Balancing ecology with human needs in wetlands

Factsheet 4

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Wetlands perform vital functions

From an ecological point of view, wetlands are fundamentally important for maintaining biological diversity. They are ecozones linking aquatic and terrestrial ecosystems, and they support an exceptional variety of aquatic, terrestrial and wetland-specific fauna and flora. Wetlands provide fundamental ecological services and are regulators of water regimes and sources of biodiversity at species, genetic and ecosystem levels. The wetlands selected for the case studies in WETwin perform such important ecological functions.

The Drivers - States - Impacts - Responses (DSIR) analysis (see Factsheet 7) is used to describe the evolution of a natural system subject to anthropogenic pressure. Drivers are represented by natural and social processes that influence the environmental state. The state describes physical, chemical or biological conditions in the given reference area. Drivers cause changes of state that ultimately result in impacts on, or damage to, the population, economy and ecosystems.

As well as identifying community-based solutions with the aim of utilizing the drinking water supply, sanitation and provisioning potential of wetlands for the benefit of people,

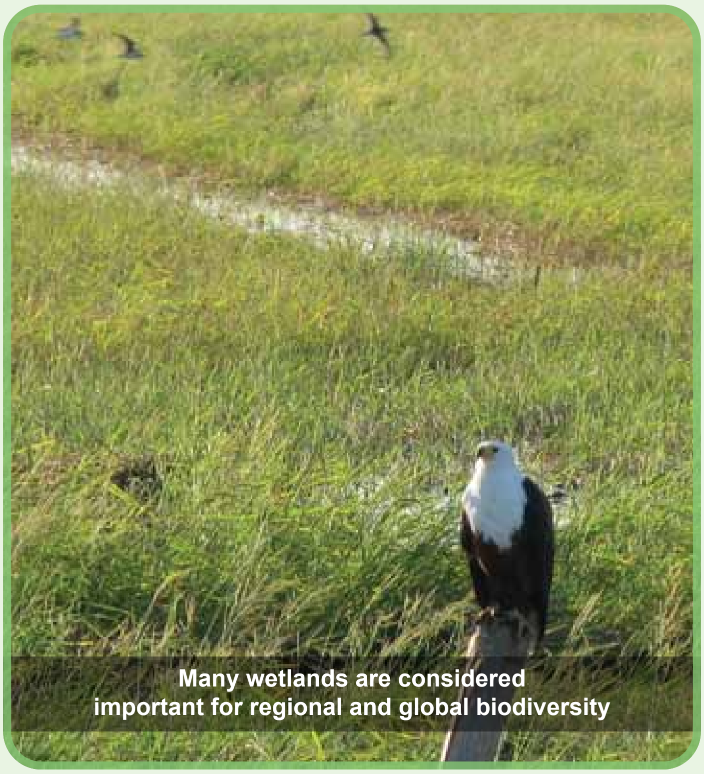
The WETwin project aims to balance the needs of people and the environment

WETwin aims to account for ecosystem functions and the ecological value of wetlands. Any proposed management solutions should also take care to preserve the ecological values of wetlands.

When assessing management solutions, ecological indicators are developed based on the ecological health approach, which focuses on habitat assessment. Habitat assessment is based on the linkage between species and the physical (hydrology and geomorphology), chemical (water quality) and biotic conditions (especially vegetation) of their habitat. It is used to describe the present status of a system and predict changes in the environment. Hydrological indicators are important to describe physical and biological functions in wetland systems. They can be used to characterize natural flow regimes, which are needed to maintain ecological conditions, and to predict the impact of hydrologic change. Another type of structural indicator considers land-use characteristics. Within this approach, important indicators are the areas associated with special land-use forms (e.g., natural vegetation, agriculture).

Many wetlands are important for their rich biodiversity

Five of the seven wetlands selected for the case studies in WETwin - the Inner Niger Delta in Mali, the Abras de Mantequilla wetland in Ecuador, the Nabajuzzi wetland in Uganda and the two European floodplain systems of the Danube Basin, Gemenc and Lobau - are in the list of wetlands of international importance as defined by the Ramsar Convention on Wetlands. Also, these sites are of high importance for regional and global biodiversity and the conservation of wetland flora and fauna.



Many wetlands are considered important for regional and global biodiversity

Assessing the state of health of WETwin study sites

For the European wetlands, regulation such as channelization and flood protection dams represent a main pressure on ecological integrity of the systems. The dams in the Inner Niger Delta, built for electricity production and irrigation, alter the flow regime of the river significantly. This might also become a future problem in the Abras de Mantequilla wetland, if planned infrastructure projects (reservoirs and water diversions) are implemented. In the Nabajuzzi wetland, water abstraction for drinking water supplies might become a pressure in the future, if population growth and increased water demands are taken into account.

The conversion of natural wetland vegetation into agricultural land is a main pressure in the Abras de Mantequilla (mainly short-term crops of corn and rice), in Namatala in Uganda, in the Ga-Mampa wetland in South Africa and in the Inner Niger Delta. This only has a minor impact in the Lobau, due to sustainable practices and the low extent of the affected areas, but is of increasing relevance in the Nabajuzzi wetland. In Gemenc, intensive forestry constrains nature conservation goals. In the Inner Niger Delta and Ga-Mampa wetlands, additional over-harvesting of natural goods through grazing and fishing is a major pressure. Pollution and eutrophication due to agriculture and sewage disposal are pressures with increasing relevance in the non-European sites, except in the Ga-Mampa wetlands.

Rapid assessments of WETwin sites

For the pre-assessment of the health status of ecosystems in the WETwin case-study sites, a rapid qualitative assessment tool was selected. WET-Health (Macfarlane et al. 2008) combines an impact-based and indicator-based approach that enables qualitative assessment of the negative impacts of human activities, such as damming, excavation of drains, cultivation, erosion and road construction, on the structure and function of wetland health in a semi-quantitative manner based on desktop and on-site evaluation.

Damming degrades wetlands

The analysis (Figure 1) revealed that the wetlands impacted by damming widely lost their pristine hydrological and geomorphological integrity. However, in the other systems, both the hydrological and geomorphological conditions ranged from near natural to largely modified, depending on the intensity of

STATUS QUO	Inner Niger Delta	Abras de Mantequilla	Namatala	Nabajuzzi	Ga-Mampa	Gemenc	Lobau
WET-Health Hydrology	D	C	D	C	D	E	F
WET-Health Geomorphology	F	A	C	C	B	C	F
WET-Health Vegetation	C	F	E	A	E	C	C

Not modified A → B → C → D → E → F Drastic alteration

Figure 1: The analysis reveals the extent to which wetland ecology is affected by human activities

anthropogenic activities such as channelization or drainage. The vegetation score reflects the intensity of agricultural activity and the resulting loss of areas with natural wetland

Hydrological and geomorphological conditions at case-study sites varied from near natural to largely modified

vegetation, as well as the degradation of typical wetland vegetation due to damming.

Options for improving wetland health

To counteract the harmful impacts of the hydro-morphological changes due to damming, technical restoration options were identified including the construction of sluice gates, weirs or bottom sills aiming to retain water in the wetland systems after flooding (Abras de Mantequilla, Gemenc), reconnection of side channels (Lobau) or rehabilitation of such connecting channels (Gemenc).

In Ga-Mampa, the Inner Niger Delta and Namatala, the restoration or replanting of natural wetland vegetation was identified as a management option to enhance the ecological integrity of the systems. The creation of ecological corridors by replacing short-cycle crops with perennial-cycle crops was selected as a means to conserve populations of threatened species in Abras de Mantequilla.

In four of the tropical wetlands, additionally, improving agricultural practices was identified as a management option with the potential to reduce sediment and nutrient loads in the wetlands. Wastewater treatment in the wetlands in Uganda mainly aimed to reduce health risks but could also have a positive effect on the integrity of the wetlands. For the Inner Niger Delta, Namatala and Ga-Mampa, supporting societal or institutional activities was identified as important for successful implementation of management practices.

Identifying ecological indicators

Hydrological models were used for all case-study sites, except Namatala, to describe the hydrological alterations in the system expressed as, for example, the flow volume in Ga-Mampa or Abras de Mantequilla or flooded area in Nabajuzzi and in the Inner Niger Delta. In all the wetlands selected for the case studies, the presence and quantity of natural (key) habitats could be used to evaluate the conservation or restoration potential of the different management options (Figure 2).

The level of complexity of the underlying models varied significantly as a consequence of data availability (which is limited in developing countries). Data used ranged from the statistical habitat models for selected key species applied in the Lobau, to geographic information system (GIS)-based assessments of potential areas of known key habitats, such as papyrus stands, in the Ugandan wetlands, or total wetland area under natural vegetation in Ga-Mampa or Abras de Mantequilla. Water-quality indicators were developed for Abras de Mantequilla, Nabajuzzi and Namatala. In Abras de Mantequilla, additionally, the relationship between abiotic parameters (water quality, hydrological, physicochemical) and the aquatic biotic communities (plankton,

Inner Niger Delta	Nursery and spawning ground for fish in the wet season, with approximately 138 species, 24 of which are endemic
	Feeding and resting habitat for migratory birds, e.g., *Philomachus pugnax* and *Chlidonias leucopterus*
	Feeding and nesting habitat for resident waterbirds, e.g., *Anhinga rufa, Ardeola ralloides, Baleorica pavonina*
Nabajuzzi	Wetland antelope Sitatunga *(Tragelaphus spekei)*
	Resident migratory and endemic bird species, e.g., *Balearica regulorum, Balaeniceps rex, Laniarius mufumbiri, Chloropeta gracilirostris*
	Spawning habitat for fish, *Clarias mossambicus, Protopterus aethiopicus*
Abras de Mantequilla	Habitat for mammals, e.g., *Lontra longicaudis, Dasypus novencinctus, Didelphys marsupialis, Philander opposum, Bradypus variegatus*
	Feeding, resting and nesting habitat for resident and migratory birds, e.g., *Crypturellus transfasciatus, Tigrisoma lineatum, Gallinula chloropus, Porphyrula martinica, Jacana jacana, Casmerodius albus, Egretta Tula*
	Habitat for reptiles, *Caiman crocodilus, Chelydra serpentina, Bothrops asper*
	Spawning and nursery habitat for fish in the wet season, with high densities of omnivores (e.g., *Astyanax festae, Rhoadsiaaltipinna*) as key food for top predators (e.g., *Brycon dentex, Cichlasoma festae*). Other key species: *Hyphessobrycon ecuadoriensis, Pseudocurimataboulengeri, Aequidens rivulatus, Cichlasoma festae, Ichthyolephashumeralis, Hoplias microlepis*
Gemenc	Habitat for mammals, *Felis sylvestris, Castor fiber, Lutra lutra*
	Nesting, feeding and resting habitat for migratory and resident birds, e.g., *Haliaeetus albicilla, Ciconia nigra, Ardea cinerea, Nycticorax nycticorax, Falco cherrug, Anser anser, Haliaetus albicillus, Milvus migrans, Anas querquedula*
	Spawning, nursery, resting and feeding habitats for fish, e.g., *Cyprinus carpio, Esox lucius, Silurus glanis, Abramis brama*
Lobau	Water bodies and residual softwood forest as habitat for Castor fiber
	Nesting, feeding and resting habitat for resident and migratory birds: water bodies with large reed-beds, forest, e.g., *Ixobrychus minutus, Milvus migrans, Porzana parva, Jynx torquilla, Egretta alba, Ardea purpurea*
	Stagnant and temporary water bodies as habitat for reptilia, *Emys orbicularis* and amphibia, e.g., *Rana arvalis, Bombina bombina, Triturus dobrogicus*
	Limnophilic fish species, e.g., *Rhodeus amarus, Misgurnus fossilis*

Figure 2:
Key or threatened wetland species

Wetlands play a vital role within river systems

macroinvertebrates, fish) was analyzed. The high ecological importance of the wetland within the river system was demonstrated.

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References

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About WETwin

The WETwin project aims to enhance the role of wetlands in integrated water resources management for twinned river basins in the European Union (EU), Africa and South America in support of EU water initiatives. The objective is to improve community service functions while conserving good ecological status.

Partners

VITUKI Environmental and Water Management Research Institute, Hungary (coordinating partner)
Wetlands International, Mali
Antea Group, Belgium
Potsdam Institute for Climate Impact Research, Germany
WasserCluster Lunz, Austria
UNESCO-IHE Institute for Water Education, the Netherlands
National Water and Sewerage Corporation, Uganda
International Water Management Institute, South Africa
Escuela Superior Politécnica del Litoral, Ecuador

Funding

WETwin is a collaborative project funded under the European Commission's Seventh Framework Programme Grant agreement number 212300.

Factsheet topics

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2: Enhancing governance in wetland management
3: Devising a Decision Support Framework
4: Balancing ecology with human needs in wetlands
5: Creating an effective Spatial Data Infrastructure
6: Wetlands in a catchment context
7: Assessing vulnerability of wetlands to change
8: Integrating health, urban planning and wetland management
9: Case study: Lobau wetland, Austria
10: Case study: Ga-Mampa wetland, South Africa
11: Case study: Abras de Mantequilla wetland, Ecuador
12: Case study: Gemenc floodplain, Hungary

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