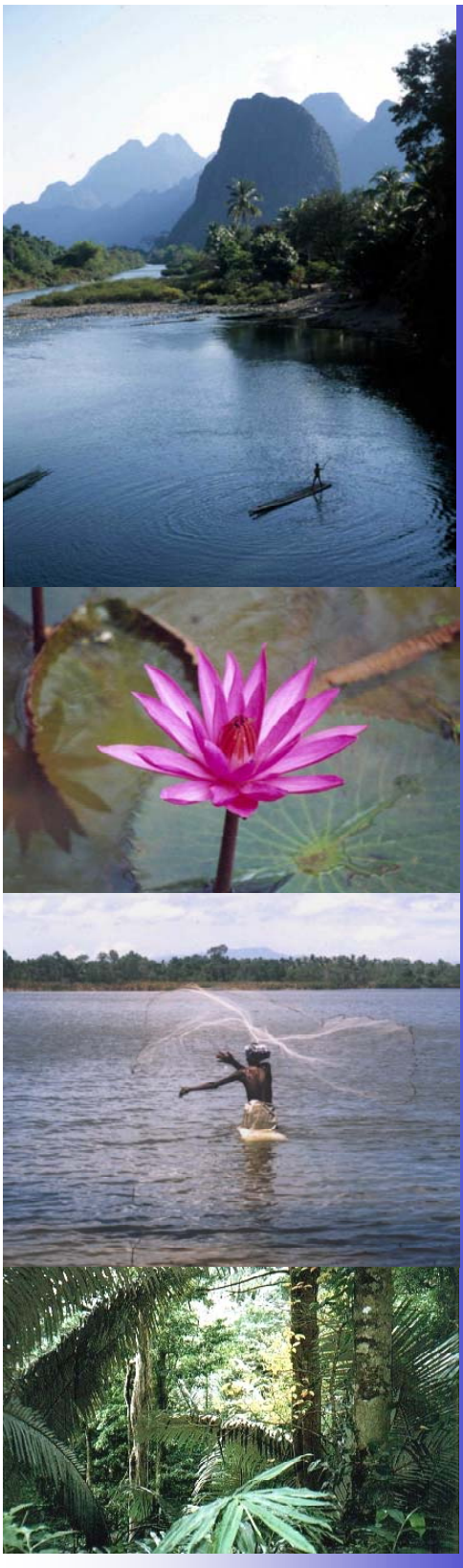
CASE STUDIES IN WETLAND VALUATION #2: May 2003

BAROTSE FLOODPLAIN, ZAMBIA: local economic dependence on wetland resources

Human use of the Zambezi

The various components of the Zambezi River Basin system, and wetlands in particular, have a high economic value to large numbers of people in Southern Africa. Yet, in spite of their obvious importance, the Zambezi's wetlands have been vulnerable to increasing pressures of economic and population growth (Seyam *et al* 2001). Resource over-exploitation, land drainage and encroachment for agriculture, and interference with river hydrology for large-scale hydropower and irrigation schemes are all resulting in wetland degradation.

This case study describes an attempt to articulate the economic value of one of the Zambezi's largest wetland complexes, the Barotse Floodplain in western Zambia. It formed a component of a project concerned with wetland conservation, with field sites in Malawi's Lower Shire Wetlands, the Zambezi Delta in Mozambique and the Eastern Caprivi Wetlands in Namibia, as well as the Barotse Floodplain itself. A particular focus of the study, and of the project more generally, was to assess the value of local-level wetland resource use by wetland communities. A major motivation for this was that in the Zambezi Basin, the ecological and economic value of wetlands to rural communities is not fully appreciated when river basin planning is undertaken or when land and water management decisions are made. As a result, such decisions often interfere with wetlands of local economic importance, thereby impacting heavily on the communities who live beside them.



IUCN The World Conservation Union

Integrating Wetland Economic Values into River Basin Management

The Barotse Floodplain

After rising in north-western Zambia and passing southward through Angola, the Zambezi re-enters Zambia in Western Province and becomes larger and more consolidated, giving rise to a series of floodplains (Timberlake 1997). These include the Barotse Floodplain and other interconnected areas. The exact extent of the Barotse Floodplain is not easy to determine, because annually flooded areas grade into occasionally inundated parts, and it is also difficult to separate the wetlands influenced by the Zambezi from those fed by other catchments. Broad estimates put the Barotse Floodplain area at approximately 550,000 hectares, and the total wetland cover in the region at some 1.2 million hectares. The floodplain is mainly comprised of grasslands. Although trees are largely absent from seasonally flooded areas, there are a number of small wooded areas on higher ground (van Gils 1998), and swamp forests are scattered over the area. The Barotse Floodplain is flanked by plateaux of Kalahari sand covered in semi-evergreen woodland, interspersed with low-lying dambos which are characterised by grassland vegetation (Timberlake 1997). The Liuwa Plain National Park and associated areas to the north west of the floodplain are relatively flat, and are waterlogged during the rainy season while remaining extremely dry during the rest of the year (Simwinji 1997).

The ecological characteristics and conditions of the Barotse Floodplain, as well as the human production systems it supports, depend largely on the timing and duration of the annual floods (Timberlake 1997). The main wet season runs from November until March, although inundation depends mainly on rainfall in the upper catchment and on seepage from the uplands (Simwinji 1997). The onset of annual flooding varies greatly and may occur anywhere between December and March, although northern parts of the floodplain are generally inundated earliest. The maximum flood level is attained in April, after which floodwaters gradually recede over May, June and July.

In total, the four Districts of the Barotse Floodplain are estimated to contain just under 225,000 people or 27,500 households. Population density, which is generally low in Western Province with fewer than 5 people per km^2, increases steeply around the floodplain. The floodplain area is occupied mainly by the Lozi people, and falls under a dual administration – that of the Barotse Royal Establishment under the rule of the King, or *Litunga*, and the Government of Zambia through Provincial and District line ministries and administrative authorities. The use of floodplain resources was in the past managed according to traditional systems, under the customary authority of the *Litunga*. Today, although formal control over natural resources has been passed over to central and provincial government, the Royal Establishment maintains a great influence on natural resource use patterns and regulations in the region.

The Lozi people are also known as the "plains or water people", and local livelihoods and cultural traditions are linked closely with seasonal flooding. During the dry season, the bulk of local production, economic activities and settlement are focused in the floodplain area. As the plain becomes inundated, most of the population move to the uplands and plain fringes. This annual relocation of people and cattle includes the movement of the *Litunga* in a highly-celebrated traditional ceremony, called the *Kuomboka* (Nkhata and Kalumiana 1997).

Wetland resources in local livelihoods

Most of the population in the Barotse Floodplain depend on a mixed livelihood strategy, combining crop farming, livestock keeping, fishing and natural resource exploitation. This diversity of livelihood components, many of which depend on wetlands, is an effective strategy for spreading risk, and income and subsistence sources vary at different times, especially according to season. The rural economy is for the most part subsistence-based, and is subject to high levels of uncertainty and variability. About 76% of the rural population in Western Province live in poverty, and lean months are November to January/February when incomes are lowest and expenditures highest, and little food is available (Simwinji 1997).

Almost all of the floodplain population are involved in crop farming. Of the total area under arable agriculture of 280,000 hectares in Western Province, about 10% is comprised of

floodplain farming systems. The main growing season in the floodplain is between November and April, and produces maize, rice, sweet potatoes, sugar cane, fruit and vegetables. Floodplain farming systems are diverse, and include raised gardens (*Lizulu*), rain-fed village gardens (*Litongo*), seepage gardens (wet *Litongo*), drained seepage gardens (*Sishango*), lagoon gardens (*Sitapa*) and riverbank gardens (*Litunda*).

Most of the cattle in Western Province are found along the Zambezi floodplain and adjoining plains (Jeanes and Baars 1991), and the Barotse Floodplain is known to be one of the most productive cattle areas in the country (Simwinji 1997). Over three quarters of cattle in Western Province are pastured in the floodplain, including 265,000 head that belong to floodplain residents. The bulk of herds are managed under a system of transhumance and move between the floodplain and adjacent uplands, usually spending January to July in the floodplain and the remainder of the year in the uplands. Primarily driven by the seasonal availability of pasture, annual transhumance is also important for the distribution of manure, and in the floodplain there is a strong interaction between herding, cropping and fishing activities (Simwinji1 997).

The fisheries sector is one of the most important sectors in Western Province, and is mainly concentrated on the floodplains of the upper Zambezi (Timberlake 1997), especially the Barotse floodplain (Simwinji 1997). Just over half of the floodplain population are involved in fishing activities. Fish are an important source of protein, and local fish consumption is five times the national average (van Gils 1998). Bream make up 80% of the catch (Maimbo *et al* 1996), and a number of smaller fish are also caught such as minnows, tilapia, bottlenose and silver barbels. Fishing is a highly seasonal activity. Between December and April, fish move from the main river channels into the wetlands, where they spawn before the height of the flood (Nkhata and Kalumiana 1997). As the floodwaters rise, a phenomenon called "red waters" occurs, where low oxygen water is pushed forward by the floods. Only barbel can survive in this water. The main fishing season takes place as the floodwaters recede, and gill nets are used in the lagoons which have formed and in which fish are concentrated. This activity intensifies from May until December, when fishermen stop fishing in anticipation of the rains. When the floodplain becomes fully inundated, fish are mainly caught using traditional *maalelo* traps, as well as with traps and spears.

The floodplain population also makes use of a wide range of wetland plants, animals and natural resources for their daily subsistence and income. Almost all households harvest grass, reeds and papyrus for use in house construction, thatching, mat and basket production, broom making and fishing apparatus construction. Clay is also important, used for house construction and pottery making. Although the loss of many of the floodplain's wild mammal populations has meant that hunting has decreased over time, turtles, birds and birds' eggs form an important supplement to local diets.

Valuing household wetland use and future management scenarios

The primary aim of the valuation exercise was to assess and articulate the value of wetland goods for local communities. It was carried out in two phases. During the first phase, scoping visits were made to the study area in order to assess the status of existing data, meet with government and traditional authorities, and consult with local villagers. This yielded information about which resource were used, their relative importance and value, and helped in the design of survey instruments and valuation methods for the subsequent main study. During the second phase of the study, household surveys were used to obtain quantitative data about the use of wetland resources. Focus group discussions with community leaders, resource users, wetland specialists, and different socio-economic categories provided a more detailed, and participatory, means of assessing the economic importance of wetland resources to the local population.

The data gathered were analysed using a static economic model to determine the value of each wetland resource. The model modified and extended an existing approach, which had originally been developed in order to assess local and national level returns to wildlife resources in Namibia (Ashley and Barnes 1996,

Barnes and de Jager 1995). It indicated the financial and economic returns to different wetland utilisation and value-added activities, measured as private net cash income and economic net value added to national income. Values were expressed at the level of the whole floodplain, and as gross and net returns per household.

A dynamic model was then developed to calculate the present net value of wetland resources under different future management scenarios. This scenario analysis used a dynamic ecological-economic model which simulated a simple wetland system and the effects of human activity on that system. A generic Zambezi wetland model was developed, and then adapted to model the Barotse area. The model was run from 30 years before the time of the study to 20 years hence, in order to simulate past resource trends recorded in the study and investigate how these trends would affect future wetland values. Four future wetland management scenarios were identified, each based on likely or planned actions in the Barotse Floodplain region, and applied to the model. These included various combinations of a "do nothing" scenario of continuing resource use and human population growth; a "wise use" scenario based on sustainable levels of wetland resource utilisation; a "protected area" scenario where parts of the floodplain were put under strict protection which required resource utilisation activities to be reduced or curtailed completely; and an "agricultural development" scenario assumed the gradual transformation of floodplain wetlands to large-scale irrigated rice. An additional scenario, "upstream hydrological developments" was identified and described but not modelled quantitatively, as it depended on actions being taken outside the direct study area and because there were at the time no such plans for developments upstream of the Barotse Floodplain.

Integrating livelihood values into wetland planning

The study confirmed the extremely high value of wetland resource use in local livelihoods, and as a way of spreading seasonal risk and

Table 1: Financial and economic returns to wetland resource utilisation

	Cattle	Crops	Fish	Wildlife	Reeds & papyrus	Palms	Grass	Clay	Total
PER HOUSEHOLD ($/year)									
Gross financial value	120.4	90.8	179.6	5.83	15.12	0.43	8.25	2.39	**417**
Net financial value	120.4	88.7	174.1	0.41	10.72	0.27	8.07	2.33	**405**
Gross cash income	11.5	6.1	52.6	0.01	1.61	0.04	0.30	0.02	**72**
Gross subsistence value	109.0	84.8	127.0	0.42	13.51	0.29	7.95	2.37	**345**
TOTAL WETLAND ($'000/year)									
Gross economic value	3,988	1,447	5,947	12	501	12	272	66	**12,244**
Net economic value	3,908	-75	4,258	10	271	3	221	52	**8,647**
Gross financial value	3,323	2,507	4,956	12	417	12	228	66	**11,520**
Net financial value	3,323	2,447	4,803	11	296	7	223	64	**11,174**
Gross cash income	316	167	1,452	0.3	44	1	8	0.5	**1,989**
Gross subsistence value	3,007	2,340	3,504	12	373	11	219	65	**9,531**

uncertainty. In total, local use of wetland resources in the Barotse Floodplain was found to have a net economic value of some $8.64 million a year (Table 1). At the household level, wetlands were calculated to generate an average net financial return of $405 a year. The major proportion, 83%, of this value was comprised of subsistence values and home consumption, and by far the most valuable products were found to be fish (43% of total, and 73% of household cash income), floodplain grazing (29% of total) and crop production (22% of total).

Dynamic modelling indicated that the most economically valuable future management option was wise use of the wetland area, possibly combined with small areas under strict protection – in comparison to a "do nothing" scenario, to putting larger areas under strict protection, or to converting the wetland for the implementation of large-scale agricultural development projects (Table 2). The economic and financial values yielded by wetland wise use and conservation were found to be most pronounced at the local level. As the area under strict protection is increased, large financial and economic losses are incurred by local communities who must reduce or curtail their utilisation of wetland resources. The financial benefits of agricultural schemes to local communities, primarily felt through increased employment opportunities, are also likely to be far outweighed by the opportunity cost of lost access to wetland resources of between $1.2 -$3.0 million a year.

Table 2: Model of economic values associated with future wetland management options

Scenario	Financial NPV ($ mill)	Economic NPV($ mill)
Do nothing	84.2	62.2
Wise use	86.7	64.4
Wise use and 10% protection	85.5	64.5
Wise use and 25% protection	82.7	63.7
Wise use and 50% protection	74.0	58.4
Agricultural development 5,000 ha and no protection	85.4	63.2
Agricultural development 5,000 ha and 25% protection	81.4	62.5
Agricultural development 20,000 ha and 25% protection	79.7	60.9

Developments outside the Barotse Floodplain area itself were also found to have a profound effect both on wetland status and on the local economy and livelihoods. A large number of new hydropower schemes, dams and reservoirs have been identified for development along the Zambezi River although none are currently planned in Angola or north western Zambia, upstream of the Barotse Floodplain. The findings of the study emphasised that any upstream development, if it influenced downstream river flow and flooding, would be likely to incur devastating economic losses to the local communities who depend on the Barotse wetlands.

An important conclusion of the study was the emphasis it accorded to the economic role of the Barotse Floodplain in local livelihoods. Not only is the value of the wetland great in absolute terms, but it also forms a key component of local livelihoods – without access to wetland resources, households would both lose the values accruing from natural resource use and also be separated from an essential source of support and inputs to other forms of production such as crop farming and livestock keeping. For a long time such values have not been a factor in decision-making in the Zambezi Basin: because they are not reflected in official prices and formal markets, they are treated as being negligible. The study made the point that this is clearly not the case. Ecological-economic modelling of future wetland options showed that any management scenario which omitted consideration of these values, and did not allow for the local-level use of wetland resources, would run the risk of being both economically and financially sub-optimal, as well as jeopardising the economic livelihoods of almost a quarter of a million people.

This case study is adapted from Turpie, J., Smith, B., Emerton, L. and J. Barnes, 1999, Economic Valuation of the Zambezi Basin Wetlands, IUCN – The World Conservation Union Regional Office for Southern Africa, Harare

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This project aims to develop, apply and demonstrate environmental economics techniques and measures for wetland, water resources and river basin management which will contribute to a more equitable, efficient and sustainable distribution of their economic benefits at the global level and in Africa, Asia and Latin America, especially for poorer and more vulnerable groups.

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