Case study: Abras de Mantequilla wetland, Ecuador

A continental wetland vital for birds

The Abras de Mantequilla (AdM) wetland is located in the central-western part of the province of Los Ríos, Ecuador, in the Guayas River Basin (Figure 1). The wetland is a floodplain covering 29,053 hectares (ha). It is listed as a 'continental wetland' under the Ramsar Convention on Wetlands, mainly because of its relevance as a nesting ground for migratory birds and fish. Major land changes have been observed during recent years; only 2% of the wetland is now covered by natural forest. The predominant land uses in the system are rice and maize crops, and perennial pastures for cattle (adding up to over 88% of the total area), and banana crops in the southwestern portion of the wetland (4% of the area) (Figure 2). There are several land use issues affecting the wetland ecosystem, such as the extensive use of pesticides and fertilizers (yellow- and red-label pesticides are sprayed on short-term crops) and the piling and burning of crop waste in the Ramsar wetland area.

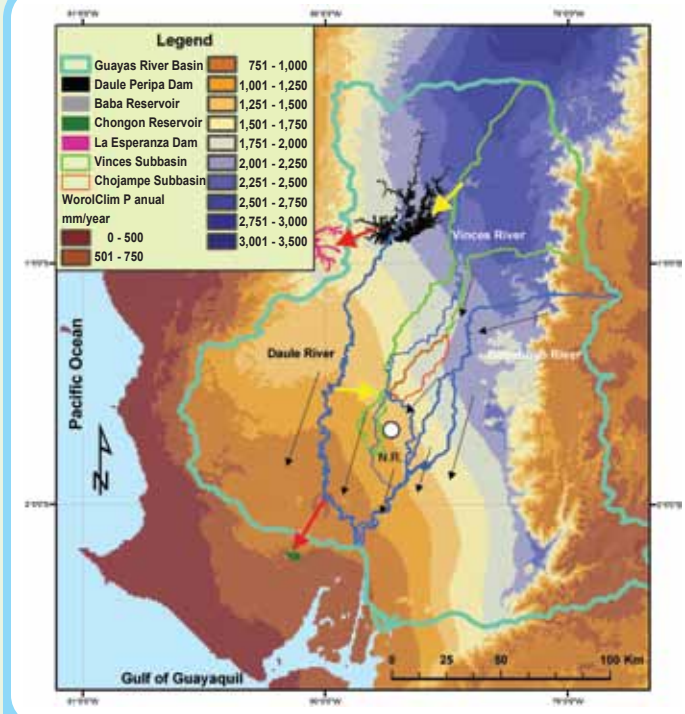

Figure 1: Location of Abras de Mantequilla wetland

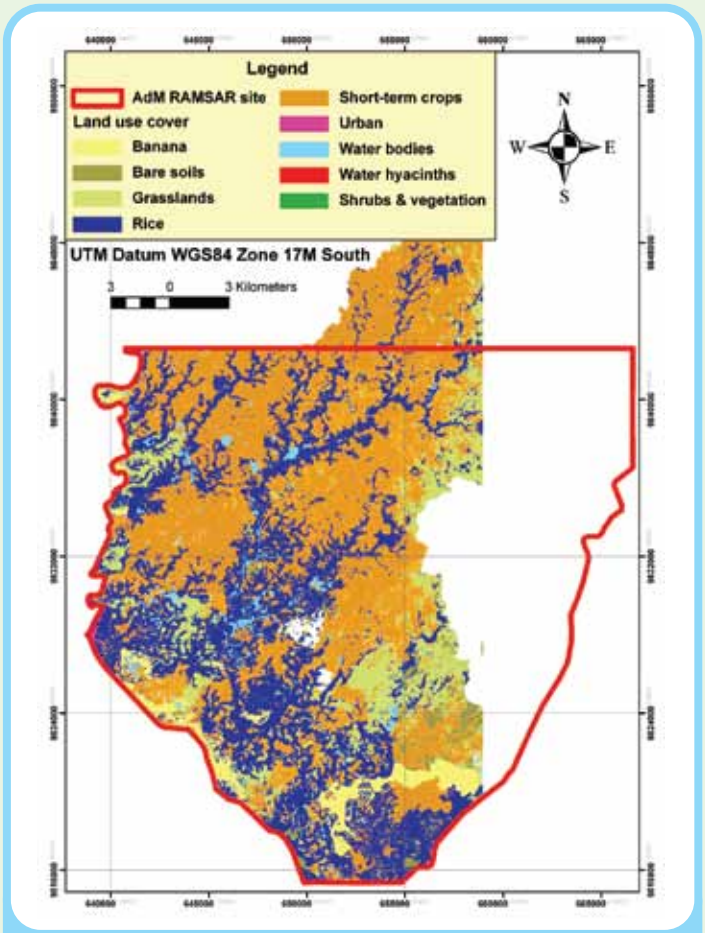

Figure 2: Land use in Abras de Mantequilla

A total of nine municipalities have an interest in the wetland, with the Baba, Pueblo Viejo and Vinces municipalities being the most active. In view of the problems besetting the wetland and the territorial reorganization at a national scale, these three municipalities pulled together in 2008 to form a commonwealth to address land use and waste disposal issues. By 2010, this process included the other six municipalities and gained legal status. Escuela Superior Politécnica del Litoral (ESPOL) (as partner of the WETwin project) established a cooperative

Agriculture is widespread across the wetland

agreement with the commonwealth to implement a participatory decision support system (DSS) for land-use planning.

Ecosystem services and uses

The most important ecosystem services provided by the wetlands are maintenance of biodiversity; cultivated foods and natural resource extraction; water supply for human use; sediment trapping and erosion control; and streamflow regulation (Figure 3). In terms of biodiversity, AdM is part of the upstream bioregion of the Gulf of Guayaquil. There are dry

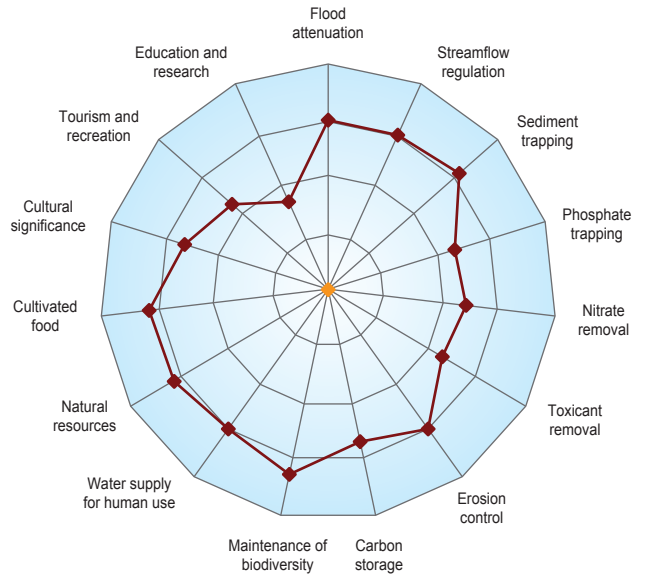

Figure 3: Ecosystem services provided by Abras de Mantequilla

forest remnants in the wetland's surroundings (specifically in the lower lands), including some forests that flood periodically during the rainy season. In these forests, there are over 728 registered plant species (Figure 4). Agricultural activity is increasing in the wetland basin, with a resulting increase in water demand.

Threats to the wetland

Increasing agricultural activities, fisheries and major hydrological alterations (due to water diversion infrastructure in the basin) are currently threatening the wetland biodiversity through hydrological stress. Therefore, the impact is not only observed in the aquatic environment, but also in the forest fragmentation. A major issue at international level is biodiversity conservation, as demanded by the Ramsar Convention on Wetlands. At local scale, ensuring water availability for navigation, fishing, crop irrigation and domestic use is a key aspect for socioeconomic development in the basin.

WETLAND HEALTH SCORES		Hydrology	Veg
		C	
	Ecosystem services	Importance of service	
	Safe drinking water supply	**HIGH:** Domestic, livestock, agriculture and cr supply for local communities.	
PROVISIONING	Natural resource harvest	**VERY HIGH:** African Palm harvesting in the e part of the wetland. Currently, unsustainable pr are being used (includes fertilizers and pesticides) and bamboo are also harvested for mostly local use	
	Agriculture and fisheries	**VERY HIGH:** Extensive seasonal farming (most and maize cropping) that reaches up to 86% of la cover in dry season. This amount reduces signi during wet season as water levels rise up to 1-6 in average. The main economic activity of the communities is related to agriculture. Local stakeh perception is that the most important function re around agriculture.	
REGULATING	Water storage	**HIGH:** Retains water during the dry season, available for the ecosystem and for riparian comm for domestic, agricultural and cropping uses.	
	Stream flow regulation	**HIGH:** The importance of this wetland sy flood regulation capacity was acknowledged RAMSAR convention. During the rainy season the w conglomerate known as "Abras de Mantequilla" is c of storing up to 56000 m³ of tributary water inflo rivers "Vinces", "Quevedo" and "Pueblo Viejo". This direct influence in maintaining local climate balance	
	Extreme event control (flood, drought)	**HIGH:** Wetlands in a large valley bottom protect the resources, although extreme events are infrequent.	
	Sediment trapping and erosion control	**VERY HIGH:** Periodic discharges of clay and lime m from upstream rivers. In all, the wetland system rep acceptable water quality state for maintaining biodiversity. These indices reported an improveme readings taken in June of 1981, which sugges overall improvement in the site's condition. stakeholder perception was fixed on the notion th wetland does not provide this service. At the very they did not consider it relevant to their everyday lif	
	Water quality regulation	**MODERATE:** Nutrient reduction (retention of fer agricultural chemicals), carbon storage and purification. In all, the wetland system repo acceptable water quality state for maintaining biodiversity. These indices reported an improveme readings taken in June of 1981, which sugges overall improvement in the site's condition.	
SUPPORTING	Ecological key processes	**MODERATE:** De-nitrification, mineralization of material, nutrient storage, soil formation, climate reg (local influence, temperature, precipitation), s habitat for aquatic species and key area for spawni breeding.	
	Cultural significance	**LOW:** Potential for eco-tourism with bird- animal-watching; research. Therefore, the significance of this wetland could increase.	
HABITAT	Biodiversity and habitat	**VERY HIGH:** Important faunal diversity, endanger endemic species. Classified as a RAMSAR site. Ho natural habitats have been modified due to the cha land uses in the last decades, decreasing the habitats for these species. Invasive species such as have been competing with local endemic species o	

Figure 4: Report card showing ecosystem

getation	Geomorphology	
D	A	
	Recent trend	Impact of drivers on ecosystem services
ropping	→	**HIGH:** Major infrastructure developments upstream and dams that will be placed in the Chojampe basin could severely alter current flow patterns. Also, increasing pressure on the system by agricultural and urban expansion could hamper the wetland's ability to sustain this service.
eastern actices). Teak e.	↑	**MEDIUM:** Expansion of harvesting activities could increase pressure on the system's resources. The projected impact of upstream infrastructure works could also be a factor to affect local natural resources.
tly rice nd use ficantly meters e local olders' evolves	↑↑	**MEDIUM:** Expansion and change in the composition of agricultural activities could increase pressure on the system's resources. The projected impact of upstream infrastructure works could also be a factor to affect the system's ability to support agriculture and fisheries at their current levels.
that is unities	→	**HIGH:** Baba Dam project may reduce flow along Vinces River, Nuevo River and hence in the wetland. Conversely, water diversions from Daule and Vinces to Nuevo River may increase the amount of surface water to the wetland. Also, aggressive use of aquifers for irrigation, may result in additional reduction to the water storage potential.
ystem's by the vetland apable w from s has a .	→	**HIGH:** Baba Dam project may reduce flow along Vinces River, Nuevo River and hence in the wetland, potentially reaching or surpassing the threshold which was set by previous studies. However, water diversions from Daule and Vinces to Nuevo River may increase the amount of surface water to the wetland, giving some relief to the stream flow regulation capacity of the wetland.
e water	→	**LOW:** Some minor changes are expected, in terms of variation of flood extents.
naterial orts an local nt from ted an Local hat the y least, e.	↑	**MEDIUM:** Removal of vegetation and cattle grazing decreases sediment trapping and increases erosion risks.
tilizers, water rts an local nt from ted an	↑	**MEDIUM:** Removal of vegetation and cattle grazing decreases sediment trapping and increases erosion risks.
organic ulation suitable ng and	↓	**HIGH:** Projected decrease in water flows could lead to an increase in nutrient concentration due to decreases in capacity. Furthermore, it will affect the availability of habitats for key aquatic species.
and cultural	→	**MEDIUM:** Foreseeable development of the wetland as a tourist site could be aided by local infrastructure works and capacity building aimed at local stakeholders.
ed and owever, nges in natural s tilapia f fishes.	↓	**HIGH:** Wetland conversion (changes in land use) could reduce suitable habitats for key species.

services in Abras de mantequilla wetland

Six management methods outlined

A set of six management solutions was identified through the combination of hydraulic control measures, establishment of ecological corridors and changes in local agricultural practices. The first requirement is for the installation of local-scale hydraulic gates for water-level control in the wetland, ensuring navigability during the dry season, as well as reasonable water storage for ecosystem functioning. Enhancing sustainable agricultural practices in the wetland through better agricultural waste management, conversion from short-term crops to perennial agroforestry, and eliminating the use of red- and yellow-label pesticides in at least 10% of the wetland basin, were also considered as strategic actions for wetland conservation. A final proposal was to establish ecological corridors connecting the remaining natural forest patches along the basin to enhance the biodiversity conservation in the wetland.

The management interventions proposed for the AdM system were evaluated using qualitative and quantitative indicators (e.g., degradation, agricultural crop costs, stakeholder capacity). Evaluation was based on a multi-criteria DSS designed to cope with data scarcity (Figure 5). Where quantitative data were

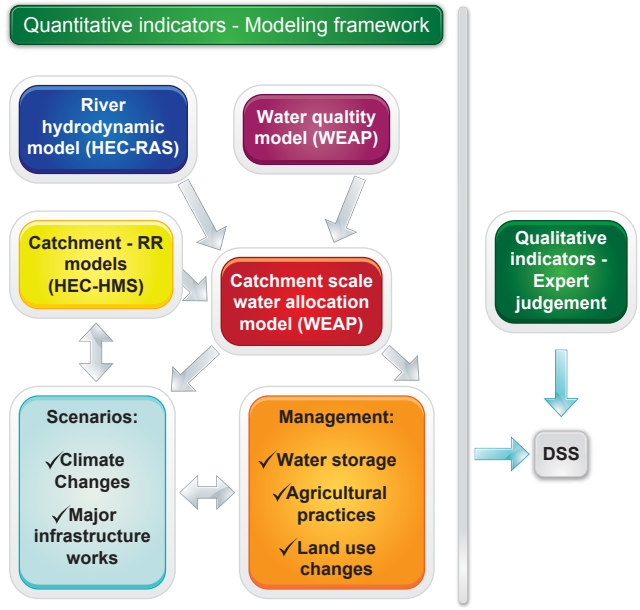

Figure 5: A decision support system for managing the wetland

lacking, several experts were asked to score qualitative indicators based on a questionnaire. The resulting scores were combined with quantitative information from hydrological and geographic information system (GIS)-based modeling and then weighted according to stakeholder preferences to derive

rankings for the different management solutions. The results were used to assist in the negotiations between the different stakeholders (government, institutional and local), by dealing with their current and potential goals.

Preliminary conclusions show that current priorities of the management agencies and local stakeholders differ. However, future expectations of stakeholders converge towards the current policy views of the AdM Commonwealth of Municipalities, which is consistent with the incremental design of the management solutions. This shows the potential for engaging in negotiations that can be directed to facilitate the territorial ordering process that is currently taking place in the AdM municipalities by command of the central government.

Recommendations for the future

Even though the AdM Commonwealth is making major efforts to conserve the wetland, it is clear that the socioeconomic development in the basin will result in significant pressures for the ecosystem in the coming years. The identification of main ecosystem services, stakeholders and environmental stressors provides the framework for the development and application of decision support systems that can help decision makers to assure the sustainable development of the wetland. Urgent measures should be taken to encourage environmentally friendly agricultural practices in the basin, ensure water availability for ecosystem functioning and human activities, and connect the remaining habitat fragments to enhance the biodiversity conservation of this Ramsar wetland.

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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

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Factsheet topics

1: Lessons learned from a comparative assessment
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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