the area. The recovery and improvement of the potential habitat of European mink in the Fluvial Territory, will guarantee the preservation of the species in the area and promote as source of individuals to recover the neighbouring populations.

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**Sustainable estuarine zone management for control of eutrophication, toxic blooms and conservation of biodiversity in the Kaštela Bay. CROATIA, Adriatic Sea**

This project foresees comprehensive solution in the next decades that will assure unhindered development of the tourism and general economy, through realization of main project objectives: the protection and preservation of water quality; the creation of conditions for safe development of economy; and the maintenance and improvement of achieved level of environment protection.

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# Demonstration Projects Network



## Geographical location of UNESCO-IHP Ecohydrology Programme Demonstration Projects

- Global Reference Projects**  
Poland and Portugal
- Operational Projects**  
Argentina, China, Germany, Italy, Kenya and Malaysia
- Evolving Projects**  
Australia, China, Costa Rica, El Salvador, Greece, Guatemala and Honduras, Indonesia, Micronesia, Philippines and Sweden
- Emerging Projects**  
Bahamas, Croatia, Bangladesh, China, Ethiopia, Ghana, Indonesia, Philippines, Spain

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**Global Ecohydrology Network**

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