SADC WETLANDS REGIONAL CONSERVATION PROJECT **PHASE II**

WETLAND ECOSYSTEM DYNAMICS AND INTEGRATED MANAGEMENT TECHNIQUES

LAKE CHILWA PALUSTRINE WETLAND

REGIONAL TRAINING SEMINAR **RESOURCE MANUAL**

Southern African

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REGIONAL TRAINING SEMINAR ON WETLAND ECOSYSTEM DYNAMICS AND INTEGRATED MANAGEMENT TECHNIQUES

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LAKE CHILWA PALUSTRINE WETLAND

Resource Manual

May, 2002

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REGIONAL TRAINING

SEMINAR ON WETLAND

ECOSYSTEM DYNAMICS AND INTEGRATED

MANAGEMENT TECHNIQUES

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LAKE CHILWA PALUSTRINE WETLAND

Resource Manual

Table of Contents

List of Abbreviations

ADC	:	**Area Development Committee**
ADMARC	:	**Agricultural Development and Marketing Corporation**
BVC	:	**Beach Village Committee**
CAMPFIRE	:	**Communal Areas Management Programme for Indigenous Species**
CBNRM	:	**Community Based Natural Resources Management**
CITES	:	**Convention for International Trade in Endangered Species**
DDC	:	**District Development Committee**
DDP	:	**District Development Planning**
DEC	:	**District Executive Committee**
FGD	:	**Focus Group Discussion**
GKG	:	**Gaza-Kruger-Gonarezhou**
ITCZ	:	**Inter tropical Co vengeance Zone**
IWM	:	**Integrated Wetland Planning**
NDP	:	**National Decentralization Policy**
NGOs	:	**Non Governmental Organizations**
NOPS	:	**Needs Opportunities Problems Solutions**
PLA	:	**Planning Learning and Action**
SADC	:	**Southern Africa Development Community**
SMART	:	**Specific Measurable Achievable Realistic and Time Bound**
SSI	:	**Semi-Structured Interview**
TA	:	**Traditional Authority**
TBNRM	:	**Trans Boundary Natural Resources Management**
TFCA	:	**Trans Frontier Conservation Areas**
VDC	:	**Village Development Committee**
ZIMOZA	:	**Zimbabwe Mozambique Zambia**
ZRA	:	**Zambezi River Authority**

Preface

This resource manual is a result of SADC and IUCNROSA's ongoing initiative to support capacity building among SADC member states on conservation and wise use of wetlands ad related resources. This is being done to address inadequacies in technical capacity to deal with wetland issues, a constraint which was identified by Phase I of the SADC Wetlands Conservation Project.

The specific objective of the Phase II project, being addressed is to facilitate technical capacity building for effective conservation, sustainable management and equitable use of wetlands in the SADC region. The project is addressing this objective through establishment of partnerships among SADC, IUCNROSA and capable regional institutions to provide targeted 'state-of-the-art' training on wetland dynamics and integrated management techniques. The training provided maintains a balance between theoretical/lecture-room presentations with field based case studies and exposure to communities within the wetland used. Therefore institutions and specialists engaged to deliver the training are those involved in academic/research as well as practical wetland development/ management work.

The Molecular Biology and Ecology Research Unit (MBERU), a specialised research and development agency of Chancellor College, University of Malawi has conducted extensive research on biophysical and socio-economic aspects of the Lake Chilwa wetland system. Their efforts have been incorporated into the Lake Chilwa Wetland Management Plan, which was launched in October 200. MBERU utilised this specialised knowledge of the wetland as well as their experience in training or trainers to impart skills to wetland managers from SADC member states.

This Publication is the first in a series of publications that will cover training material prepared under the SADC Wetlands Conservation Project Phase II. Subsequent publications will be on: *Conflict Management and participatory approaches, Wetland Dynamics and integrated management techniques-riverine wetlands, Wetland dynamics and integrated management techniques-marine wetlands, Wetland dynamics and integrated management techniques-estuarine wetlands.*

Financial support for the SADC Wetlands Conservation Project Phase II, and publication of this resource manual is provided by NORAD. The project also includes components on demonstration of wetland management planning for palustrine, riverine, estuarine and marine wetlands in the SADC region, information exchange, and research.

Who are the Users of the Manual?

This manual of ecosystem dynamics and integrated management techniques for wetlands is developed for personnel involved in the development of plans with emphasis on wetlands. It emphasizes on involvement of communities, the marginalized individuals in the rural and urban set up. The wetland managers are facilitators of the wetland planning process. While in the past, the communities looked for development to be supported by government and donor funding, this manual encourages the communities to use locally available material and human resources in the management of natural resources in their wetlands before they seek outside support.

The manual was used for Regional Training Seminar on Wetland Ecosystem Dynamics and Integrated Management Techniques using Lake Chilwa Wetland as a case study. Participants to the course will be drawn from members of the regional grouping called Southern Africa Development Community (SADC).

Acknowledgements

The Molecular Biology and Ecology Research Unit (MBERU) would like to sincerely acknowledge the IUCN-ROSA for the financial support it provided to the Unit for compiling this resource manual. The cordial relationship that has been developed between staff of IUCN-ROSA and MBERU is also greatly appreciated.

We are also grateful to many individuals and organizations that in one way or another provided support towards the compilation of this manual. Special thanks go Lenka Thamae, the Programme Coordinator, who reviewed the draft of this manual, Mr L. Sefu, Director, Department of National Parks and Wildlife and Mr R. Jiah, Co-ordinator, SADC-Wildlife Sector Training Co-ordinating Unit (WSTCU). Finally MBERU is acknowledging use of some information on wetlands contained in a CD-Rom entitled Wetland Rehabilitation produced by Mondi Wetlands Project. MBERU holds the responsibility for all errors and shortcomings in this manual.

MODULE 1

Introduction to Wetland Hydrology, Soils and Landforms

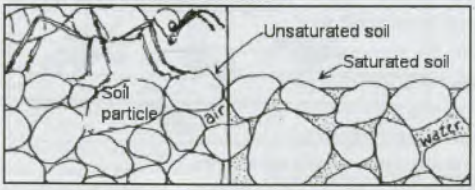
1.1 Introduction.

Even though wetlands have many benefits to society, such as purifying water, controlling erosion and providing habitat for wetland dependent species, they continue to be destroyed and poorly managed. This is usually because the benefits are poorly understood or they benefit people distant from the wetland. In order to begin improving the management and protection of wetlands, one needs to have a better understanding of how wetlands function.

1.1.2 What is a Wetland?

A wetland is wet land (i.e. land which is wet)! But not all wet land results in a wetland. Why is this so? A wetland is found where the land is wet enough (i.e. saturated or flooded) for long enough to be unfavourable to most plants but are favourable to plants adapted to anaerobic soil conditions. As soil becomes increasingly wet, the water starts to, fill the space; between the soil particles. When all the spaces are filled with water, the soil is said to be saturated. In areas which are not wetlands, water drains away quickly and the soil does not remain saturated. However, in wetlands the water persists or drains away very slowly and the soil remains saturated or flooded for long periods. Soil in these conditions is said to be waterlogged. Depending on factors such as temperature, it usually takes a week or so for the plant roots and other living organisms in the soil to use up the oxygen, causing anaerobic conditions to develop in the waterlogged soil.

In trying to understand wetlands, a good place to start is - with the question: ***what is a wetland?***



1.1.3 What are Anaerobic Soil Conditions and What Importance do They Have for Plants?

Anaerobic conditions occur when there is no, or very little oxygen present in the soil. This is important to plants because plant roots require oxygen to live and function. Hydrophytes are plants that have special adaptations for living in anaerobic soils (e.g. specialised air spaces which allow oxygen to move easily from the leaves and stems down into the roots). Anaerobic conditions may, contribute to the ability of wetlands to purify water because many chemical processes that help in removing pollutants from the water require anaerobic conditions. If the soil is saturated and the anaerobic zone is within the upper 50 cm of soil (i.e. the main rooting zone), it is generally close enough to the soil surface to significantly influence the plants

growing in the soil, this will cause the area to develop characteristics of a wetland. However, if the water clogged layer always remains below 50 cm from the soil surface it would probably be too deep to significantly influence the vegetation (i.e. there is sufficient aerated surface soil for non-wetland conditions to prevail). Such an area is unlikely to develop the characteristics of a wetland.

1.1.4 What Causes Anaerobic Conditions to Develop in Saturated Soils?

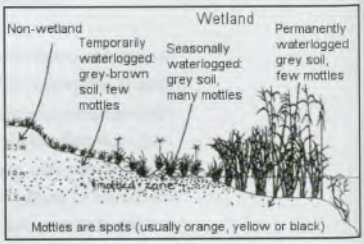
To answer this question we need to examine the relative speed with which oxygen diffuses through air and water. There is, in fact, a tremendous difference, with oxygen diffusing 10 000 times more quickly through air than through water. Thus, when roots and soil micro-organisms use the oxygen in the soil, the rate at which it is replaced by oxygen diffusing from the air above the soil and down through the soil is much slower if the soil is saturated than if it is unsaturated. In saturated soil, the water in the spaces between the soil particles effectively "blocks" the diffusion of oxygen. To summarise: expressed very-simply, a wetland is just that - it is a wet land. More specifically it is land which is wet at or close to the soil surface for long enough for anaerobic conditions to develop. The land does not have to have surface water to be considered a wetland.

To summarise: expressed very-simply, a wetland is just that - it is a wet land. More specifically it is land which is wet at or close to the soil surface for long enough for anaerobic conditions to develop. The land does not have to have surface water to be considered a wetland.

Water regime is a term used to describe how, the wetness of the soil changes over time. **Do all wetlands have similar water regimes?**

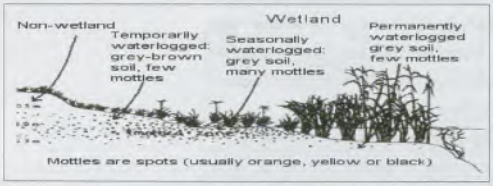
No - wetlands can have quite different water regimes, from permanently waterlogged areas, which remain flooded or saturated to the surface for the entire year; to temporarily waterlogged areas, which are flooded or saturated too close to the soil surface for only a few weeks in the year (but still long enough to develop anaerobic conditions and determine the nature of the plants growing in the soil).

The upper limit of the saturated zone in the soil is referred to as the groundwater table. In most pans of the landscape the water table lies many metres below the soil surface. However, in wetlands the water table usually lies close to or above the soil surface. Even so, the water table depth changes in

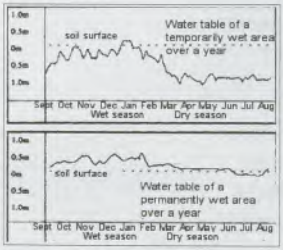


response to climatic changes (e.g. from year to year, season to season, and within a season). This is most noticeable in seasonally and temporarily waterlogged areas (see diagrams below)

Water table differences between the wet and dry seasons in a hypothetical wetland



Water table differences between the wet and dry seasons in a hypothetical wetland To see the depth of the water table at a particular time: simply dig a hole in the ground until water is reached and measure the depth once the water level has stabilised. If you find that the saturated zone is close to the soil surface (i.e. within 50 cm) you are probably in a wetland. If, however, you find that the saturated zone is not close to the soil surface, this does not necessarily mean that the area is not a wetland. You may be in a temporary wetland and you will need to wait for some months before water is visible close to the soil surface. Thus, it is usually not enough to simply know if the water table is at one instance in time. One needs a general picture of how it changes over time i.e. one needs to determine the water regime). One way of doing this is to directly measure the water regime over a long time (preferably for more than a year) through the use of a measuring well. Because of the expense and time, this is usually not possible. Alternatively, indirect indicators of the.water regime could be used. The best indirect indicator is the soil morphology (i.e. the colour patterns and general appearance of the soil). The presence of plants that are adapted to certain water regimes may also be used as indicators, in South Africa most sedge species are confined to wetland areas. There are, however, exceptions; such as Cypress especially, a common weed in croplands, which occurs widely outside of wetlands. Water table changes over a year in two hypothetical wetland areas Some common sedges found in wetlands



Water table changes over a year in two hypothetical wetland areas

1.1.5 How Can Soil Colour Patterns be Used to Indicate Soil Water Regime?

Some common sedges found in wetlands

The water regime has a strong effect on the colour patterns of the soil. One can say that the water regime leaves its signature on the soil. So different water regimes leave different signatures. This means that we can indirectly determine what the water regime is for a particular area by interpreting the area's soil colour patterns (i.e. by "reading

its signature") from a single site visit. Because these signatures develop slowly they reflect 'average' conditions over a long time. Well drained soils that are seldom saturated have enough oxygen present to oxidise the iron, resulting in the soil being uniformly red/brown in colour, usually without mottles (see Glossary: soil drainage classes). Under aerobic conditions iron in the soil is not soluble in water, and thus it is not leached out of the soil and the soil retains its red/brown colour. In contrast, under anaerobic conditions the iron oxides are reduced and broken down and the effect that they would have in making the soil red/brown is lost. Thus, we find that wetland soils, often referred to as hydric soils, are generally grey, in colour. On a colour chart these soils have a chroma of 2 or less. You can demonstrate the effect of anaerobic conditions on iron by seeing what happens when a mild steel-welding rod is inserted into a permanently anaerobic soil and left for several months. Where it is inserted into the soil the rod does not rust because there is no oxygen in the immediate environment to react with the iron in the rod and form iron oxides (rust), as would occur to an iron rod inserted in an aerobic soil. Although temporarily wet soils tend to be anaerobic for shorter periods and less close to the soil surface than seasonally wet soils, both of these soils alternate between being anaerobic (mainly in the wet season) and aerobic (mainly in the dry season). When anaerobic soil dries out, iron oxides form in patches, resulting in mottles. Mottles often form around plant roots, which provide a route for oxygen to move down into the soil. Thus, soil which is grey but has many mottles may be interpreted as indicating a zone with a fluctuating (rising and falling) water table. When a wetland is drained and the water regime is changed the soils retain their characteristic colour signatures. Thus, soils are useful for indicating if a drained area used to be a wetland. This helps in determining where wetlands used to be and assists in working out the extent of wetland loss.

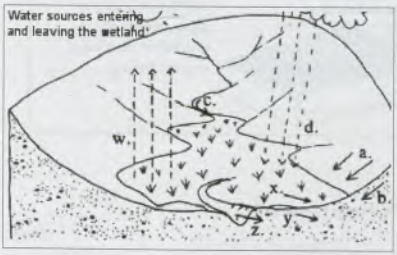
1.1.6 How do Anaerobic Conditions Affect Organic Matter in the Soil?

Besides affecting the mineral chemistry of soils (with iron being especially noticeable) the water regime of wetlands also has an important influence on soil organic matter. Most micro-organisms which decompose (break down) organic matter use oxygen in the process. So when oxygen is depleted these organisms cannot function. Although other organisms gain energy by anaerobic respiration they decompose organic matter much more slowly. This increases the amount of organic matter in the soil. Thus, the wettest parts of the wetland, which are most anaerobic, tend to have the highest organic matter contents in a given wetland. Low temperatures also promote organic matter accumulation, so that for a particular water regime, more

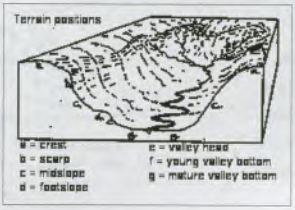
water regime, more will accumulate in a cool climate than in a warmer one. Soil with a very high organic matter content is referred to as peat. In cold areas such as Ireland and Canada many of the wetlands have peat soils. Under the warmer conditions of Africa, peat is much less common but is still found in many permanently wet areas. Wetlands with peat soils are referred to as bogs or fens.

1.2 Where are Wetlands Found?

In the preceding section, we have seen how important water is in affecting the functioning of wetlands. Unless there is a supply of water to the wetland and the water is retained there will be no wetland! Water which falls as rain or snow on the catchment, and which is not lost to the atmosphere through evaporation or transpiration, moves down through the catchment to the sea. It moves (see diagram below) as : (a) overland flow on the soil surface; (b) subsurface flow beneath the soil surface; and (c) streamflow. Wetlands are found where this movement of water through the catchment is slowed down or obstructed, resulting in waterlogged soils. Water also reaches the wetland directly as rain or snow (d). Water may be lost from the wetland in several ways: (w) loss into the atmosphere through evaporation and transpiration; (x) overland flow; (y) groundwater flow; and (z) streamflow.



The slowing down of water flow is important for many wetland functions (e.g. the deposition of sediment) and waterlogging is also important for many- functions (e.g. removal of pollutants such as nitrogen from the water). These functions have several benefits to people, such as erosion control and water purification. An important question we should answer in trying to understand a wetland better is: what causes these particular areas to be wet (i.e. what maintains the wetlands as wet areas)? This may be difficult to find out, but to begin it is helpful to look at the wetland's terrain position and landform setting.



1.2.1 What is the Wetland's Terrain Position?

Wetlands are – characteristically – found in bottomland positions, which have gentle slopes giving rise to poorly drained conditions where water is retained in the soil. However, wetlands are also found in other positions, including: footslopes,

which have gentle slopes; mid-slopes, in small areas where groundwater discharges and valleyheads, where groundwater may also be discharging.

1.2.2 What is the Landform Setting of the Wetland?

Wetlands have a wide range of landform settings shown below. Many wetlands, particularly those which are large, consist of a combination of landform settings. A good example of this is the Blood River vlei, shown below.

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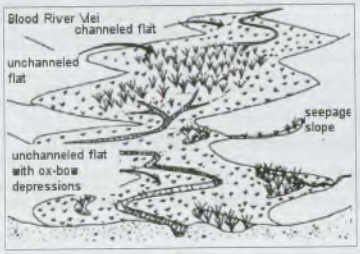
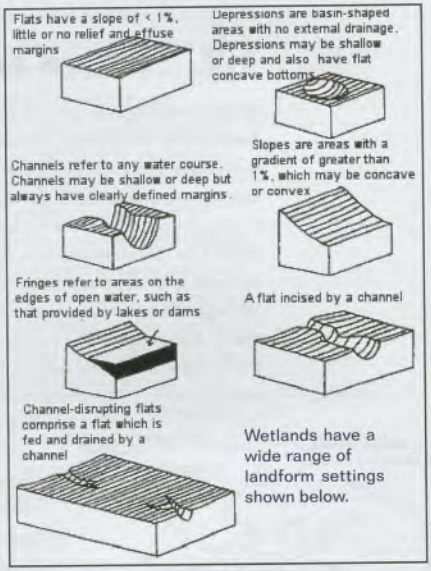
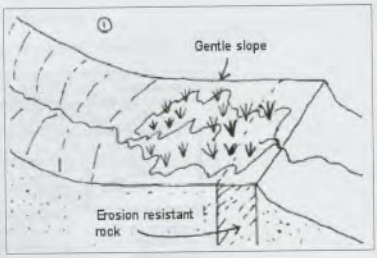


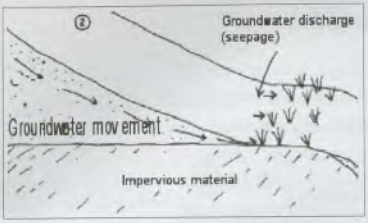


1.2.3 What Part does Geology Play in the Formation of Wetlands?

In trying to establish further why a wetland is found in a particular place, it is helpful to examine the geology of the area. Generally, there are two main ways in which the geology contributes to wetlands forming:

1. A geological obstruction may resist downward erosion, resulting in extensive flat areas where water accumulates if there is a sufficient source, usually surface, water but also groundwater. This obstruction (sometimes referred to as the key point of the wetland) often consists of very hard erosion





resistant rock, such as dolerite, but alluvial soil deposits may also act as an obstruction. An obstruction may further be caused through geological faulting, as is the case in the Okavango Swamps.

2. Impervious material close to the surface forces groundwater movement very close to or onto the soil surface discharging groundwater.

1.2.4 Conclusion

You should by now have a better understanding of: (1) what a wetland is; (2) the source/s of water that maintain wetland water regimes and what geological and landform factors cause water to accumulate at wetland sites; (3) anaerobic conditions and how they develop in wetlands; and (4) how wetland water regimes vary greatly, from areas which remain permanently wet to areas which are only temporarily wet.

1.3 The Hydrogeomorphology Of Wetlands

1.3.1 Introduction

The formation, size and persistence of wetlands are controlled ultimately by hydrological factors. For a wetland to form one needs a surplus water supply at the soil surface for a sufficiently prolonged period to cause anaerobic conditions in the rooting zone of herbaceous plants. Rivers and lakes also have excess water supply that leads to the creation of anaerobic conditions in the soil, but they either have fast flowing water (rivers) or are flooded to too great a depth to permit the colonisation of macrophytic plants (rivers and lakes). Thus, for a wetland to form, flooding needs to be prolonged and shallow. What are the immediate circumstances that lead to such prolonged and shallow flooding?

The subject of why wetlands occur where they do, and a consideration of wetland evolution, is important. Wetlands are transient features of the landscape, and they are dynamic over relatively short time periods. Wetland "managers" generally treat them as permanent features that are static or stable.

1.3.2 Wetland Distribution and Classification in Southern Africa

Inland wetlands occur widely in this region of Africa. They occur in diverse settings ranging from the broad, flat coastal plain of northern KwaZulu-Natal to the highlands of the eastern escarpment of southern Africa, and from the arid Namib Desert and semi-arid Kalahari and Karoo regions, to the cool, wet southern coast of Africa. They occur at the heads of streams, as flood plains along watercourses, and in the downstream reaches of most rivers - particularly of larger rivers such as the Zambezi and Orange/Vaal systems. They may be associated with lakes or dams, they occur as shallow, closed drainage systems ("pans"), and they vary from fresh to brackish. They vary in size from 15 000 km^2 in the case of the Okavango Delta to tens of square metres in the case of many wetlands that lead into headwater streams. The variety of wetlands in the region is attributable to differences in geology, drainage and climate, as well as being the product of human-induced disturbance.

1.3.3 Broad-scale Geomorphology and Drainage of Southern Africa

The overall drainage pattern of southern Africa is determined largely by geological processes associated with the breakup of Gondwanaland and subsequent warping of the Earth's crust, together with geomorphological processes of weathering and erosion. The present drainage of the subcontinent comprises short rivers that flow from the Great Escarpment to the coast, and the presence of 4 large rivers that drain the interior of the subcontinent (the Kunene, Orange/Vaal, Limpopo and Zambezi Rivers; Fig. 1.1). The Kalahari Basin (Okavango and Makgadikgadi Pan) and Etosha Basin (Etosha Pan) are the last remaining parts of this internal drainage basin.

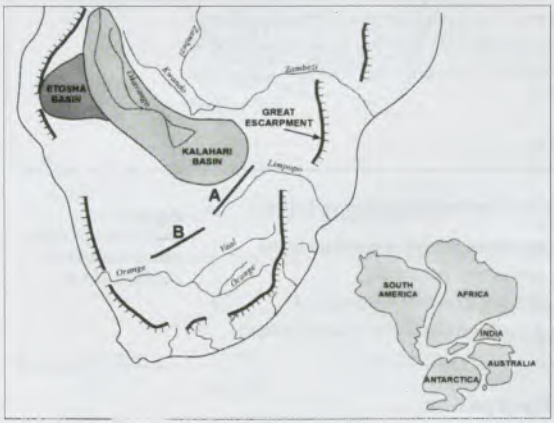


Fig.1.1
Drainage of southern Africa

1.3.4 Climate of the Region

Inland wetlands rely ultimately on rainfall for their water supply - either because rainfall becomes runoff (surface inflow), contributes to groundwater recharge that enters a wetland (subsurface inflow), or falls directly on the wetland. The pattern of rainfall in the region is generally well understood (Tyson & Preston-Whyte 2000). In the tropics, rainfall is determined primarily by the Inter-Tropical Convergence Zone (ITCZ), the position of which migrates seasonally in response to the position of the sun. During the southern summer the ITCZ migraites southwards. The equatorial zone receives high rainfall of over 800mm (Fig. 1.2). Moisture in the southern tip of the sub continent originates mainly over the Indian Ocean. As this moisture laden air moves westwards over the subcontinent, the presence of the great escarpment causes precipitation, and moisture content declines progressively towards the west, resulting in increased aridity in the interior.

Upwelling of the cold Benguela current along the southwestern coast ensures that air masses originating over the Atlantic Ocean carry little moisture. The west coast is therefore arid, and there is a striking westward gradient of decreasing rainfall over the subcontinent. Cold fronts originating over the south Atlantic Ocean move eastwards onto the subcontinent in the wintertime, bringing rain to the southern and south-western coast.

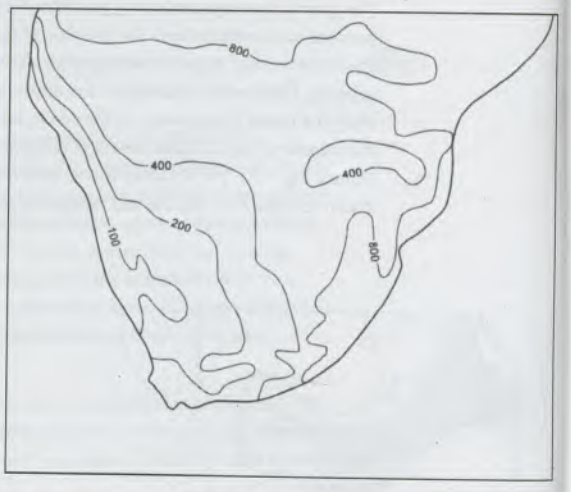


Fig. 1.2 Distribution of mean annual rainfall over southern Africa

Water availability in wetlands is determined not just by inputs from rainfall and its contribution to runoff and groundwater, but also by atmospheric demand. Thus, it is important to consider the water balance, with potential evapotranspiration being a useful indicator of atmospheric demand for water. Solar radiation provides the energy that drives evapotranspiration. Potential evapotranspiration increases westwards in the region due to the presence of clear skies and high levels of solar radiation.

Given this combination of climatic circumstances where rainfall is greatest in the eastern and northern part of the subcontinent, and where potential evapotranspiration is greatest in the western part, the greatest incidence of wetlands should be expected in the eastern and northern parts of the subcontinent.

1.3.5 Wetland Hydrology and Hydraulics

1.3.5.1 The Water Balance

Given this background it is appropriate now to consider the origin of wetlands. Wetlands occur in areas where there is a water surplus at or close to the surface of the earth, indeed the periodic saturation of soils by water is a defining feature of wetlands. Not only does the presence of water in soil bring about unique physiochemical conditions in a wetland, water also transports nutrients and sediment into a wetland and perhaps, nutrients and sediments out of a wetland. In addition, these processes also involve the transport of energy. It is this complex interaction of inflows and outflows of energy, sediment and nutrients, together with

the suite of processes which occur within a wetland, which over time, shapes the physical template of the wetland.

$$\Delta V/\Delta t = P_n + S_i + G_i - ET - S_o - G_o$$

where:

V = volume of water storage in wetlands
$\Delta V/\Delta t$ = change in volume of water storage in wetland per unit time
P_n = net precipitation (precipitation - interception)
S_i = surface streams, including flooding streams
G_i = groundwater inflows
ET = evapotranspiration
S_o = surface outflows
G_o = groundwater outflows

The hydrologic pathways through which this may occur include rainfall, streamflow through a channel entering the wetland, surface runoff and overland flow from the adjacent terrestrial environment, flow through the subsurface soil profile (interflow) and often, groundwater. In some cases, coastal wetlands are affected by the ebb and flow of tides. In each case the relative contribution of each input source may vary with time, as may the flow characteristics of each source. These inflows create a dynamic sequence of inputs which then interact with the physical template of the wetland, bringing about local changes to the flow characteristics and therefore the transport and outflow of energy and matter.

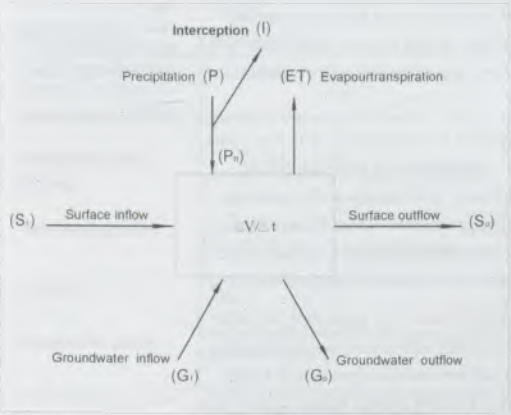


Fig. 1.3 Generalised water budget for a wetland (after Mitsch & Gosselink 1993)

A mass-balance approach is generally used to understand wetland hydrology, and typically takes the form of an equation which states that the change in the volume of water storage in a wetland is equal to the balance of the inflows and outflows. While many forms of this equation are utilised in the literature, the form given by Mitsch and Gosselink (1993) is given here and depicted in Fig. 1.3:

Determining the basic water budget of a wetland is important in developing an understanding of the functioning of the system, but is also important for the rehabilitation of wetlands. Restoring a natural flow regime may be a key requirement for rehabilitation. The purpose of this section is to consider each component of the water balance in relation to its significance in rehabilitation and available sources of information.

Hence, the possible sources of water to a wetland are precipitation, surface inflows and groundwater inflows, and losses are as evapotranspiration, surface water outflows

and groundwater outflows. In any given wetland, both inflows and outflows are from a combination of more than one of the potential sources and sinks, and clearly the size of the storage component varies in proportion to the relative contributions of inflows and outflows over time (seasonally and from year to year). Thus, during the wet season or during the flood phase, the size of the storage component may be large, or during the dry season or when river water levels are low, the storage component may be small.

This simple equation helps us to think about where wetlands occur since they only occur in settings where the storage component is positive for at least part of the year. Thus, the sum of the input components must be greater than the sum of the output components for some time during the year. So, not only does this equation help us to think about the water balance of wetlands, but it is a useful tool that helps us to think about why wetlands occur where they do. Those factors that enhance inflows relative to outflows will increase the likelihood of wetland formation such that as long as the sum of inputs is greater than the sum of outputs for an extended period each year, a wetland will occur. The important point here is that there is more than one way of increasing the size of the storage compartment: increase the rate of water inflow or decrease the rate of outflow.

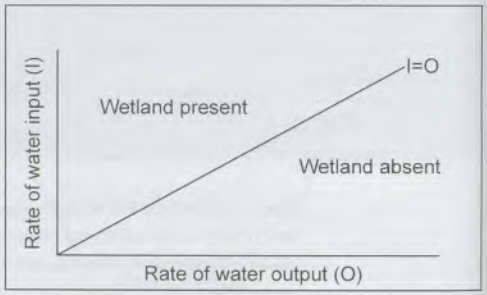


Fig. 1.4 Relationship between the distribution of wetlands and inflow and outflow of water supply

Fig. 1.4 depicts very simply the concept that in order for a wetland to occur, the rate of inflow needs to be greater than the rate of outflow - to the point of seeming trivial. However, it highlights the fact that one needs to consider both inputs and outputs in order to understand the occurrence of wetlands in the landscape. Thus, in settings where inputs are small, wetlands can still occur in settings where output is restricted in some way. Similarly, where inputs are large, wetlands will not occur if outputs are large.

It is also useful to think about the rates at which water is added to wetlands, and the rates at which water is lost from wetlands. Processes that add water rapidly to a site will increase the likelihood of wetland formation, as will any factors that inhibit rapid water movement away from a site. Rainfall and surface inflow deliver water rapidly to a site, while surface outflow acts rapidly to remove water from a site. In the first instance we should therefore expect wetlands to occur in areas where there is high rainfall, where there are large rivers, or alternatively where runoff via streams or rivers is restricted.

This brings into focus the distinction between those wetlands that occur as part of open drainage systems (floodplains and exorheic marsh and swamp systems) and those that are part of closed basins (endorheic pans of semi-arid regions, true ombrotrophic bogs of the eastern highlands, and coastal mires that form part of the dune-swale topography of northern KwaZulu-Natal). We should expect wetlands to occur in settings where depressions are not connected to watercourses that deliver water from continental areas to the sea, irrespective of the amount of rainfall present. A further caveat needs to be added in the case of the seasonally inundated pans in southern Africa that are characterised by impermeable strata below surface that limit water loss as subsurface outflow. Thus, the combination of restricted loss to groundwater and the absence of water loss to an open drainage network, gives rise to endorheic wetland systems that are extremely variable in extent and distribution in the region.

1.3.5.2 Wetland Hydroperiod

Mitsch and Gosselink (1993) refer to the *hydroperiod* of a wetland as the hydrological signature describing the seasonal pattern of waterlevel fluctuations. This is the integration of all inflows and outflows and characterises the nature and constancy of fluctuations. For wetlands which are seasonally flooded, the *flood duration* (amount of time a wetland is in standing water) and the *flood frequency* (average number of times that a wetland is flooded in a given period) are usually important characteristics (Table 1.1). These flood characteristics will vary seasonally and from year to year. From a rehabilitation perspective, it is important to characterise the hydroperiod for undisturbed conditions relative to current conditions. In many cases implementation of the natural hydroperiod through environmental flows may be a significant rehabilitation measure.

HYDROPERIOD	DESCRIPTION
Permanently flooded	flooded throughout the year in all years
Intermittently exposed	flooded throughout the year except in years of extreme drought
Semipermanently flooded	flooded in the growing season in most years
Seasonally flooded	flooded for extended periods in the growing season, but usually no surface water by the end of the growing season
Saturated	substrate is saturated for extended periods, but standing water is rarely present
Temporarily flooded	flooded for brief periods in the growing season, but water table is otherwise well below the surface
Intermittently flooded	surface is usually exposed with surface water present for variable periods without detectable seasonal pattern

Table 1.1

Definitions of wetland hydroperiods (*after* Mitsch & Gosselink 1993)

The hydroperiod is generally one of the most important factors affecting the functioning, management and rehabilitation of wetlands, and can be easily influenced by human activities in the catchment and wetland. It is therefore important the hydroperiod be described in order to make informed management and rehabilitation decisions. As long term hydrological data are usually lacking, the best surrogate (substitute) measure possible, soil morphology, should be used in combination with vegetation. A four class system is given below for identifying wetness zones based on soil morphological features (notably colour of the soil matrix and the presence and abundance of mottles) and vegetation (Table 1.2).

	SOIL WETNESS ZONES			
SOIL	**Non-wetland**	**Temporary**	**Seasonal**	**Permanent / Semi-permanent**
Soil depth 0-10 cm	Matrix usually brown/red (chroma >1) No/very few mottles Nonsulphidic	Matrix brown to greyish brown (chroma 0-3, usually 1 or 2) Few/no mottles Nonsulphidic	Matrix brownish grey to grey (chroma 0-2) Many mottles Sometimes sulphidic	Matrix grey (chroma 0-1) Few/no mottles Often sulphidic
Soil depth 30-40 cm	Matrix usually brown (chroma >2) No/few mottles	Matrix greyish brown (chroma 0-2, usually 1) Few/many mottles	Matrix brownish grey to grey (chroma 0-1) Many mottles	Matrix grey (chroma 0-1) No/few mottles Matrix chroma: 0-1
VEGETATION	Dominated by plant species which occur extensively in non-wetland areas; hydrophytic species may be present in very low abundance	Predominantly grass species; mixture of species which occur extensively in non-wetland areas, and hydrophytic plant species which are restricted largely to wetland areas	Hydrophytic sedge and grass species which are restricted to wetland areas, usually <1m tall.	Dominated by: (1) emergent plants, including reeds (*Phragmites australis*), sedges and bulrushes (*Typha capensis*), usually >1 m tall (marsh); or (2) floating or submerged aquatic plants.

Table 1.2
Soil wetness zones

Key to Table 1.2:
Sulphidic soil material has sulphides present which give it a characteristic "rotten egg" smell, and nonsulphidic material lacks sulphides.
Soil material (usually in the seasonal zone) may be so greatly mottled that the mottles make up a greater area than the matrix, which may be confusing when determining the chroma of the matrix. Chroma refers to the relative purity of the spectral colour, which decreases with increasing greyness. To determine chroma, a Munsell colour chart is required. If this is not available then in order to characterise the colour of the soil matrix, use the following colour descriptions, given in order of increasing greyness:
Brown/Red Greyish brown Brownish grey Grey

1.3.5.3 River and Stream Hydraulics

In Southern Africa, most wetlands form an integral part of the drainage network comprising rivers and streams. These systems play a very important role in shaping the earth's surface, and a rudimentary understanding of how they work will provide some insight into the occurrence, morphology and dynamics of wetlands. Rivers and streams arise as a consequence of runoff that is generated ultimately by rainfall. They occur in valleys that have been carved by the erosive power of running water. Thus, a stream or river valley is one of the visible effects of erosion by running water. Streams are thus more than conduits of water. The power of moving water makes it possible to erode and transport sediment. Where the ability of the stream to transport sediment is greater than its sediment load, erosion occurs. Conversely, where sediment load exceeds the ability of the stream to transport sediment, deposition occurs. Where the two are roughly equal, rivers act as conduits of water and sediment.

Important hydraulic concepts

The ability of running water to erode and transport sediment is largely dependant upon stream velocity (Fig. 1.5). The velocity at which a grain of a given size is picked up from the bed and moved downstream is shown by the upper curve. The velocity at which erosion occurs depends upon on characteristics of the water such as water depth and density, as well as upon characteristics of the grains being lifted such as shape and density. The lower curve shows settling velocity - the velocity at which a particle settles out of suspension. Velocity in surface water is usually described by Manning's Equation (Box 1.1). The energy available to erode sediment is defined by the stream power, a function of bed slope and discharge.

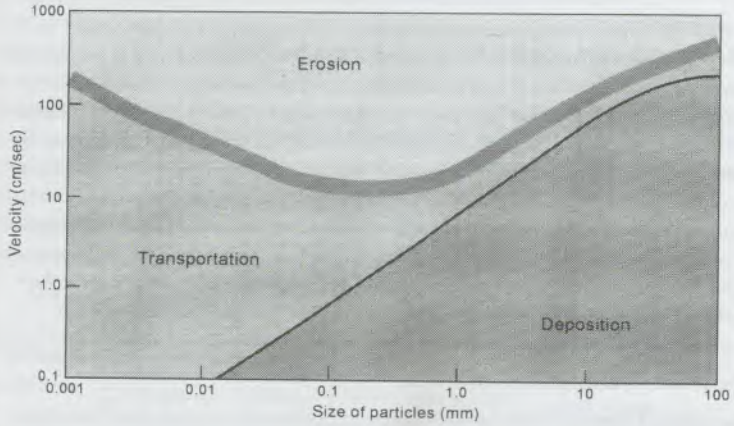


Fig. 1.5
Erosion, transportation and settling of sediment in relation to grain size and current velocity

Manning's equation

$$v = \frac{R^{2/3} \cdot S^{1/2}}{n}$$

where

v =	mean velocity
R =	hydraulic radius = cross-sectional area / wetted perimeter
S =	slope of the channel
n =	Manning's roughness co-efficient

The Stream power equation

$$\Omega = \rho_w \cdot g \cdot Q \cdot s$$

where

Ω =	stream power
ρ_w =	density of water
g =	acceleration of gravity
Q =	discharge
s =	channel gradient

Box 1.1

Manning's equation describing the velocity of surface water flow.

Thus, for all other variables constant, velocity is:

- proportional to hydraulic radius such that for a given roughness and slope, wide, shallow channels have a lower velocity than channels with a square cross-section (Fig. 1.6a),
- proportional to slope such that for a given hydraulic radius and roughness, channels with a steep slope have a higher velocity than with a shallow slope (Fig. 1.6b), and
- inversely proportional to bed roughness, such that for a given hydraulic radius and slope, streams with boulder strewn or vegetated beds have lower velocity than flat sandy or unvegetated beds (Fig. 1.6c).

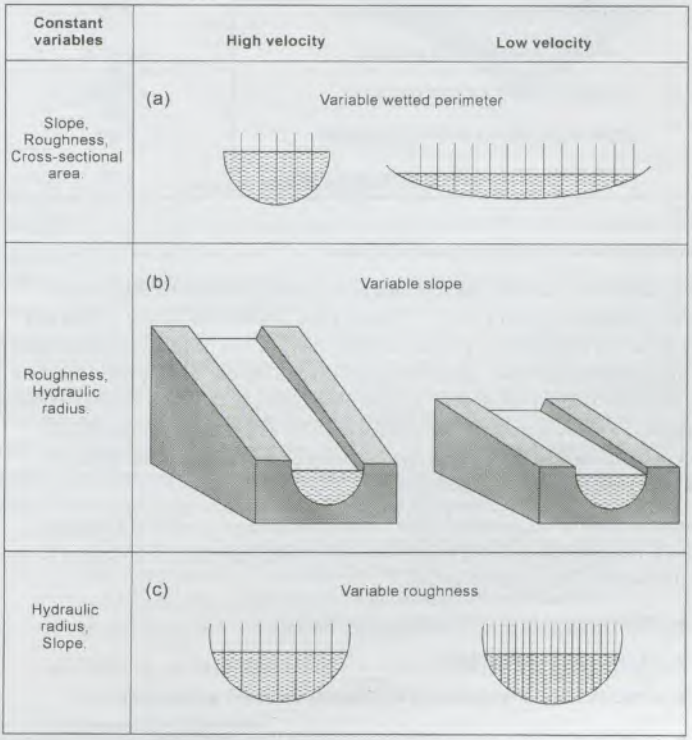


Fig. 1.6 Relationship between current velocity and the variables hydraulic radius, slope and bed roughness.

It is also useful to consider that the hydraulic radius can be approximated by the mean depth of the channel. It is interesting to consider that velocity increases with depth for a given slope and bed roughness. This is because relative roughness is greater in the case of a shallow channel than for a deep channel with constant slope and roughness.

Examples of roughness co-efficients are provided in Table 1.3. These co-efficients have generally not been determined from wetland studies, but they can be applied to streamflow into and out of wetlands.

STREAM CONDITIONS	*MANNING CO-EFFICIENT*
Straightened earth canal	*0.02*
Winding natural stream with some plant growth	*0.035*
Mountain stream with rocky streambed	*0.04-0.05*
Winding stream with abundant plant growth	*0.04-0.05*
uggish stream with very abundant plant growth	*0.065*
uggish stream with extremely abundant plant growth	*0.112*

Table 1.3

Roughness co-efficients for Manning's Equation in different environmental settings

(ii) Longitudinal characteristics of river systems

Drainage basins are typically characterised by headwaters where the downstream gradient is steep and streams are fast flowing. Here streams are deeply incised and valleys are steep sided with a "V" shaped cross-section. This gives way downstream to a region of the drainage basin where river gradient and current velocity decrease, and where the valley flattens out to a "U" shaped cross-section. The lower reaches of rivers typically have a shallow gradient, low current velocity, and valleys are typically very shallow in cross-section. Thus, rivers typically have a concave upward longitudinal profile from headwater to the sea (Fig. 1.7).

This concave upward longitudinal profile is accompanied by a number of systematic changes in the characteristics of the stream and its bed from the stream source to the ocean, the most important of which are:

- an increase in river cross-section and discharge,
- an increase in valley size,
- a decrease in current velocity and therefore stream energy, and
- a decrease in the grain size of sediments on the stream bed.

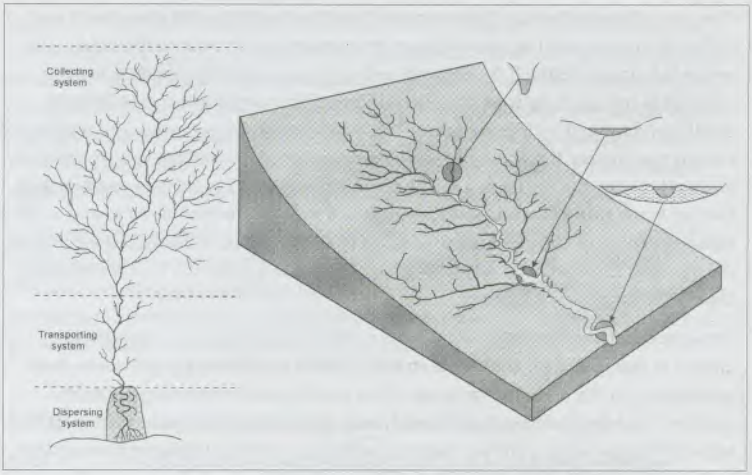


Fig. 1.7
The typical form of drainage basins in which grade has been achieved, showing patterns of tributary inflow, valley cross-sectional shape, longitudinal profile of a stream having achieved grade, and zones of the stream where erosion, transport and deposition predominate (after Hamblin 1992)

(iii) The concept of equilibrium in streams and rivers

The achievement of such a concave upward longitudinal profile occurs because rivers function as unified entities, where a change in one part of a system affects other parts. Factors that determine stream flow (discharge, velocity, channel form, gradient, base level and load) constantly change towards an equilibrium so that the gradient of a stream is adjusted to accommodate the volume of water available, channel form, and the velocity necessary to transport the sediment load. A river is in equilibrium if its channel form and gradient are balanced so that there is no net erosion or deposition. This does not mean that the river does not transport sediment, but that the amount of sediment entering any section of river is the same as the amount leaving it. A stream in equilibrium is referred to as a graded stream. Here we need to introduce two concepts that relate to the ability of a stream to transport sediment:

- Competence is the largest size of grain that a stream can move along its bed. Competence varies spatially downstream along the course of a stream and it varies temporally at a given point depending on river discharge. The largest grains are transported and deposited during periods of high floods.
- Capacity refers to the maximum amount of sediment of a given size that a stream can carry. Capacity depends upon stream gradient, discharge and the caliber of the load.

Streams will always tend to balance capacity and competence with the amount and caliber of the load and the effort of the river to maintain that balance throughout its length (Morisawa 1968). If the capacity and competence are in excess of those required to transport the load, the river will lower its capacity and competence by modifying slope and/or morphology (width, depth and bed roughness). The smaller the stream, the steeper the slope that is required to move water and the coarse sediment load that is typical in the upper regions of drainage basins. The relative roughness of the bed in the case of a small stream is high and a steep gradient is required to sustain flow. In the case of a larger stream, because of the increased volume of water, relative roughness is lower and a shallower slope is required to sustain the flow of water and the movement of finer sediment.

The concept of equilibrium in a river system can be appreciated by considering a change in gradient of a hypothetical stream in which equilibrium has previously been established. In Fig. 1.8a, the variables of the stream system (discharge, velocity, gradient, base level and load) are in balance so that neither erosion nor sedimentation occurs along the stream profile. There is just enough water to transport the available sediment load down the existing slope. If the gradient was displaced by the occurrence of a fault (Fig. 1.8b), the increased gradient at the fault leads to an increase in velocity such that erosion takes place. As this happens, the river reduces its gradient and the rapids migrate upstream. The eroded sediment is added to the stream. Downstream of the fault the gradient of the stream is too low to transport the added sediment, so it is deposited and the river steepens its gradient. This combination of reducing the gradient where the capacity is greater than the load, and of steepening the gradient where capacity is less than the load, leads to the establishment of the equilibrium profile again (Figs. 1.8c-e).

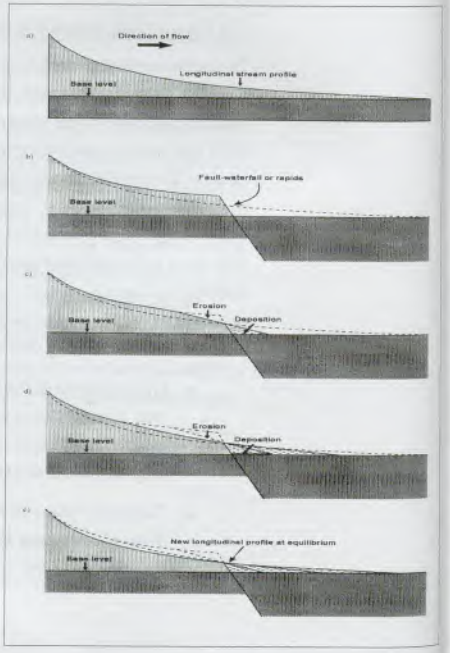


Fig. 1.8
Illustration of the disruption of a stream having achieved grade (a) by faulting in which the downstream gradient is steepened at the fault line (b). By steepening gradient above the fault, stream capacity is increased, resulting in headward erosion propagates upstream, while downstream of the fault, gradient and capacity are reduced, leading to sediment deposition (c-e). This combination of processes results in a restoration of the original grade over time.

It needs to be stressed that the uniform logarithmic profile of a river in equilibrium presented in Fig. 1.8a represents the ideal situation of a stream on uniform lithology. However, streams in equilibrium do not necessarily have a uniform decline in slope downstream because lithology varies downstream. Thus, streams with uneven slopes may be in equilibrium (Morisawa 1968). This is because of the presence of tributaries, lakes and differences in underlying lithology, which affect discharge and sediment characteristics of a stream, thus affecting capacity and competence.

In the same way as faulting affects fluvial processes through modification of gradient, variation in base level caused by variation in sea level for example, or the construction of a dam, would result in stream adjustment to establish grade. Similarly, variation in discharge in a catchment as a consequence of urban development, agricultural irrigation or climate change, would result in stream adjustment.

1.3.6 Wetland Hydrology and Landforms

1.3.6.1 Interactions Between Wetlands and Surface and Ground Water

In order to understand the hydrological processes maintaining the functioning of the wetland, it is important that the following questions are considered in relation to the wetland's water balance and hydrological processes:

- What are the sources of the water entering the wetland and their relative contribution (precipitation, groundwater, streamflow, diffuse surface in flow)?
- How does water pass through the wetland (channel flow or diffuse flow)?
- How does water leave the wetland and how significant are each of these outflows (channel, groundwater, evapotranspiration)?

In many wetlands there is a close relationship between surface water, saturation of the soil horizons, and groundwater. Wetlands can recharge groundwater (i.e. supply water to groundwater reserves) or may occur because groundwater flows out to become surface water. Surface runoff or periodic innundation by flooding may also be important. Which of these processes dominate is largely controlled by the topography of the area (landform), although the ability of the soil or rock to transmit water is also important. The landform setting of a wetland has strong influence over:

(1) local patterns of water movement (surface and sub-surface, and the interactions of these) and

(2) the degree to which wetlands are open to lateral exchanges of water, sediment, nutrients and pollutants (Bedford and Preston, 1988).

Mitsch and Gosselink (1993) describe a number of situations which illustrate both the nature and diversity of this relationship. Fig. 1.9a shows that in some situations a wetland may occur because a topographic depression intersects the water table. Thus groundwater can be a major source of water for the wetland. Some wetlands are located at the base of steep slopes, where the groundwaterc intersects the surface of the land (Fig. 1.9b). Riparian wetlands may have inflows and outflows of groundwater (Fig. 1.9c), with seasonal flooding also contributing to the wetland water balance. In some situations wetlands recharge groundwater (Fig. 1.9d) because the wetland is higher than the regional water table, and the rate of inflow of surface water exceeds the rate of recharge to the groundwater.

In other cases where the wetland water table is much higher than the regional water table, the wetland is referred to as being perched. This occurs because downward percolation into the regional water table is prevented by an impervious layer (aquiclude), or a layer which does not permit rapid movement of water (Fig. 1.9e). Mitsch and Gosselink (1993) indicate that groundwater inflows can also be significant in tidally influenced wetlands, where they help maintain soil moisture at low tides and also help to reduce soil salinity (Fig. 1.9f). In some cases groundwater may not constitute a significant component of the water budget at all. This would occur in areas where soils have low permeability, and consequently surface runoff would tend to pond in topographic depressions. Losses from these systems would generally be due to transpiration and evaporation, but inputs would be restricted to precipitation and surface inflow. These systems may therefore be seasonal or ephemeral.

Fig. 1.9(a) Groundwater depression wetland (after Mitsch & Gosselink 1993)

Fig. 1.9(b) Groundwater spring or seep wetland (after Mitsch & Gosselink 1993)

Fig. 1.9 (c) Riparian floodplain wetland fed by groundwater (after Mitsch & Gosselink 1993)

Fig. 1.9 (d) Groundwater recharge wetland (after Mitsch & Gosselink 1993)

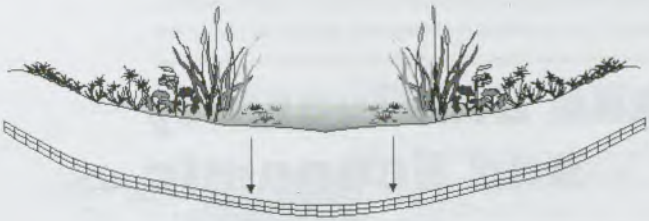


Fig. 1.9 (e) Surface water depression wetland (after Mitsch & Gosselink 1993)

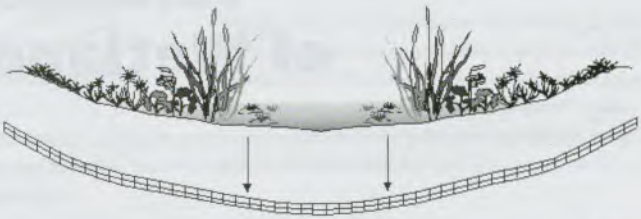


Fig. 1.9(f) Groundwater flow through tidal wetland (after Mitsch & Gosselink 1993)

Landform setting is an important factor in determining the key components of the water balance, and in understanding the hydrological processes which maintain wetland functioning. Given that moving water transports sediment, it is also important to view wetlands from a geomorphic perspective. In settings where stream capacity exceeds load, erosion will occur. Conversely, where capacity is less than load, deposition will occur. In certain settings in the upper reaches of catchments, discharge and velocity are low such that surface water flow is unable to transport load, and in these settings neither erosion nor deposition will occur.

MODULE 2

Wetland Biodiversity and Economic Valuation of Wetlands

Introduction

This module encompasses three issues. First, it introduces you to the indirect and direct ways in which wetlands benefit society. As much as possible, country specific examples are used to explicitly illustrate wetlands benefits. Second, the module helps you to understand how these benefits are affected by activities of people. Lastly, it gives an overview of wetland valuation with special reference to Lake Chilwa wetland in Malawi

Wetlands are many things to many people – once they are understood and appreciated as valuable ecosystems. In many places, wetlands are increasingly appreciated as habitats that are necessary for various economic and conservation activities. Wetlands are usually places where there is much plant growth because of the abundance of water and nutrients in the soil. The plants, in turn, provide food and shelter for animals. There are many different plants and animals that depend on wetlands, and without the habitat that wetlands provide, they would not be able to survive, as some species are entirely dependent on wetlands for food, water and cover. Several of these species, such as the white-wing flufftail and wattled crane are threatened.

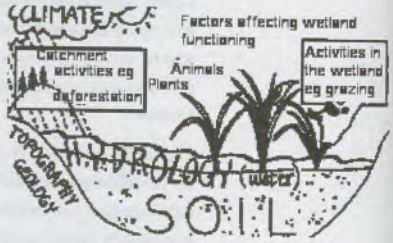
Wetlands have had a considerable influence on human activities because of their productivity and diversity. The extent of utilization of wetland resources by different communities varies from region to region

People living around wetlands derive most of their livelihood from the consumptive foreign or utilization of the wetland. The benefits, from wetland biodiversity, are numerous: fish and birds for sale and home consumption, building materials for houses and boats, brooms, mats, fish traps, bird traps and baskets. Wetland water is used for irrigation, transport and domestic consumption.

Wetlands are certainly not wastelands. On the contrary, the importance of derived benefits to the local population makes the wetland an immensely valuable asset.

2.1 Direct and Indirect Benefits of Functioning Wetlands to Society

Without water there would be no life on earth. Plants, animals and people need water to survive and grow. Both droughts and floods are common. Wetlands are able to reduce the severity of droughts and floods by regulating streamflow. Wetlands also purify water and provide habitat for many different plants and animals. Besides these **indirect benefits** to society, wetlands provide many **direct benefits** in the form of resources such as fibre for making crafts.

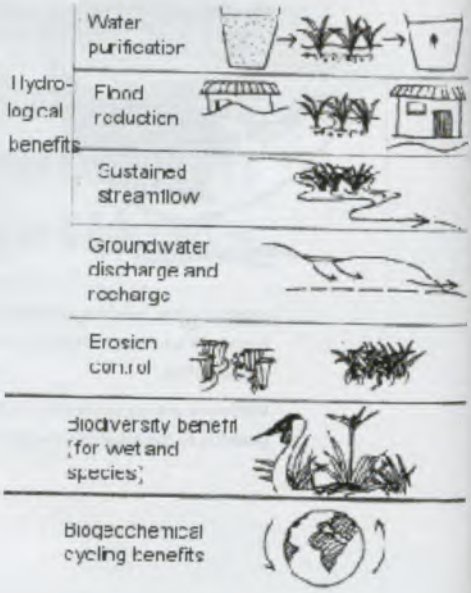


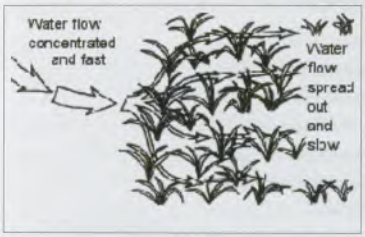
2.1.1 Indirect Benefits

2.1.1.1 Flood Reduction and Streamflow Regulation

Wetlands spread out and slow down water moving through the catchment because of: (1) the characteristically gentle slopes of wetlands and (2) the resistance offered by the dense wetland vegetation. Also, many wetlands do not have well defined channels that would otherwise speed up the movement of water.

By slowing down the movement of water and detaining it for a while wetlands act like sponges which reduce floods and also prolong streamflow during low flow periods. Loss of water to the atmosphere through evaporation and transpiration does, however, reduce the amount of water available to prolong low flows. When wetland vegetation is growing, water is lost from the leaves through transpiration. However, the water lost into the atmosphere from a vegetated wetland is usually less than would be lost from the surface of an open water area such as a dam. This is because the cover provided by wetland vegetation reduces



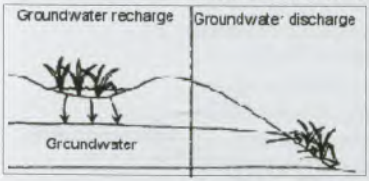


evaporation from saturated or flooded soil by sheltering it against the sun and wind. When the vegetation dies back, there is no loss of water through transpiration and the dead leaves remain, continuing to shelter the soil. During such times, water loss is most effectively regulated.

Country examples: In Zambia the Barotse flood plain, situated in the upper Zambezi of Western Zambia, gets flooded from January to April when the River Zambezi overflows its banks. Since the floodplain is a large flat land, the water is spread over a large surface area, in the process minimizing the impact of the flood. Therefore, the flow of water in the river itself is slowed.

2.1.1.2 Ground Water Recharge and Discharge

Wetlands may have an important influence on the recharge or discharge of groundwater. Groundwater recharge refers to the movement of surface water down through the soil into the zone in which permeable rocks and overlying soil are saturated. Groundwater discharge, in contrast, refers to the movement of groundwater out into the soil surface. Although poorly understood, it appears that most wetlands are groundwater discharge or throughflow areas. Wetland areas where groundwater is discharging are often referred to as seepage wetlands because they are places where the water seeps slowly out into the soil surface.



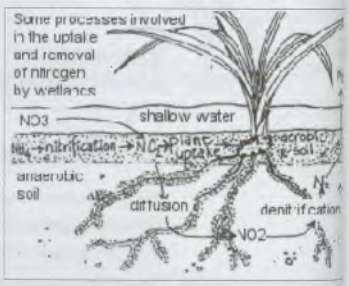
Country Examples: In Namibia, the Kuiseb River recharges the underground water which supplies water to the coastal towns.

2.1.1.3 Water Purification

Wetlands are natural filters, helping to purify water by trapping pollutants (i.e. sediment, excess nutrients [most importantly nitrogen and phosporus] heavy metals, disease-causing bacteria and viruses and synthesised organic pollutants such as pesticides). Thus, the water leaving a wetland is often purer than the water which enters the wetland. Wetlands are able to purify water effectively because :

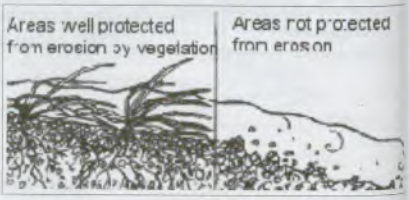
- they slow down the flow of water (see flood reduction and streamflow regulation) causing sediment carried in the water to be deposited in the wetland. This also results in the trapping of other pollutants (e.g. phosphorus) which are attached to soil particles;

- surface water is spread out over a wide area, making it easier for ex changes between soil and water;
- there are many different chemical processes taking place in wetlands that remove pollutants from the water. For example, wetlands provide a suitable place for denitrification because anaerobic and aerobic soil zones are found close together. Denitrification is important because it converts nitrates, which could potentially pollute the water, to atmospheric nitrogen which is not a pollution hazard;
- some pollutants such as nitrates (NO_3) are taken up by the rapidly growing wetland plants;
- the abundant organic matter in wetland soils provides suitable surfaces for trapping certain pollutants such as heavy metals; and
- wetland micro-organisms help decompose man-made organic pollutants such as pesticides.



Examples: In wetlands anaerobic and aerobic soil zones are found close together therefore providing a suitable place for denitrification.

2.1.1.4 Erosion Control by Wetland Vegetation



Wetland vegetation is generally good at controlling erosion by :

(1) reducing wave and current energy;

(2) binding and stabilizing the soil; and

(3) recovering rapidly from flood damage.

2.1.1.5 Biodiversity

Wetlands are usually places where there is much plant growth because of the abundance of water and nutrients in the soil. The plants, in turn, provide food and shelter for animals. There are many different plants and animals that depend on wetlands, and without the habitat that wetlands provide, they would not be able to survive.

Country examples: Lake Chilwa, for example, provides habitat for 161 bird species, and 14 fish species, 35 mammal species and supported 916,447 people in 1998.

2.1.1.6 Chemical Cycling

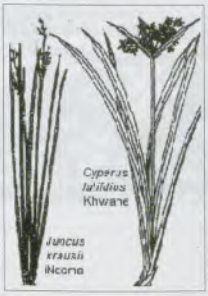
In wetlands, the **decomposition** of organic matter is slowed down by the anaerobic conditions present in wetlands. This results in wetlands trapping carbon as soil organic matter instead of releasing it into the atmosphere as carbon dioxide. Presently too much carbon dioxide is being released into the atmosphere when fossil fuels (i.e. coal and oil) are used to produce energy, resulting in the global climate change being disrupted. Coal is, in fact, formed from plant material accumulated under wetland conditions in **swamps** that existed millions of years ago. Thus, instead of destroying wetlands and releasing carbon dioxide into the atmosphere, we should be conserving wetlands, which will help reduce carbon dioxide levels in the atmosphere.

2.1.2 Direct Benefits:

2.1.2.1 Livestock Grazing

Wetlands, especially temporarily and seasonally **waterlogged** areas, may provide very valuable grazing-lands for domestic and wild grazers. This is particularly so in the early growing season and during droughts when grazing reserves are low in the surrounding veld (rangeland) but the wetlands continue to produce a lot of grazing. Permanently wet **marsh** areas tend to have a lower grazing value because most mature marsh plants are unpalatable, and the excessive wetness may stop animals getting into the wetland. Utilization needs to be **sustainable** if the wetland is to maintain its value for grazing. As with dryland pastures, wetlands are only able to sustain a certain amount of grazing. Particular care is required in wetlands where the erosion hazard is high.

Country examples: Temporary and seasonal flood plains valuable for livestock grazing (eg Ntsikeni Vlei in Eastern Cape, SouthAfrica, Matebeleland, Zimbabwe, Upper pan handle Okavango,Botswana)



2.1.2.2 Fibre for Construction and Handcraft Production

Wetland plants have been used for thousands of years, providing valued material for products such as mats, baskets and paper (produced from papyrus, which is a sedge). There are several plant species, which are suitable and are used extensively for making handcrafts. In South Africa, for example, plant species such as the rush *Juncus krausii* (iNcema), and the **sedges** *Cyperus latifolius* (Ikhwane) and *C.textilis* (iMisis) are used for making handicrafts while the common reed (*Phragmites australis*) is used for construction purposes. Some wetland plants are also collected for medicines.

Handcraft production from harvested wetland plants has many benefits as a development option in poor communities: it makes use of local traditional skills; it has the potential for immediate cash returns and, by increasing the financial benefits to the local people, it increases the incentive not to destroy the wetland, thereby contributing to the conservation of natural habitats. However, harvesting needs to be sensitive to the functioning of the wetland.

Country examples: Lake Chilwa Malawi,Okavango delta Botswana,KZN South Africa

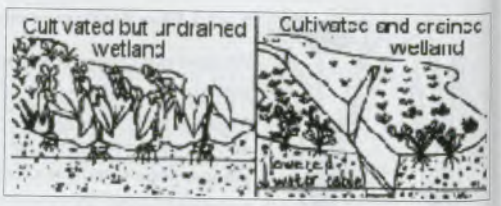
2.1.2.3 Valuable Fisheries

Although the value of wetlands for fisheries varies greatly, floodplain wetlands (e.g. Pongola River Flats) and estuaries (e.g. Kosi Bay) are typically valuable in the production of fish for human consumption. Many sea fishes in South Africa spend some of the early phases of their life cycle in estuaries, and freshwater fishes such as barbel also use wetlands.

Country examples: Fish as income generating at local and national scale (Malawi). More nutrients in wetland provide good habitats for fish production, for instance, in estuaries and lakes (e.g. Lake St.Lucia and Esturie Kosi Bay,South Africa)

2.1.2.4 Hunting Waterfowl and Other Wildlife

Some wetlands are important places where waterfowl (including ducks and snipe) and other wildlife such as reedbuck can be hunted. In the USA a great many people take part in the recreational hunting of waterfowl, which depend on wetlands for breeding and food. In fact, duck hunters have helped to conserve many wetlands. The hunters recognize the importance of wetlands for ducks and are willing to pay to make sure that the wetlands remain in their natural functioning condition.



2.1.2.5 Valuable Land for Cultivation

Wetland soils are potentially productive. However, the anaerobic conditions associated with wetlands exclude most commonly grown crops except for those specially adapted, such as madumbes (Colocasia esculenta) and rice. Thus, wetlands are often drained so that plants not adapted to the waterlogged conditions can be grown. This has important environmental impacts, requiring that the cultivation of wetlands be well controlled.

Some wetlands are used for timber production but because of the impact that trees have on wetland benefits, strict controls are required.

Country examples: dambos Madumbe (Colcasia esculenta, Manikaland Province Zimbabwe), Lakes e.g. rice (Lake Chilwa Malawi), Flood plain e.g. sugar cane (for commercial in KZN South Africa) (for subsistence in Okavango Botswana)

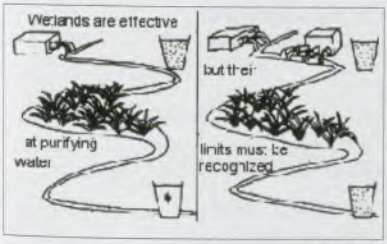
2.1.2.6 A Valuable Source of Water

Because water is stored in wetlands, they provide sites for the supply of water for domestic and livestock use, as well as for irrigation. The storage capacities of wetlands are sometimes increased through damming. However, this often has important negative effects on other benefits.

Country examples: Water-supply eg Lesotho Highland Water Scheme

2.1.2.7 Economically Efficient Wastewater Treatment

You will have learned in the water purification section that wetlands purify water. Natural wetlands provide this service to society "free of charge". Thus, natural wetlands are sometimes purposefully used to treat polluted water and many artificial wetlands area being created for wastewater treatment. When using a wetland to treat wastewater, several factors need to be considered to assess how effectively a wetland will purify water:



- the pollutant, the wetland soil, flow patterns in the wetland, the size of the wetland, and the climate affecting the wetland, which all determine the capacity of the wetland for purifying the wastewater. For example, more pollutants are likely to be trapped in a wetland where the flow is spread out across all of the wetland than in a wetland where a channel concentrates flow in only part of the wetland. If the pollutants are heavy metals then a wetland with soils rich in organic

matter is likely to be more efficient at trapping heavy metals than a wetland with soils poor in organic matter; and

- the amount of pollutant relative to the capacity of the wetland. The capacity of the wetland is obviously limited, and if the amount of pollutant greatly exceeds the capacity, the wetland will not effectively purify the water. The impacts of pollutants on the wetland also need to be considered.

2.1.2.8 Aesthetics (beauty) and Nature Appreciation

Although wetlands which fringe estuaries, rivers and streams are next to open water, most natural inland wetlands have fairly limited open water associated with them. Thus, they are generally not good sites for water sports.
However, wetlands are good places to see birds. Large numbers of birds are often attracted to wetlands, with many of these birds found only in wetlands. Wetlands also add to the diversity and beauty of the landscape. Wetlands have a diverse range of colours and textures and some very attractive flowers such as those of vlei lilies (Crinum spp.) and ground orchids.

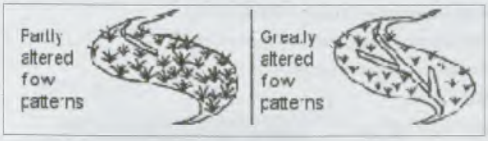
Aesthetics (beauty) and nature appreciation (ecotourism) Okavango Delta Botswana, Pungwe River System Zimbabwe, Zambezi river (Victoria falls) Zimbabwe/Zambia)

2.2 Land-use Activities that Affect Wetlands

The manner in which we use wetlands and the scale on which we do so determines the extent of our impact. Uses which provide good economic returns are not necessarily sustainable. Land-use activities (e.g. growing crops or damming water) often affect how a wetland functions and what benefits it provides to society. In many cases, the effects are negative, such as when a wetland is disturbed in order to plant crops, the wetland's function of trapping sediment and holding the soil is reduced. This reduces the benefits that society receives from the wetland in purifying water and controlling erosion. Impacts on wetlands result from both 'on-site' activities at the wetland site (e.g. drainage, disturbance through cultivation, infilling, and flooding by dams) and from 'off-site' activities in the wetland's surrounding catchment (e.g. afforestation, mining and crop production).

2.2.1 On-site Land-use Impacts

2.2.1.1 How do On-site Land-uses Affect the Functioning and Benefits of Wetlands?

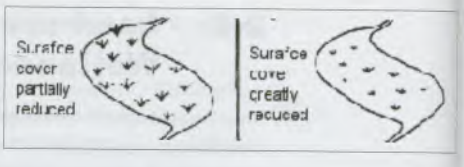


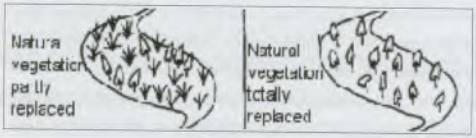
Below are four points to consider when assessing the general "on-site" impacts of land-uses on wetlands (for more information see references).

Changes to the flow pattern within the wetland through drainage channels which cause flow to become more channelled and less diffuse, thereby reducing the wetness of the area.

Disturbances of the soil, making it more susceptible to erosion.

Changes in the surface roughness and vegetation cover (when these are reduced the ability of the wetland to slow down water flow, reduce erosion and purify water is reduced).

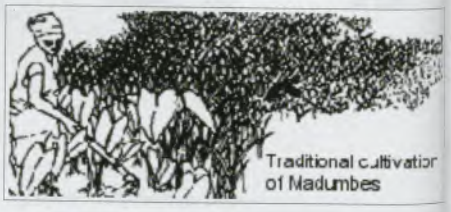




Replacement of the natural vegetation by introduced plants, which generally reduces the value of the wetland for wetland dependent species.

2.2.1.2 Drainage and the Production of Crops and Planted Pastures

When wetlands are converted to cropland most of the indirect benefits of the wetland are lost, especially if the wetland is drained. Drained wetlands are less effective at regulating streamflow and purifying water because the drainage channels speed up the movement of water through the wetland. Drainage increases the danger of erosion by concentrating water flow and thus increasing the erosive power of the water. Also, the hydrological changes resulting from drainage have negative effects on the soil (e.g. reduced soil organic matter and moisture levels and, sometimes, increased risk of underground fires and increased acidity due to the oxidation of sulphides to produce sulphuric acid). The soil is disturbed when crops are planted, and crops do not bind or cover the soils as well as the natural wetland vegetation. Thus, erosion is controlled less effectively, which may be a very serious problem in areas with high erosion hazards. Adding fertilizer and pesticides (which may leach into the river system) further reduces the effectiveness of the wetland in purifying water. The impact of cultivation can be reduced if practices characteristic of low input/traditional cultivation are followed.

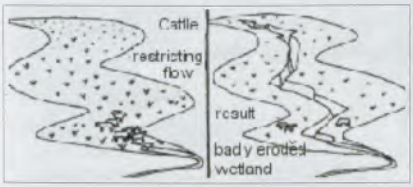

Traditional cultivation of Madumbes

Traditional cultivation practices, which are more sensitive to the functioning of the wetland, include:

- planting crops (e.g. madumbes) which are tolerant of waterlogging, minimizing the need to drain;
- tillage and harvesting by hand, resulting in less soil compaction and potential disturbance than with mechanical tillage and harvesting;
- not using pesticides and artificial fertilizers, which reduces the impact on water quality; and
- not planting extensive areas but leaving indigenous vegetation between cultivated patches.

In South Africa wetlands are protected by the Conservation of Agricultural Resources Act 43 of 1983 (administered by the Directorate:Resource Conservation) that prevents land users from cultivating or draining wetlands.

2.2.1.3 Timber Production



Timber plantations have a high impact on the water storage function of wetlands because a lot of water is lost by the trees through transpiration. Some trees (e.g. gum trees) use more water than other trees (e.g. poplars, which lose their leaves in winter). Trees also have a strong negative effect on the habitat value of wetlands. Under increased shading beneath the trees, the vigour of indigenous plants which are not adapted to these conditions is reduced and they are often out-competed by alien invasive plants. In South Africa there is a law (Section 75 of the Forestry Act No 122 of 1986) which prevents the planting up of wetlands to timber.

2.2.1.4 Grazing of Undeveloped Wetlands by Domestic Stock

Grazing may have both positive and negative effects on the indirect benefits of wetlands. In wetlands which have some areas grazed short and other areas left tall, the diversity of habitats is increased. In wetlands which are grazed short completely, the diversity of habitats is decreased. Heavy grazing may cause valuable grazing species to be replaced by less productive and/or palatable species. Some wetlands erode easily when disturbed by trampling and grazing. The most easily eroded are

those wetlands with unstable soil and where water flowing diffusely across the wetland concentrates into a channel. In these situations erosion can cause the channel to cut up into the wetland and dry it out, destroying most of its value. Thus, grazing pressure should not be too high and cattle need to be kept away from these flow concentration areas.

2.2.1.5 Causes and Effects of Wetland Erosion

As we described at the beginning of this section, wetlands are characteristically areas where the movement of surface water is slowed down and sediment is deposited. Sometimes, however, wetlands with high erosion hazards erode and more sediment is removed from the wetland than is deposited. The erosion hazard of the wetland depends on several factors, including the erodibility (stability) of the soil, slope and landform setting. Other factors which are influenced by management, such as vegetation cover and disturbance of the soil (e.g. by cattle or farm machinery), also contribute to erosion. As a very general rule, soils from dry areas (i.e. <750mm of rainfall per year) tend to be less erodible than soils from wetter areas (>750mm rainfall). The particular type of rock from which the soil is formed also affects its erodibility. Landforms that are steep and landforms that have open drainage tend to erode more easily than those which are gently sloped and those which have inward drainage. Erosion of wetlands may result in deep gullies which drain the water rapidly from the wetland and make the water regime much less wet. This often greatly reduces the values of the wetland.

2.2.1.6 Mowing and Harvesting of Plants

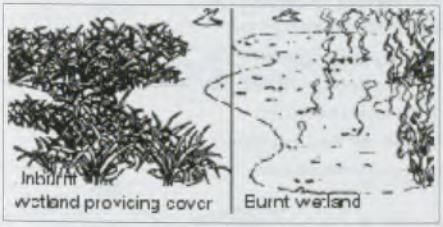
Mowing and harvesting of plants by hand tends to have much less of a negative impact on the indirect benefits of wetlands than cultivation. Cutting plants has similar effects to grazing and generally increases habitat diversity, provided that extensive areas are not mown or cut at one time. Mowing and harvesting may also be harmful if done while animals are still breeding. In the case of mowing, the machinery used for cutting may also disturb the wetland soil and increase the danger of erosion. This would not occur when plants are harvested by hand. Harvesting must be done on a sustainable basis if we are to continue to benefit from the wetland plants. If harvesting is beyond the resource's capacity for renewal, resource degradation will occur and the benefits derived by the users will be lost. Plants should not be harvested more than once a year, and the areas which are harvested should be rested for a whole year a least every third or fourth year.

2.2.1.7 Fishing and Hunting

In order that hunting and fishing be sustainable, the number of animals or fish caught or hunted should obviously not exceed the capacity of the population to renew itself. If too many animals or fish are caught or hunted there will not be enough left to reproduce and to replace the ones that are removed. Consequently, the value of the wetland to continue providing these resources will be reduced.

2.2.1.8 Burning

Wetlands are burnt for many reasons: to improve the grazing value for livestock by removing old dead material and increase productivity; to improve the habitat value for wetland dependent species; to assist in alien plant control; and, to reduce the risk of run-away fires. Wetland fires usually burn above-ground plant parts and most plants recover rapidly from this. Some fires also burn soil and plant parts below the ground, which usually destroys the plants. This generally detracts from the values of the wetland (e.g. by increasing the risk of erosion). However, by burning away the upper soil layers, open water areas may be created which may enhance the diversity of the wetland. While burning has short term impacts such as killing some animals which are not able to escape, it also has many positive effects (e.g. controlling alien plants and increasing the productivity of the indigenous plants which may increase the breeding success of certain wetland dependent animals). Whether or not the overall effect will be positive or negative depends on many factors including : timing; frequency and extent of the fire; and the type of fire (determined by conditions at the time of the fire; such as humidity and air temperature). Late winter burning is least likely to impact on breeding animals, as very few species are likely to be breeding at this time. Early winter or summer burns are more likely to affect breeding animals. It appears that in the high rainfall areas of South Africa, a fire every second year is unlikely to have a negative effect on known wetland dependent species. However, when a wetland area is burnt it is important that unburnt areas are present nearby where animals can seek cover while the burnt area is re-growing. Back fires (burning against the wind) tend to have a greater impact on the growing points of plants than head fires (burning with the wind). Burning when humidity is high and air temperature low, generally has a lower impact than burning when humidity is low and air temperature high.



2.2.1.9 Damming

Many wetlands in South Africa have been flooded by dams, as wetlands are often found in places which are ideal dam sites. Whilst dams perform certain wetland functions (e.g. sediment trapping and water storage) they do not perform other functions well. The habitat required by specialised wetland dependent species is frequently lost when a wetland is dammed. The vegetation which develops around the shoreline is limited in many dams by sudden fluctuations in the water level and by the steep sides of the dam. When a series of dams occurs along a stream, the cumulative effect that the dams have in reducing the streamflow may be considerable, particularly where water is pumped out of the dams. The effects of dams are usually most noticeable in the early wet season, when dams are at their lowest levels after the dry season and retain the early flows.

2.2.1.10 Purification of Wastewater

From Section 1 we saw that wetlands are generally very effective at purifying polluted water. However, using a wetland to purify wastewater will affect the functioning of the wetland and may cause a loss of some of the other benefits of the wetland, particularly if the pollutant loadings are close to or greater than the capacity of the wetland for purification. For example, under increased nutrient inputs the bulrush (Typha capensis), a very common wetland species that competes well under nutrient-rich conditions, may out-compete and eliminate less common wetland species. This would reduce the diversity of the wetland. In South Africa, standards have been set by the Department of Water Affairs and Forestry for the discharge of wastewater into streams (see references) and these should not be exceeded.

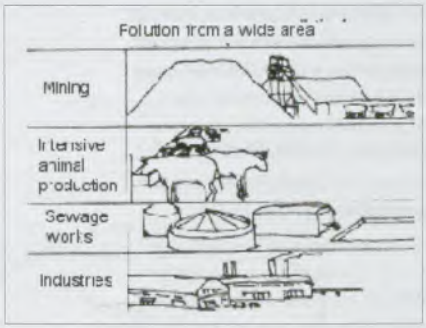
2.2.2 Off-site Impacts

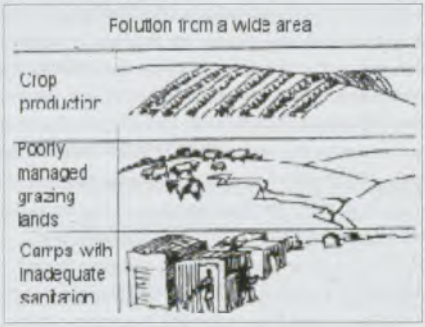
Most of the water in a wetland derives from the catchment surrounding the wetland. Therefore wetlands are strongly influenced by activities in the surrounding catchment even when they are distant from the wetland. When assessing the impacts of off-site land-uses on wetlands one needs to look at how the land-uses change the quality and quantity of water entering the wetland from the surrounding catchment and how this, in turn, affects the functioning and benefits of the wetland.

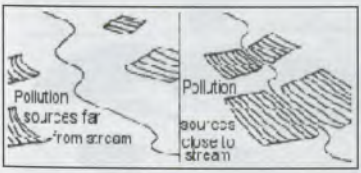
2.2.2.1 How do Off-site Land-uses Affect the Quality and Quantity of Runoff?

Probably the two most important land-uses affecting runoff quantity and timing from the wetland's surrounding catchment are damming/pumping of water (usually for

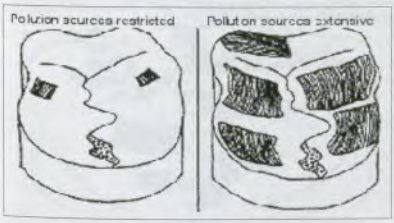
irrigation) and afforestation. As a general rule, trees use more water than natural grassland. Gum trees use the most water (sometimes increasing water loss by more than twice that of natural grassland) followed by wattle and pine trees. Sugarcane also increases water loss. The extra water used by trees, sugarcane or any other crop that has a high transpiration rate would no longer reach the wetland. Dams reduce runoff through evaporation from the dam surface. Dams also allow for large quantities of water to be abstracted and used for irrigation, which may greatly reduce runoff to the wetland. There are several land-uses that may affect the quality of runoff, including :







- mining
- intensive animal production
- sewage works
- industries
- crop production
- poorly managed grazing lands
- human settlements with inadequate sanitation



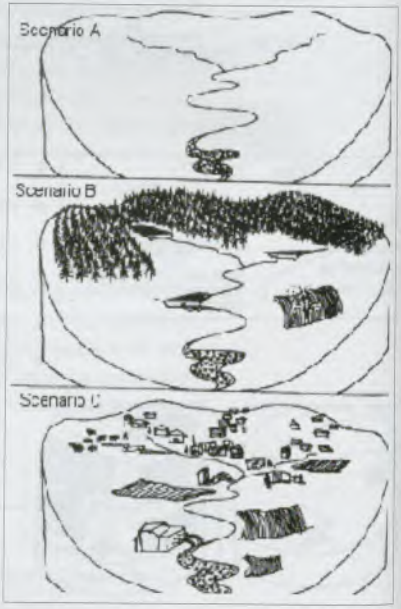
In order to determine the potential problems that may be generated by a pollution source (point source and non-point source) you will need to find out :

- Are the water quality standards of the Department of Water Affairs being met (see references)?

- What is the type of pollutant being released and what are its concentrations (this may vary greatly through the year)?
- How close is the pollution source to a stream (pollution which enters directly into a stream is likely to have a greater impact than pollution which has to pass overland first, particularly if it moves through wetland areas)?

In the case of non-point source pollution, what is the extent in the catchment of the area generating the pollutant (the greater the area occupied by the land-sue, the greater the potential impact)?

Runoff from mines typically has high pollutant levels. For example, iron sulphate-bearing rocks dug up in coal mining are exposed to oxygen and water, which produces sulphuric acid, and, under the acidic conditions metals such as manganese and zinc become more soluble and may reach toxic concentrations. Wastewaters from many industries also have high levels of pollutants, including a wide range of pollutant types. Wastewaters from intensive animal production operations and sewage works typically have high levels of nutrients and disease-causing bacteria and viruses. In South Africa,by law, water from point sources has to meet certain water quality standards set by the Department of Water Affairs and Forestry (see references). However, in many cases even though wastewaters receive some treatment before being allowed to continue down the catchment, the water quality standards are not met. Well-managed veld used for grazing generally has a low level of impact on runoff. However, heavy grazing pressure may have a high impact particularly if it leads to high levels of soil erosion. Also, heavy grazing pressure, causing decreased vegetation cover and increased soil compaction, decreases infiltration and groundwater recharge. This, in turn, increases floods and reduces dry season flows from the catchment. The disturbance involved in crop production and the reduced vegetation cover increases soil losses, leading to increased sediment loads. It has been shown that even if lands are protected, and acceptable levels of soil loss are occurring, soil loss is still likely to be greater than that which would occur from well-managed natural veld. Thus, where lands are inadequately protected the potential impact may be considerable. Human settlements without adequate



sanitation usually produce pollutants consisting of nutrients and disease-causing bacteria and viruses. Let us look at the surrounding catchment of a wetland under different land-use scenarios and see to what extent the quality and quantity of runoff is likely to differ (refer to the diagrams). Scenario A has very little human activity and is likely to yield unaltered volumes of good quality water, which would benefit downstream users. In Scenario B, a large proportion of the catchment is afforested and there are several dams and some irrigation. Scenario B is likely to yield less water for downstream users, which may be of a slightly lower quality than in Scenario A. Scenario C has no afforestation and damming but has cultivation and human settlements with poor sanitation situated close to the streams. It is therefore likely to have poorer water quality than Scenarios A and B but yield more water than Scenario B. Imagine a combination of catchment B and C where the quality and quantity of water would be lowered.

2.2.2.2 How do Off-site Impacts on Runoff Affect Wetlands?

The effect of a change in the water quality of the runoff on the functioning and benefits of a wetland depends very much on the type and concentrations of the pollutant and the type of wetland (see wastewater treatment, page). The deposition within the wetland of excess sediment from the wetland's catchment will alter the wetland landform, which may then affect the hydrological regime of the wetland. For example, if a wetland depression is filled with deposited sediment, it will retain less water than previously. A reduction in the quantity of runoff obviously changes the hydrology of the wetland. If the runoff is greatly reduced, the wetland may become much less wet. This would happen if the wetland was artificially drained, causing many of its benefits to society to be lost. A change in the timing of runoff would also alter the hydrology of the wetland, and is likely to cause some of the wetland benefits to be lost. The species found naturally in a wetland may be adapted to wetness at a particular time and they may not be able to survive if this is changed, besides reducing the amount of water reaching the wetland. Trees planted close to the wetland may increase shading of the natural vegetation and allow the establishment of alien plants. Wetland dependent species, such as wattled crane, which use non-wetland grassland areas nearby for feeding would also be negatively affected by trees planted close to the wetland.

2.3 Valuation of Wetlands

Empirical evidence on wetland values is hard to come by, although values attributed to wetlands have received considerable attention in the literature. In southern Africa, for example, concern about the lack of documented evidence of the value of wetland systems is exacerbated by the view held by some that wetlands are sources of diseases and are impediments to development.

2.3.1 The Concept of Value:

The word "value" can have a number of interpretations. In the valuation of natural resources, it is normally meant in the sense of a measure of social welfare. There is no standard measure for social welfare, however. To the economist, scarcity is what imparts value to a good or service. This is usually reflected in market prices. Thus, the value of a commodity (good or service) is generally accepted as society's willingness to pay for it, less the costs of production.

In many cases, the costs of production are zero or negligible, and the environmental goods or services have the characteristics of "free goods." Many environmental goods and services are thus unpriced, implying often incorrectly, that they are unlimited in supply. It is the measurement of unpriced economic value which presents the greatest problem in any economic study of an environmental asset.

2.3.2 Economic Valuation of Wetlands

Natural resources such as wetlands yield a number of goods and services of economic value to society and also possess other attributes of value. These goods, services and attributes relate directly to the ecological characteristics of wetlands. Until very recently the benefits of wetlands to society were often not recognized, and many wetlands have been destroyed or poorly managed.

Because wetland values are attributed to wetland functions and properties, it follows that wetland values should be considered in association with the user culture and their perceptions of the environment.

The complexity of the concept of value of natural resources and their measurement has led to the development of a hierarchical breakdown of total economic value into component values. Although it is often difficult to separate these types of value in practice, this breakdown provides a useful starting point for the identification of different values and for the design of a methodology for their measurement. Thus total economic value is usually broken down as follows:

Total economic value = Direct use value + Indirect use value + Non-use value

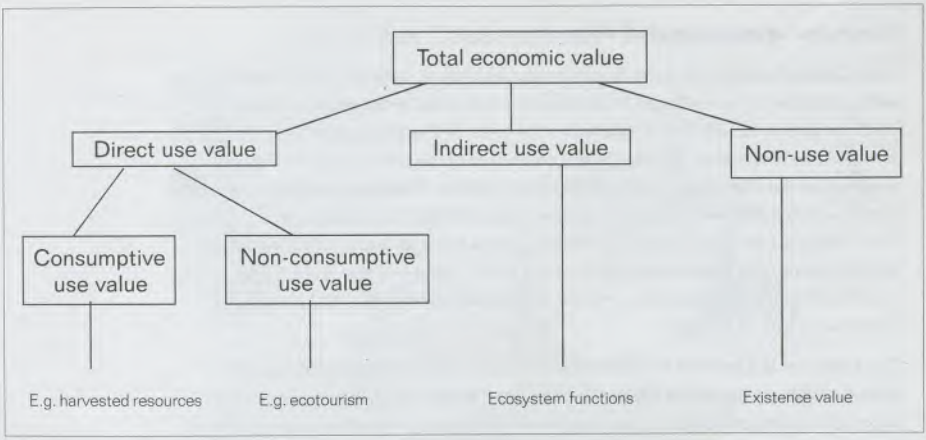


Fig. 2.1
The hierarchical breakdown of types of economic value of natural resources (adapted from: Turpie, et.al., 1998)

The types of value shown in the figure are decreasingly tangible and increasingly difficult to measure from left to right.

Direct use values are the easiest kind of environmental benefits to envisage, and comprise both consumptive and non-consumptive use value. Consumptive use value is obtained from harvesting resources, or wetland 'goods'. Non-consumptive use value such as that obtained from the recreational enjoyment of a resource is associated mainly with the 'attributes' of a wetland.

Indirect use values are the benefits obtained from ecological functions, or 'services', of the wetland. These include climate regulation, nutrient cycling and storage (or water quality regulation), ground water storage and recharge functions, storm protection and erosion control.

Option value is the value that people place on retaining the option to use a resource in the future, irrespective of whether it is any use to them at present.

Non-use value, also called 'existence value' is the value of knowing that a resource exists, even if that resource is remote and is never used directly. Existence value is often expressed in people's willingness to pay for the conservation of endangered species in far-off places.

Whether or not the different types of values associated with natural resources can actually be summed is a contentious issue. In particular, expressed existence values are fairly difficult to decouple from other types of values or trade-offs. For example, the value of grazing and thatching may compete, if livestock graze the same species used for thatching. Similarly, the game viewing value of a wetland may not be additive with its potential sport-hunting value.

Description of the Lake Chilwa Wetland

Lake Chilwa Wetland lies in the Southern part of Malawi, between Mozambique to the east, Tanzania to the north and Mozambique and Zambia to the west (latitude 15° 30'S, longitude 35° 30'E). It is located to the north of Phalombe plain between Zomba and Mulanje Mountains. The catchment comprises of the whole of Phalombe District, most of Zomba District and 43% of Machinga District. The entire catchment is 8,349 km^2 of which 5,669 km^2 belongs to Malawi and 2,680 km^2 (30%) belongs to Mozambique. Lake Chilwa itself is *endorheic*, thus it has no outlet and is therefore slightly saline with salt concentration range of 1-1.25ppt and can reach 12ppt during periods of minor recession. It is shallow with an average depth of 1-2 metres and maximum depth of 5 metres.

The Lake and the wetland is about 40 km across and 60 km from north to south giving a total area of 2,400 km^2 comprising open water, *typha* swamps, marshes, flood plains and grasslands. Area covered by open water varies from one season to another but it can be up to 1,500 km^2 and the maximum depth is five meters. When the lake level is low, open water covers 28.1% while *typha* swamps and marshes cover 43.3% marsh and flood plain takes 18.6%. In times of high lake levels, open water occupies 45.6% and *typha* swamp and marsh takes 34.7% and flood plain takes 9.5%. Presence of *typha*, *Phragmites* and marshes results in accumulation of biomass (20-30 tonnes) per hectare per year in the lake.

Much as the lake and wetland contain water most of the time, in the last 100 years seven recessions have been observed: 1900, 1923, 1931-33, 1943-48, 1949, 1953/55 and 1960/61. Heavy recessions resulting into complete drying has occurred for three times: 1914/15, 1966/67 (Morgan, 1971) and in 1995 (pers observation). In consideration of the effects of these recessions, the Government of Malawi mandated the University of Malawi to lead in developing a management plan for the lake (Chibambo, 1996). The plan was meant to determine measures to mitigate the impacts of the 1995 lake recession on the biological, chemical and physical limnology of Lake Chilwa and on the livelihoods of the fishing communities. This management plan has indeed been consolidated the Lake Chilwa Wetland Project.

The Lake Chilwa wetland and catchment area has a large variety of habitats harbouring diverse groups of plants, animals and other organisms, some of which are rare. The wetland it self has been designated a Ramsar site because of its international importance as a waterfowl habitat. The area has ten habitats recognized and these are: aquatic (lakes, lagoons, swamps and marshes, rivers, dams and water pools) and terrestrial (wooded hills, cultivated land, homes, grassland and forests). The most extensive natural habitats are the wetlands i.e. lakes and surrounding


Lake Chilwa Catchment and Districts
N
Lake Chiuta
MACHINGA
Shire
Liwonde
Domasi
Lake Chilwa
Zomba
Likangala
Thondwe
Phalombe
ZOMBA
PHALOMBE
Municipality
Town
Main Road
Secondary Road
Tertiary Road
District Road
Railway
District Boundary
Contours
Rivers
Lake Chilwa Catchment
10 0 10 20 30 Kilometers

swamps and marshes. It is believed that Lake Chilwa's high productivity is due to the extensive *Typhas* which offer protection to fish and birds breeding ground, food to many organisms and plays an important role in nutrient cycling.

The terrestrial habitats include important natural ecosystems in the catchment such as forests, woodlands and grasslands. Some forests are protected while those under customary land are not. The protected forests contain many rare animals and plants. An estimated number of 1,000 plant species have been identified in the Lake Chilwa districts. In case of animals, it has been identified that there are: 27 species of fish, 23 species of amphibians, 23 species of reptiles, 161 species of birds, and 35 species of mammals (Kabwazi and Wilson, 1998; Kabwazi and Gulule, 1999; Wilson and van Zegeren, 1998; and Dudley, 1998). Most of the mammals are rodents, bats and other small mammals which co-exist with people in land under cultivation. Many larger mammals such as bushbucks, duiker and bush pigs are rare and heavily hunted for food. An exception to these, are the monkeys (baboons and vervet monkeys), which are not eaten. Generally, the animals are becoming rare because of hunting for food and plants are also extinct because of land clearance for cultivation.

The biological diversity, the totality of variety of living organisms (plants, animals, fungi and microbes) is vital for the needs, survival and well being of the human population. For example, major source of energy for households is fuel wood, the rural population depends on wild plants for medicines, construction materials, furniture and other wood carvings. Plants also benefit people in soil and water conservation.

There are 14 species of fish in the lake and more than 29 species in the marsh and swamps where the water is not saline. Fishing is by far the most significant economic activity in Lake Chilwa and its catchment. It is estimated that, at peak level, about 6,000 people are directly engaged in fishing activities per year. On average these people usually yield 10,000 tonnes of fish in a normal year and this translates into a total value of US$11 million. Thus, making an average income of about US$1817.00. However, this value is from markets away from the lake, which means the money usually goes to the middle-men. The ordinary need to be assisted for them to fully enjoy the benefit of fishing.

Lake Chilwa and the associated wetlands are habitats to about 161 species of birds. About 41 species are migrants. In total, around 1.5 million birds of both resident and migratory are found in the wetland. The number of individuals of as much as 12 bird species exceeds 1% of the global population. Among these are Fulvous Whistling-Duck, Lesser Moorhen, Lesser Gallinule, Black Crake, Grey Headed Gull and Glossy Ibis.

Why so many birds are found in the Lake Chilwa wetland is because it is both a breeding ground and a resting and feeding station along an important migratory bird

flyway in Southern Africa. Hence, the wetland has international values that connect life in Malawi with the outside world. In fact, bird hunters have many times hunted birds with rings that are put on the legs as identification particulars. This international relationship is useful for outside world to appreciate and support initiatives aimed at preserving the birds in Malawi. Otherwise very few birds that come to rest, feed and breed in Malawi will have chances to go back to Europe because they will been hunted.

Locally, in the wetland itself, birds are heavily utilized for human consumption and at least 461 bird trappers in the area are trapping 1.2 million birds every year. The economic value of bird trapping is estimated at US$215,000.

Usually, the nesting period of many birds coincides with the hunger period experienced by humans between February and the end of March. As such, during this period, hunters and gathers collect chicks, eggs and hunt the old birds. This practice is considered retrogressive on the sustenance of the bird species. Currently, communities have formed community committees that have formed by-laws to regulate bird hunting.

In the Lake Chilwa catchment there are 13 threatened species of plants due to overexploitation. Invasive alien species occur in the wetland and upper catchment, including *Prosopis glandulosa*, *Rubus ellipticus*, *Pinus patula* and *Eichhornia crassipes*. Extensive agricultural activities are carried out in the wetland with maize and rice being the major crops grown.

Lake Chilwa and the wetland are neither in a national park nor are they protected area. Most of the area is under customary land tenure and thus under an open access regime. Human population in the catchment is around 1.0 million and about 77,000 people living right in the wetland itself while others live in the lake in floating houses. The population density in the catchment area is 164 persons per km^2. More than 40% of the rural people do not have an annual cash income of more than US$63. It is generally acknowledged that poverty and population pressures are most important enemies to conservation and the sustainable utilization of natural resources.

The extent of human dependence on the natural resources available in the Lake Chilwa wetland makes it difficult to isolate the wetland from people. The communities are heavily dependent on the resources to the extent that some of resources are being depleted at a rate beyond sustainability. All the reserves in the wetland are being threatened by encroachments from increased population in the area. Deforestation is at an increasing rate in some of the hills. The river bank vegetation has been opened up to agriculture making it difficult for animals to use river banks as corridors between habitats. Flash floods have recently been common in the wetland due to cultivation that is taking place in steep slopes leading to erosion and high silt loads of rivers as well as infrastructure breakdown.

2.4 Economic Valuation of Wetland Benefits: The Case of Lake Chilwa Wetland

The economic valuation of the Lake Chilwa Wetland presented here is derived from studies conducted in the wetland during the late 1980s and early 1990s.

2.4.1 Net Benefits of Fish:

The net benefits of fish are divided into two parts. The first part contains the value of fish that accrues to fishermen. The second part takes into account the added value of fish that accrues to fish traders when they sell fish of the Lake Chilwa wetland at outside markets such as Zomba, Blantyre and Lilongwe.

2.4.1.1 Fishermen:

2.4.1.1a Gross Benefits:

The most valuable asset of the Lake Chilwa wetland is the fishery. The average annual catch from Lake Chilwa amounts to approximately 16,600 tons per year,

Species	1 kg fresh fish beach price	
	MK	US$
Barbus	11.4	0.27
Catfish	10	0.23
Tilapia	15.5	0.36
AVERAGE	12.3	0.30

Table 2.1

Fresh fish beach prices according to species

which makes it one of the most productive lakes in Africa. The number of full-time and part-time fishermen was estimated at about 1,309. Barbus, Catfish and Tilapia were three main species of fish sold from Lake Chilwa. The following local beach prices for fresh fish were obtained for the three main species sold:

The average beach price for fresh fish recorded here is significantly lower than the beach price recorded in Walter (1988), which was $ 0.50. Taking into account uncertainties of inflation, it is best to use Walter's fresh fish beach price of $0.50 for the following analysis.

With an average of 16,600 tons fish caught per year, the gross benefits of fish accruing to fishermen are then $ 8,300,000 per year.

2.4.1.1.b Costs

Employment

Approximately 19% of all fishermen (about 249 fishermen) employ other people. The employment costs are $7.8 per month and an average of 2.6 people are employed per fishermen. The total employment costs per year for fisherman as a total then amount to $60,733.

Depreciation Costs for Boats

Of all the fishermen interviewed, 93% (or 1,217) use boats for fishing. A further 68% (or 828 fishermen) actually own these boats. Fishermen own two types of boats, planked boats and dug-out canoes, and the average number of boats owned per fisherman is 1.2 boats. The depreciation costs according to type of boat are given in the table below.

Table 2.2

Deprciation costs according to type of boats

	Purchasing cost (US$)	Durability	Depreciation costs p/y (US$)
Planked	58	5.6 years	10.4
Dug-out	12.3	4.9 years	2.5

The durability of dug-out canoes has seriously decreased due to the lack of availability of hard wood as a result of deforestation. While 50 years ago canoes depending on tree specie could be kept for an average of 16.5 years, current research indicates an average lifespan of 4.9 years only. About 76% of all fishermen own dug-out canoes while 24% own planked boats. In Mposa, some people own boats known as Khungwa

that are made of tree bark. They cost about $1.7 and would last for one year. The total depreciation cost for dug-out canoes and planked boats is presented in the table below.

Depreciation cost of boats per year for the Lake Chilwa wetland is $ 4,386.

Rental Cost: Boats

Fishermen that do not own boats rent from other fishermen. The number of fishermen renting boats lies around 377, representing 31% of all fishermen interviewed, and the average number of boats rented is 1. The rent paid per month varies from $3.7 to $6.7, with an average of $5.2. The total rental costs per year for the Lake Chilwa wetland are $ 23,462.

Repairs Costs: Boats

Boat repairing is carried out an average of 0.9 times per year, or once every 13 months. Costs of repairs range from $6 to $2.6, or an average of $4.3 per unit. This means that fishermen spend $3.9 per year on repairs, which amount to a total boat-repairing cost of $ 5,627 per year for the wetland.

Depreciation: Equipment

The main types of gears used by fishermen are lines, seines, traps and gill nets. While three of these come from outside the wetland, traps are often made by the fishermen themselves from material gathered in the wetland. Sometimes, traps are bought from trap makers in the wetland. Costs of repairs for these gears is however negligible – lines and traps are thrown away when used up; seines and gillnets are fixed by the fishermen using a small piece of string or rubber. Costs for repairs are therefore not included as a major cost. The costs for depreciation of equipment are given below.

	Number of boats owned	Depreciation costs p/y (US$)	Total Depreciation Costs (US$)
Planked	239	10.4	2490
Dug-out	755	2.5	1.896
TOTAL	994	12.9	**4.386**

Table 2.3
Total deprciation costs boat.

The total depreciation costs of fishing equipment is $ 16,213.

2.4.1.1.c Net Benefits

Since material for fish traps comes from within the Lake Chilwa wetland, it is not subtracted from gross benefits as a cost of fishing; fish trap makers is an additional group of people benefiting from the wetland. Therefore, Net Benefits of fish for the

Lake Chilwa wetland per year are:

Gross Benefits	$ 8,300,000
Costs	
1. Depreciation equipment	$ 8,530
Net Benefits	$ 8,291,470

The Gross Benefits of fish per year for each group are as follows:

1. Hired Hands	$ 60,733
2. People renting boats	$ 23,462
3. Boat repairers	$ 5,627
4. Fish trap makers	$ 7,683
5. Boat makers	$ 4,386
6. Fishermen	$ 8,198,109
Gross Benefits	$ 8,300,000

Assuming a total of 1,309 fishermen, the net benefit per fisherman amounts to $ 6,334 per year.

The area of open water is 1,056 km^2, so:

Net Benefits Fish (Fishermen) Lake Chilwa per year km^2 1999 = $ 7,852

2.4.1.2 Fish Traders

All data comes from Walter (1988).

2.4.1.2.a Gross Benefits

The area examined by Walter (1988) covers both Lake Chilwa and Chiuta. The average annual catch of both lakes together is 17,950 tons per year; 16,600 tons comes from Lake Chilwa, or 93%. The retail price of fresh fish is MK 3 per kg which equals $1.2[1]. There are a total of 4,000 fish traders around Lake Chilwa and Chiuta. Assuming that the ratio of fish traders is equal to the ratio of fish catch between the two lakes gives us 3,720 fish traders around Lake Chilwa. A total of 3.5 tons of fish is traded per fish trader per year, or a total of 13,020,000 kg for all fish traders. The gross benefits of fish accruing from fish trade from the Lake Chilwa wetland amount to $ 15,624,000 per year.

[1] The 1998 exchange rate is $ 1 = MK 2.56

2.4.1.2.b Costs

The costs per fish trader per trip are presented in Table 2.5.

Table 2.5: Total Costs per Fishtrader per Trip (MK)

Type of Cost	MK	US$
purchasing fish	112.5	44
processing	3.75	1.5
transport	12.20	4.8
living	3.30	1.3
market fees	1.50	0.6
TOTAL	**133.25**	**52**

A fish trader makes a total number of 34.5 trips per year, so the total costs for the fish trade amounts to $ 6,659,328 per year.

2.4.1.2.c Net Benefits

The Net Benefits of fish accruing to fish traders per year are:

Gross Benefits	$ 15,624,000
Costs	$ 6,659,328
Net Benefits	$ 8,964,672

The estimated number of fishtraders around Lake Chilwa is 3,720, so the net benefit per fish trader is $ 2,410 per year.

The area of open water is 1,056 km^2, so:

Net Economic Benefits of Fish (Fish Traders) per year p/km^2 1988 = $ 8,489

2.4.1.3 Net Benefits of Fish

The net benefits of fish in the Lake Chilwa wetland can be presented as follows:

Net Benefit Fish, Fishermen:	$ 8,291,470
Net Benefit Fish, Fish Traders:	$ 8,964,672
NET BENEFITS OF FISH :	$ 17,256,142

The total economic value of fish per km^2 is:

Net Benefit Fish km^2, Fishermen:	$ 7,852
Net Benefit Fish km^2, Fish Traders:	$ 8,489
NET BENEFITS OF FISH P/KM^2:	$ 16,341

Conclusion

The net benefit of fish is the value of fish coming from fishermen and the value added to fish of fish traders. As will be seen, the value of fish is the highest value of all wetland products, while the value of fish km^2 is the second highest. The amount of money that is earned from the fishing industry in the Lake Chilwa wetland and therefore people's dependency on this wetland product make fish a highly valuable natural capital asset.

2.4.2 Benefits of Vegetation

The vegetation of the Lake Chilwa wetland that is used in economic activities includes reeds, bamboo, grass, wood and clay. The *reeds* are used for making mats, brooms and baskets. *Bamboo* is mostly used for making fish traps. *Clay* is used as a building material for making bricks. Unfortunately, the data on brick makers obtained during the field research is highly distorted, and therefore not presented here. *Grass* called Njeza is gathered by the local people from all over the wetland and is used as a building material for roofs, walls and fences. Not enough data was gathered on this activity therefore a full economic valuation is not possible. Similarly, information on the value of wood in the Lake Chilwa wetland is quite scanty. Consequently, the estimation of the net benefits of vegetation is based on benefits that accrue from mat makers, broom makers, and basket makers.

2.4.2.1 Mat Makers

2.4.2.1.a Gross Benefit

A total of 48 mat makers were interviewed in Kachulu, Mposa and Namanja. None seemed to be residing on Chisi Island. In Nayuchi, most mat makers live in a village called Likhonyowa but obtain the reeds from Mozambique and are therefore not included in this analysis. Based on this information, an estimation of 150 mat makers that obtain the reeds from the wetland is made for the Lake Chilwa wetland as a whole. The quantities and prices of mats sold in the wetland is given in Table 2.6 below.

	quantity sold per matmaker p/month	price per mat (US$)
high	6.34	0.91
low	2	0.54
AVERAGE	**4.17**	**0.73**

Table 2.6
Quantaties and prices of mats

The gross benefits of mat makers in the Lake Chilwa wetland amounts to $ 5,464 per year.

2.4.2.1.b Costs

None of the mat makers interviewed employ other people.

Reeds

Although most reeds are obtained from the wetland by the mat makers themselves, occasionally reeds are bought from reed sellers since it is faster and easier. Of all the mat makers interviewed, only 11% occasionally buy reeds. The costs of reeds is given in Table 2.7.

	Cost reeds per mat (US$)
high	0.34
low	0.21
AVERAGE	**0.27**

The total cost of reeds for mat makers in the Lake Chilwa wetland is $ 234 per year.

2.4.2.1.c Net Benefits

The costs of reeds is an income for reed sellers within the Lake Chilwa wetland and are therefore not subtracted from the gross benefits. The Net Benefit of vegetation that accrues from mat makers in the Lake Chilwa wetland is:

Gross Benefits	$ 5,464
Costs	0 (nil)
Net Benefits	$ 5,464

The Gross Benefits of vegetation according to group are:

1.	Mat Makers	$ 5,230
2.	Reed Sellers	$ 0,234
	Gross Benefits	$ 5,464

Assuming a total of 150 mat makers live around Lake Chilwa, the net benefits per mat maker amounts to $36 per year.

The total area of marsh, where most of the reeds are found, within the Lake Chilwa wetland is approximately 804 km², so:

Net Benefit of Vegetation (Mat Makers) per year km² 1999 = $ 7

2.4.2.2 Broom Makers

2.4.2.2.a Gross Benefits

The total number of broom makers per village is approximately equal to the number of mat makers, so the estimation of the number of broom makers in the Lake Chilwa wetland is 150. The quantities and prices of brooms are given in Table 2.8 below.

Table 2.8
Quantities and prices of brooms

	quantity sold per matmaker p/month	price per mat (US$)
high	6.34	0.91
low	2	0.54
AVERAGE	**4.17**	**0.73**

The gross benefits of vegetation that accrues from broom makers amounts to $1,884 per year.

2.4.2.2.b Costs

Table 2.9
Cost of reeds, broom makers

None of the broom makers said to employ other people.

Reeds

	Cost reeds per broom (US$)
high	0.12
low	0.05
AVERAGE	**0.08**

As is the case with mat makers, broom makers mostly gather the reeds from the wetland themselves. Only in some cases do they buy reeds from reed sellers; 14% of the broom makers said to buy reeds. The costs of reeds are given in Table 2.9.

The total cost of reeds per year for broom makers in the Lake Chilwa wetland is $ 328.

2.4.2.2.c Net Benefits

The net benefits of vegetation per year for broom makers are:

Gross Benefits	$ 1,884
Costs	0 (nil)
Net Benefits	$ 1,884

The gross benefits of vegetation of the Lake Chilwa wetland that accrue to the different groups is:

1. Broom Makers	$ 1,556
2. Reed Sellers	$ 328
3. Gross Benefits	$ 1,884

Applying the estimate of 150 broom makers living in the wetland, the net benefit per broom maker equals $ 12.6 per year.

The area of marsh in the Lake Chilwa wetland is estimated at 804 km^2, so:

Net Benefits of Vegetation (Broom Makers) per year km^2 (1999) = $ 2.4

2.4.2.3 Basket Makers

2.4.2.3.a Gross Benefits

The total number of basket-makers around Lake Chilwa is on average much less than mat makers and broom makers. The total is estimated at 75 basket makers. The quantities and prices of baskets in the Lake Chilwa wetland are presented in Table 2.10 below.

	quantity sold per basketmaker p/month	price per basket (US$)
high	13.57	0.85
low	4.20	0.41
AVERAGE	9	63

Table 2.10
Quantities and prices of baskets

The gross benefits of basket makers in the Lake Chilwa wetland then amounts to

$ 5,086 per year.

2.4.2.3.b Costs

All of the basket makers interviewed claimed they had no employment costs and never bought reeds.

2.4.2.3.c Net Benefits

The Net Benefits of vegetation of the Lake Chilwa wetland that accrue to basket makers per year are:

Gross Benefits	$ 5,086
Costs	0 (nil)
Net Benefits	$ 5,086

All gross benefits accrue to basket makers.

Assuming 75 basket makers in the wetland, the net benefit per mat maker equals $ 68 per year.

The area of the marsh is estimated at 804 km^2, so:

Net Benefits of Vegetation (Basket Makers) per year p/km^2 1999 = $ 6

2.4.2.4 Net Benefits of Vegetation

The net benefits of vegetation per year in the Lake Chilwa wetland can be presented as follows:

Net Benefit of Vegetation, Mat Makers:	$ 5,464
Net Benefit of Vegetation, Broom Makers:	$ 1,884
Net Benefit of Vegetation, Basket Makers:	$ 5,086
NET BENEFITS OF VEGETATION:	$ 12,434

Assuming a total number of 375 people around Lake Chilwa are involved in income-generating activities concerning vegetation, the per capita net benefit for vegetation equals $33 per year.

The total economic value of vegetation per km^2 is:

Net Benefit of Vegetation km^2, Mat Makers:	$ 7.0
Net Benefit of Vegetation km^2, Broom Makers:	$ 2.4
Net Benefit of Vegetation km^2, Basket Makers:	$ 6.0
NET BENEFITS OF VEGETATION KM^2:	$ 15.4

Conclusion

When compared to other wetland products, vegetation does not represent a high income. Obviously, when compared to fish and agricultural grounds, the potential of vegetation becomes dwarfed. This does not mean that it should not be viewed as unimportant to the local people: on the contrary, vegetation is an extremely important source for living. If vegetation did not exist, people would be spending much money on substitutes such as building materials. It must be kept in mind that the above figures only apply to mat-, broom-, and basket makers and must therefore be viewed as an absolute minimum value of vegetation. The values of clay and wood, as well as Njeza, should be researched to present the full picture. To give an indication of the value of wood, a study of fuelwood on Chisi Island, poles in Mposa and fuelwood in the Chikala Hills is presented below. They are not included in the total economic value of vegetation for the Lake Chilwa wetland because important data are lacking and more research on economic activities surrounding wood must be carried out.

2.4.2.5 Firewood on Chisi Island

The firewood on Chisi Island is taken from the mountains for free. Most of the firewood gathered is sold on Chisi Island itself. Since none of the respondents said to have any costs, gross benefits are equal to net benefits.

2.4.2.5.a Net Benefits

The approximate number of firewood sellers on Chisi Island is 32. The quantities and prices of firewood are presented in Table 2.11 below.

	Quantity sold p/m (bundles)	Price per bundle (US$)
high	7.53	0.33
low	4.73	0.21
AVERAGE	**6.13**	**0.27**

The net benefits of firewood on Chisi Island for 32 wood sellers amounts to $ 645 per year.

2.4.2.6 Poles in Mposa

All pole sellers indicated they had no costs, so gross benefits is equal to net benefits.

2.4.2.6.a Net Benefits

The total number of professional pole sellers in Mposa is estimated at 10. The quantities and prices of poles are presented in Table 2.12.

Table 2.12
Quantities amd prices of poles

	Quantity sold p/m (poles)	Price per pole (US$)
high	85	0.33
low	15	0.19
AVERAGE	**50**	**0.26**

The total net benefits of poles in Mposa per year is $ 1,570.

2.4.2.7 Fuelwood Consumption Chikala Hills

The analysis on wood consumption from the Chikala Hills comes from Walter (1988). The only indication Walter gives on costs of fuelwood sellers, is the costs per trip for the northern rim fuelwood sellers:

1. buying 3 trees:	MK18
2. extras:	MK2
3. cutting:	MK30
4. transport to home:	MK12.50
5. transport home-railroad	MK12.50
5. railroad fee:	MK10
6. ngolo:	MK3
TOTAL:	MK83

No indication of such costs are given for the southern rim. Therefore, the presentation below will be in terms of gross benefits only.

2.4.2.7.a Gross Benefits

In the northern rim of the Lake Chilwa wetland, approximately 20-30 traders deal in locally harvested wood. Each trader earns an average of $19.5 to $39 per month. Therefore, the total income from fuelwood at the northern rim (1988) is $ 8,789.

In the southern rim of the Lake Chilwa wetland, annual fuelwood turnover is about 235 tons. For 1 kg of fuelwood, an average of $0.02 is paid. The total income from fuelwood in the southern rim therefore amounts to $ 4,590.

For both the northern and southern rim, total gross benefits of fuelwood per year is

$ 13,379

2.4.3 Benefits of Open Water

The benefits deriving from open water include fish, water transport and water as a product for irrigation and domestic use. Fish has been valued as a wetland product on its own. The value of water for domestic use and irrigation has not been derived, although the following data on water use within the wetland were obtained. An average of 75% of all people interviewed said to depend on the wetland's water. The other 25% only retrieve water from boreholes. Of the people depending on water, 62% use this water for irrigation and another 62% for domestic use, which includes washing clothes and bathing. The rest of this analysis is thus dedicated to the economic value of water from the point of view of water transport, and distinguishes between small ferryowners and big ferryowners in Kachulu.

2.4.3.1 Small Ferryowners

2.4.3.1.a Gross Benefits

Water transport in the Lake Chilwa wetland is most prominent in Kachulu and Chisi Island. Some water transport takes place in Mposa, but none in Namanja and Nayuchi. The reason for non-existence of water transport at these two places is probably the distance of the two towns from open water; both places are situated in an area characterized by marsh, where people have to travel long distances before they reach the actual lake. In the other three places it is still not very common to use a ferry. Only on Chisi Island and Kachulu do people use ferries to travel back and forth. When travelling to other places in the area it is very uncommon to use a ferry and the mode of transport is either by foot, bicycle or pick-up. Most people interviewed claimed to be afraid of water; many people can't swim and the belief that spirits exist in open water make people reluctant to use water transport.

Approximately 60 ferryowners are active in Kachulu, Chisi Island and Mposa, and the total number of small ferryowners around Lake Chilwa is estimated at around 100. The data regarding trips or the three places are given in Table 2.13.

Table 2.13

Prices of trips, number of trips and number of passengers

	Prices p/trip (US$)			Number of trips p/week			Number of passengers p/trip		
	Kachulu	Chisi	Mposa	Kachulu	Chisi	Mposa	Kachulu	Chisi	Mposa
High	0.47	0.70	3.5	7.67	9.57	3	25.6	26.53	1.8
Low	0.47	0.47	2.3	3.85	3	1.2	10	5	1
AVERAGE	**0.47**	**0.59**	**2.9**	**5.8**	**6.3**	**2.1**	**18**	**16**	**1.4**

The average price of a trip within the wetland is $0.99 and the average number of trips per week is 4.7. The average number of passengers taken per trip is 12. The gross benefits of open water then amounts to $ 312,167 per year.

2.4.3.1.b Costs

Depreciation of Boats

The prices and durability of boats owned by ferryowners is presented in Table 2.14 below.

Table 2.14
Prices of ferryboats and durability.

	Price (US$)	Durability (yrs)
high	52.2	6.28
low	24.2	3.35
AVERAGE	38.2	4.8

The depreciation costs of ferry boats per year is $ 795.

Boat-Repairing Costs

Of all the ferryowners interviewed, 80% said to repair their boats an average of 1.14 times per year. The specifics regarding boat reparation are given in Table 2.15.

Table 2.15
Repair for ferryboats.

	Price 1 repair (US$)	No. Repairs p/y
High	3.7	1.06
Low	8.2	1.22
AVERAGE	5.9	1.14

The total repair costs of ferryboats per year amounts to $ 541.

Engine Costs

Small ferries are usually not equipped with engines; only 6% of small ferryowners claimed to own an engine. The costs of one engine are approximately MK 39,375 or $ 916. The engines are never repaired so the durability of one engine is extremely low – 3 years. The total depreciation costs for engines in the Lake Chilwa wetland amount to $ 1,831 per year.

Employment Costs

Approximately 36% of the ferryowners employ people. The employment costs for ferryowners are given in Table 2.16 below.

Table 2.16
Employment costs, ferryowners.

	number of people employed	Costs p/m (US$)
High	1.11	-
Low	1.10	-
AVERAGE	1.1	5

Total employment costs of ferryowners per year are $ 2,381.

2.4.3.1.c Net Benefits

Since engines are imported into the wetland, these costs will be subtracted from gross benefits. All other costs to small ferryowners are incomes to other people within the Lake Chilwa wetland and are therefore not subtracted. The net benefits of open water that accrue to small ferryowners can be presented as follows:

Gross Benefits	$ 312,167
Costs	
1. Engine Costs	$ 1,831
Net Benefits	$ 310,336

The gross benefits that accrue to the different groups are:

1. Boat Makers	$ 795
2. Boat Repairers	$ 541
3. Hired Hands	$ 2,381
4. Ferryowners	$ 308,450
Gross Benefits	$ 312,167

Assuming a total of 100 small ferryowners around Lake Chilwa, the net benefit per ferryowner per year equals $3,103.

The area of open water in the Lake Chilwa wetland is 1,056 km ^{2}, so:

Net Benefits of Open Water (Small Ferryowners) per year km^2 1999 = $ 294

2.4.3.2 Big Ferryowners

2.4.3.2.a Gross Benefits

All big ferryowners of the Lake Chilwa wetland operate from Kachulu and they are estimated to be around 6. They own ferries that mostly go to Ngotha Ngotha in Mozambique and travel mostly during the fishing season, which is eight months per year. During this period, people from Mozambique come to sell their fish in Kachulu and vice versa. The boats travel approximately two times per week, where one trip costs MK 100 or $2.3. The maximum amount of people each ferry can take is approximately 140 people and the minimum around 70; the average number of people taken per trip is 105 people.

The gross benefits of open water that accrue to big ferryowners per year amounts to $ 93,767.

2.4.3.2.b Costs

Depreciation Costs of Boats

The average number of boats owned per ferryman is 1 and the prices and durability of ferry boats are given in Table 2.17 below. No repair work is done on these boats.

Table 2.17

Costs boats, big ferryowners.

	Purchasing cost (US$)	Durability (yrs)
High	387.6	16.67
Low	201.6	8.67
AVERAGE	**294.6**	**12.7**

The total depreciation cost of boats per year is $ 139.

Engine Costs

All of the ferry boats are equipped with engines. The engine costs and durability are presented in Table 2.18.

The engines of these big ferryboats are somewhat larger than the engines of the smaller ferryboats which accounts for the difference in price. The total depreciation costs of engines per year are $ 1,546.

Table 2.18

Engine costs and durability

	purchasing cost (US$)	Durability (yrs)
high	1,627.9	-
low	434	-
AVERAGE	**1.031**	**4**

Employment Costs

All big ferryowners employ people. The specifics regarding employment are given in Table 2.19 below.

Table 2.19

Employment costs, bigferryowners.

	No. of people employed	costs p/m (US$)
high	3.33	-
low	1.33	-
AVERAGE	**2.33**	**6.6**

The total costs of employment for big ferryowners per year is $ 737.

2.4.3.2.c Net Benefits

Net benefits of open water per year that accrue to big ferryowners are:

Gross Benefits	$ 93,767
Costs	
1. Engine Costs	$ 1,546
Net Benefits	$ 92,221

Once more, only engine costs are subtracted from gross benefits as these are imported into the wetland. The gross benefits that accrue to the different groups per year are:

1.	Boat Makers	$ 139
2.	Hired Hands	$ 737
3.	Ferryowners	$ 92,891
	Gross Benefits	$ 93,767

Assuming about 6 big ferryowners operate from Kachulu, the net benefit per year per big ferryowner is $ 15,370.

The area of open water in the Lake Chilwa wetland is 1,056 km^2, so:

Net Benefits of Open Water (Big Ferryowners) per year km^2 1999 = $ 87.

2.4.3.3 Net Benefits of Open Water

The net benefits of open water per year in the Lake Chilwa wetland that accrue to small and big ferryowners can be summed up as follows:

Net Benefits of Open Water, Small Ferryowners:	$ 310,336
Net Benefits of Open Water, Big Ferryowners:	$ 92,221
NET BENEFITS OF OPEN WATER:	$ 402,557

The total area for open water in the wetland is 1,056 km^2, so

Net Benefits Open Water per km^2, Small Ferryowners:	$ 294
Net Benefits Open Water per km^2, Big Ferryowners:	$ 87
NET BENEFITS OPEN WATER KM^2:	$ 381

Conclusion

Although relative to other wetland values the benefits of open water with respect to water transport is not extremely high, it is an important wetland product as a source of income for the local people and for subsistence. Small ferryowners, boatmakers, boat repairers, hired hands, and especially the big ferryowners in Kachulu earn a reasonable income from the provision of water transport and thus their dependence on this wetland product is considerable. Furthermore, water as a product for washing, bathing and irrigation is an extremely important value for households in the wetland. As a wetland product on its own, open water is a very valuable natural capital asset.

Module 3

Integrated Wetland Management

Introduction

In the wetland several factors interact such as wetland ecosystems, communities, cultures, economy and government institutions. This interaction makes the wetland complicated since what happens in one part of the wetland affects other parts. For instance industrial discharge into the wetland may result in pollution of the water, which in turn may affect the fish, other aquatic biota and human communities. The wetland therefore does exist and acts as a system thus necessitating an integrated management (IWM).

IWM can be defined as a continuous and dynamic process that unites all stakeholders, including communities, in the wetland in preparing and implementing a plan for the protection and development of wetland systems and resources. The main thrust of IWM is to improve the quality of life of human communities who depend on wetland resources while maintaining the biological diversity and productivity of the wetland ecosystems. Success of IWM hinges on the provision of an equitable, transparent and dynamic process that is acceptable to the communities hence the need to involve the communities throughout the process.

IWM is an attempt to solve problems in the wetland areas, which include:

- Lack of coordination among government departments
- Insufficient planning and regulatory authority
- Resource-harvesting decisions made primarily on the basis of economic considerations to the exclusion of ecological considerations
- Lack of community acceptance and implementation of government enforced laws that govern natural resource exploitation
- Limited public participation in decision-making

3.1 Decentralization – a Case Study of Malawi

In October 1998 the Cabinet in Malawi approved a National Decentralization Policy (NDP) which will with effect from July 1, 2002 transform not only the functions of district administration, but also many of the functions which are presently the responsibility of central government institutions. The policy devolves administrative and political authority to the district level, and integrates governmental agencies at the district and local levels into a single administrative unit. The goal of decentralization in Malawi is to empower the local/rural people in identifying their problems, finding ways of solving these problems, implementing the solutions and evaluating the progress and impact. The heads of government departments at district level will form a secretariat or management team answerable to the Assembly through a District Commissioner. They will no longer report to their parent ministries. The existing structures within the district are provided below under section 3.1.1.

The Ministries/Departments to be decentralized will include: Health, Education, Lands, Housing, Physical Planning and Surveys, Fisheries, Forestry, Agriculture, Works and Supplies, Water, Community Development, Commerce and Industry, Tourism, Environmental Affairs (District Environmental Officers only).

3.1.1 District Structures

There are four different formalized local government structures at District level. These are the Village Development Committee, the Area Development Committee, the District Development Committee and the District Executive Committee. A summarized overview of their composition and functions is described below.

3.1.1.1 Village Development Committee (VDC)

The VDC is a 'representative' body from a group of villages. Generally a village covers an area under a jurisdiction of a Village Headman with about 10-75 households. A group of Villages or sometimes a 'group village development committee' is the organization that is the focus of the District Development Planning system, as a village, in most cases is too small. Therefore for purposes of the District Development Planning System: VDC refers to a group of villages, led by a Group Village Headman. Therefore a VDC is a representative body from a village or a group of villages charged with the responsibility of facilitating the planning of development in a village.

Its functions include:

- Organization of meetings for the VDC,
- Co-ordination of meetings between the VDC, ADC and DDC,
- Mobilization of community resources,
- Identification and prioritization of needs,
- Submission of proposals to the ADC,
- Supervision of community development activities.

The membership includes:

- Chairperson: Village/Group Headman/Woman,
- Vice Chairperson,
- Secretary/Vice secretary,
- Treasurer/Vice Treasurer,
- Members (at least 10) as elected from the various villages within the VDC.

3.1.1.2 Area Development Committee (ADC)

The ADC is a representative body of all the VDCs under the jurisdiction of a Traditional authority made up of the following:

- Chief-member and chairperson of the VDC,
- Two elected representatives from each VDC (one man, one woman),
- Representative of political parties,
- Members of Parliament,
- Representatives of religious denominations,
- Ward councillors,
- Representatives of youth and women groups in the area,
- Representatives of business community and,
- Extension Workers, chief's clerk, ADMARC Supervisor and other civil servants as ex-officio members.

The ADC through the steering committee has the responsibility for:

Organization of monthly general meetings of the ADC in liaison with the relevant VDCs,

Identification, prioritisation and preparation of community needs which encompass more than one VDC,

Submission of proposals to the DEC,

Supervision of projects at TA level,

Mobilisation of community resources prioritisation and,

Preparation of VDC projects for submission to the DEC and training of the VDCs.

3.1.1.3 District Development Committee (DDC)

The DDC is the policy body that approves the District Development Planning Framework and District Development Plan of the district. Other functions include "fostering dialogue between government and ordinary people in the villages, through their representatives, during the identification, planning and implementation of district and area based micro-projects, generally or specifically promoting government policies among the rural population of any district or area concerned, and co-ordinating the identification, planning and implementation of any micro-projects in the district" (Cabinet Paper No.C/P6/93 of November 2, 1993).

The composition of the DDC as reviewed in 1994 is as follows:

Chairperson,

Members of Parliament in the district,

Chairpersons of all registered political parties operating in the district,

Two representatives of non-governmental organizations,

Chairpersons of all local authorities.

3.1.1.4 District Executive Committee (DEC)

The DEC is comprised of all heads of Departments in the District and is the technical advisory body to the DDC. The DEC is responsible for implementation of all aspects of the District Planning System. The DEC is chaired by the District Development Officer.

3.1.2 District Planning Process:

The District Planning System is the most important mechanism for collecting the real issues on wetland management as perceived by the communities. It recognizes and considers as fundamental, the centrality of communities in the process of planning. The key features are that the wetland management plan carried out through the district planning process is locality focused/decentralized, people centred, bottom-up and participatory.

The district planning has been developed to ensure that decision-making and control is done at a level closer to the people in the communities.

3.1.2.1 Basic Features of the District Development Planning System:

District Focused: All the data is generated from and by the district structure and analysed to identify gaps within the district. There is therefore need to empower the district. For the planning to be district focused, instruments for funding and the process of budgeting have to be district based.

People Centred: The center of the District Development Planning System are the people at the village level.

Bottom-up: The District Development Planning Structures recognizes that all planning begins at the community level.

Participatory: The District Development Planning System ensures that it is participatory by providing the opportunity to communities to be involved in the development projects in various ways from planning to implementation.

The activities carried out by each of the committees in the district development planning system are presented in Table 2.

Table 3. District Development Planning (DDP) System

Stage (Activity)	District Develop Committee (DDC)	District Executive Committee (DEC)	Area Development Committee (ADC)	Village Development Committee (VDC)
Situation Analysis -Community based needs/issues assessment -Preparation of socio-economic profile	X	X X	X X	X
Establishment of District objectives -District development analysis (DDA) to prioritise objectives		X		
Approval of District Development planning Framework (DDPF) -Establishment of DDPF as a legal document	X			
Project identification -Communities identify projects within DDPF. -Approval within priorities of area and submitted for funding. -Detailed formulation and approval	X	X	X	X X
Project Appraisal -Desk and field appraisals to assess feasibility of proposals		X		
Formulation of District Development Plan (DDP) -Prioritize and consolidation of sectorial plans into one document.		X		
Negotiations and Approval of DDP -Review in light of DDPF and approval -Submit to Donors for funding (if required)	X			
Plan and Project implementation. -Production of final version for circulation -Arrange implementation of approved projects.		X	X	X
Plan and Project Monitoring and Evaluation -Continuous assessment of progress		X	X	X
Annual system Evaluation and Re-appraisal -Review implementation of DDP to improve effectiveness	X	X		
Situation Analysis Repeated		X	X	

3.2 Approach to Development of IWM Plan

Participatory Assessment, Planning and Implementation for Wetland Zone Management is used as a tool for planning officers to obtain social and organizational information. This requires mobilizing local communities in IWM and is achieved through problem solving and opportunity-seeking with the community and planning together.

The participatory approach to wetland management is based on the following principles among several others:

1. Popular mobilization
2. Participation
3. Sustainable livelihood
4. Communication.

3.2.1 Popular Mobilization

For human development, there must be both individual and collective action. People must have individually the creative energy to initiate activities for their own benefit. Collectively, they must also work together for a common vision for their community, to lobby government, local business and share resources for the local projects.

People in sub-saharan Africa have been actively encouraged by government to look to outsiders to provide 'development'. People have been prohibited from mobilizing themselves for local actions and for their own development and even now, people lack confidence in themselves and their initiatives for positive development. Yet popular mobilization does occur in villages and has thrived despite years of oppression. People will unite in the community for activities that provide personal fulfilment and when they are direct beneficiaries, particularly for religious ceremonies, traditional or cultural activities (traditional dances, weddings, and funerals initiation ceremonies) and in times of crisis (floods, droughts, outbreaks of disease).

However, for "development," local people may not always feel they will benefit from working together. They also feel they have no power to make a change in their community. The impediment to collective or popular action include:

- fear of the unknown;
- suspicion of others and that others may benefit more;
- traditional power dynamics;
- lack of experience or awareness of collective action;
- poor local leadership that discourages non-traditional leadership;
- difficulties with unequal input to activities if activities are undertaken collectively; and
- lack of time to devote to activities other than basic subsistence.

Suggestions to partially overcome these constraints include:

- supporting emerging leaders who have the desire to mobilize people for popular, positive action;
- active communication and information sharing on new ideas between people and villages, including identification of positive role models who have prospered through their own initiatives;
- civic education;
- transparency in leadership and decision-making;

- trust-building between members of the community to build confidence of the people in themselves and each other;
- catalysing small collective activities, such as community action planning; and finally to:
- engage people to take actions through the promotion of participatory decision-making and planning.

3.2.2 Participation

Many of the problems faced by rural poor in developing countries have been linked to the lack of decision-making power, or participatory, by the communities who are meant to benefit most. As a result, people working in development have increasingly recognized the need for involving communities in decision-making, planning, implementation and evaluation of development projects.

Participatory development activities now collectively fall under the banner of *participatory learning and action* (PLA). PLA brings together all participatory methodologies that have emerged in the past three decades. Common principle include: a focus on cumulative learning; recognition and respect for multiple and diverse perspectives; outsiders are facilitators to aid and improve people's learning and transformation and allow people to direct the process, and; the participatory process leads to an actual transformation or desire to bring positive change.

The principle of participatory development is that it should be a means of empowering the oppressed, the marginalized and the vulnerable: those who are missed by development policy and programmes. It should enhance people's ability to analyse their situation and help them learn ways for taking action. It should empower them to make changes in the power relations and interactions inside and outside the community. Participation is a learning-centred process. Its "ends" is to empower people. Its "means" is to be an instrument for change that forms the basis for wider involvement, mutual learning and decision-making of all in a society.

3.2.3 Sustainable Livelihood

Despite the abject poverty in much of sub-Sahara Africa, people manage to thrive through their abilities to adapt to changes. They do this through indigenous know-how and creative experimentation. These " adaptive strategies" are diversified and comprehensive knowledge systems that help people survive despite political, social and ecological and economic environments that work against positive human growth.

These strategies are unique to local cultures and are accumulated through experience, informal experiments and an intimate understanding of the environment. Adapting has ensured at least minimal livelihoods for people, even within the context of a population explosion, environmental degradation and disabling government systems.

"***Adaptive strategies***" is a term used to describe a process of conscious and deliberate change in the way people organise and re-organise their lives in response to long term changes and challenges. These strategies are distinct from "coping mechanisms", which are short term, reversible responses to situations such as declining food availability and entitlements, in abnormal seasons and years. "***Coping strategies***" are characteristic of secure livelihood systems only during periods of stress and constitute fallback mechanisms during periods of declining access to food. Examples of this include selling household items, stealing, loitering, street children engaging in mob actions or prostitution.

Livelihoods are the abilities, activities and assets, such as stores, resources, claims and access, which allow people to make a living. To be lasting and durable (sustainable), people must be able to generate and maintain their means of living-including coping with and recovery from stresses and shocks while not compromising future generations' abilities to also live well and prosper.

Example of adaptive strategies include:

- Diversification of income earnings, such as crafts, small services or tourism
- Commercialization of traditional collectibles
- Modifications to cultivation practices, such as animal traction, or new crops
- Formation of new associations of producers or sellers e.g. Beach Village Committees
- Formation of pressure groups to lobby government for development activities, such as water or roads
- Formation of new institutions or the reinforcements of traditional ones in order to resolve conflicts or manage natural resources better

The strengthening of better governance systems and participation in decision-making are critical for creating lasting human development. This idea and approach of alternative development will help enhance people's capacities to exploit their options and opportunities while sustaining both their livelihoods and their environment.

3.2.4 Communication

Another important aspect of the sustainable natural resources management is the role of information and communication. Good communication can encourage peoples' participation and inform and challenge people in a way that makes them take action. It provides people with powerful tools to research problems, needs and solutions and helps to build understanding and consensus for action.

Understanding and utilizing existing local communications networks is an integral part of better development. It can hinder or help popular development movements. These networks include local media, traditional and modern forms of expression, influential sources and perceptions of various groups within the community. One of the goals of this process then becomes finding and exploiting these channels of indigenous and outside communications to enhance people's involvement.

Conclusion

It should be noted that the majority of the Ramsar listed sites in Africa are situated in National Parks, and thus have legally protected status in contrast with Lake Chilwa, which is an open access common resource which lies in one of the most densely populated and impoverished areas of Africa.

The need to reduce the depletion and degradation of natural resources on which wetlands communities depend is of national concern, and more so to the riparian communities. The wetlands have several natural resources that include fish, forests, water, land etc, which are the mainstay of the livelihood of the communities. However, pressure is being exerted on the resources by the communities and other user groups leading to degradation and depletion. Experience has shown that sustainable management of natural resources has failed because the communities have not played a central role in the management of the resources and have all along regarded them (natural resources) as government property.

In order to reverse the situation, there has been a strong campaign to embark on participatory management programmes. Unfortunately, these efforts have had limited successes because the programmes have been developed without the involved of the stakeholders and have been commodity oriented e.g Fisheries, Forestry, Water, Agriculture etc. As a result, stakeholders have also not fully understood the inter-relationships of the various commodities. This has limited their capacity to adopt the integrated approach to management of resources in the wetlands, besides some fundamental constraints ranging from ecological to socio-economic.

Lake Chilwa is a particular wetland that is an open access common property resource and has been subjected to commodity oriented management programmes. Traditional leaders control most of the land in Lake Chilwa while government departments have been looking after the utilization, management and conservation of their commodities. This is poised to change because of the Decentralization process. The policy devolves administrative and political authority to the district level, and integrates government agencies at the district and local levels into a single administrative unit.

For Lake Chilwa, there is an Inter district Committee charged with the responsibility of overseeing the activities of Lake Chilwa. Members of this committee are drawn from Zomba, Machinga and Phalombe districts, which share the Lake. This is all to promote Integrated Wetland Management.

Module 4:

The Wetland Planning Process

Introduction

Wetland planning refers to ongoing process of analyzing the wetland in order to prepare plans to guide the district structures about how to allocate and use wetland resources and where to allocate different human activities on the wetland.

The product of wetland planning is a range of wetland management activities that include:

Development Facilitation and Assessment of Wetland Development Proposals:

This refers to promoting and/or restricting physical development within the framework of a wetland plan, where such a plan exists. Where no such plan exists, consideration should be given to the wider implications of the proposal.

Day-to-day Wetland Resource Management:

This is a consultative and participatory process of maintaining and restoring wetland resources where necessary and appropriate and regulating human activities which may have an impact on these resources. These management activities should integrate with other management and development processes into a single integrated development assessment procedure.

Supporting Activities and Mechanisms:

Includes applied research, long-term monitoring, public awareness, education, law, institutional capacity building and finances.

4.1 Getting To Know The Wetland And Communities

In this section:

Developing relationships with community members

1. Identification of issues

When you first arrive in the community, you are a "visitor". After a while, you will develop trust with people by showing that you want to learn from them as well as share your knowledge.

4.1.1 Introduction and Expectations

It is very important to brief the community on your role as the natural resources management officer. Simple introductions will allow people to get to know each other better. This process includes:

Introduction: self-introductions should take place and can include more information other than names alone. Self-introductions are good means of helping community team members feel relaxed and liberate those who feel shy.

Explain the purpose of your work: The purpose of your work should be explained, even if this has been done on previous visits. A common concern of natural resources management officers is that community members sometimes think political leaders can do everything to help them. You should allow people to ask you questions in order to help them understand that you have a specific purpose.

Know the different interaction groups: The whole community cannot be expected to be present for all activities all the time. You may need to work specially with groups of particular composition, such as farmers, fishermen, young women, older women, young men, older men, community organizations and youth. As you get to know the community better, you will begin to see different interaction groups or may want to encourage the formation of these groups for targeted work.

4.1.2. Select the Monitoring Group

The selection should be done by the community members themselves by allowing people to volunteer or be nominated, rather than allowing the chief to select people,

so that people feel their interests are equally represented. The group should represent a wide cross-section of the community, including men, women, old and young people. People can be selected from the clinic, the market, the bar or the school. In addition to being in touch with different sections of the community, they should be people of discretion and who show an interest in the welfare of the community and wetland resources. The monitoring group could include members of the VDC and /or ADC.

4.1.3. Training for the Listening Survey

Volunteers should be assisted or "trained" to observe, in the form of a listening survey, what goes on in the wetland villages, particularly during the natural resources management officers' visits and meetings. Preparation should begin with an informal "training" or introduction to the listening survey. This "training" should begin with a trust building exercises to promote a team spirit and develop the concept of "open unbiased" listening. Poor listening leads to prejudicial and selective listening, which may in the end represent the individual's own personal views or those of his own family or group.

4.1.3.1 Listening Survey

Volunteers should listen to capture what issues the community is discussing and things which people have strong feelings about. The results of the listening survey will help to identify issues, which are relevant to the community and relevant to you the natural resources management officer. The survey is not to uncover "secret" issues. It should be a means of discovering what issues people have strong feelings about the wetland.

The issues can be presented to the community through role plays and will lead the community to take ownership of problems, analyze the causes and plan for action. The stages involved in the listening survey include:

Identifying target groups: Identify groups that would be best to listen to in order to find the burning issues in community.

Where to listen: The volunteers should prepare to listen wherever the community meets together and where they would be found naturally. Listening is done as part of the normal course of daily activities.

What to observe and listen to: The team should listen and observe what people say and do; who does what; why; note change in customs, expectations, observe words used most frequently and any emotive.

Duration of survey: The survey lasts as the natural resources management officer and the monitoring group feel it is necessary to make-work more effective.

BOX NOTE: While a listening survey is not a secret, discretion is required to avoid raising the customary expectations that once again people are going "to do something for us – that we are going to receive a hand-out"

4.1.4. Regular Meetings with the Monitory Group

At the end of the visit or group meeting, you should meet with the group to review the day's outputs and discuss issues. These issues can be recorded and analysed on the Needs, Opportunities, Problems and Solutions (NOPS) grid, which necessary to help you and the group to analyse the problems. A sample of the NOPS grid is shown below. You should analyse each issue with the group as it is presented and decide if the issue is a need, an opportunity, a problem or a solution.

As you will be visiting the community on regular basis, you may begin to see a pattern emerge. There may be issues that come out continuously; these are the " burning issues". It is important to distinguish between short-term problems, such as the periodic drought before the rains, which will be dealt with once the rain commences, and those problems, which are more long term. As these problems relate to you, or to other colleagues, these issues will help form a basis for local planning and problem analysis

NOPS Table

Issues	Needs	Opportunities	Problems	Solutions

4.2 Information Gathering Tools

In this section: How to use participatory tools

1. Secondary data review
2. Focus group discussions
3. Semi-structured interviewing (SSI)

a. Individual interviews

b. Key informant interviews

4. Historical timeline
5. Transect walk
6. Social map
7. Wetland resource map

There is need to learn more about the community, and collect outside information through asking questions and interviewing. These information-gathering tools are very useful for everyday work, particularly the focus group discussion and semi-structured interviews, as ways of discussing issues and getting input from individuals and groups.

Individual semi-structured interviews and key informant interviews are also important tools to use when communities do not have the time together in one group, such as when people are fishing. Interviews outside of a group will help to triangulate on issues discussed as a group, including things such as hunting, credit advice, employment opportunities and income generating activities.

4.2.1. Secondary Data Review

Secondary data is the information already available from other sources, either qualitative or quantitative. Vast amounts of information have been generated, documenting the living conditions and livelihoods in the wetland. It is therefore important to do a review of background information where one is working to learn more about the area.

Secondary data provides an overview of the area. It includes information on the resource base, land use, problems and opportunities. Sources include: published and unpublished reports, departmental statistics, and latest departmental reports at community, district and regional level.

Secondary data review has the following advantages:

1. It increases the soundness, relevance, integrity, validity and applicability of work, its objectives, methodology, outcome and utilization.
2. It increases awareness of decision making and planning and highlights the likely constraints to sharing, analyzing and using information
3. Well-used secondary sources make work more acceptable when included in advocacy.

Visit libraries, government ministries and offices in the district, region and gather available data. Conduct interviews and consultations with key informants in the district, such as local government staff and local leaders. Also interview and consult local or district women's groups. Other secondary sources include the district situation analysis, district plans, district reports and previous assessment document

BOX NOTE:

Secondary Data Things to look for, disaggregated by sex, age, socio-economic groups, ethnicity, and rural and urban differences:

- demographic information: human resource pyramid and the distribution of males and females by age; small holders, beach.
- Education & adult literacy: primary, secondary and tertiary
- Labour force participation & major production sectors: type of occupation
- health status data: mortality, morbidity, maternal mortality, life expectancy; birth spacing, growth monitoring, malnutrition; access to health services, contraception, safe water & latrines;
- Food security & availability and accessible food by season/month: staple food & nutritional balance
- Household types: female-headed and income by household;
- Housing facilities
- Infrastructure
- Access to land, water, inputs, credit, extension services and information, markets
- Community history- famine, wars, drought, floods
- Coping strategies
- Adaptive strategies
- Social & political history

4.2.2 Focus Group Discussions (FGD)

A focus group discussion brings together a group of up to 15 people who either volunteer themselves or are selected. The group is asked a series of questions concentrated on a particular subject area. The discussion is guided to keep people focused on a particular topic.

It is important to keep people focused on a particular subject area without straying too far away from the main topic, while also allowing as many different people to give input in a discussion as possible.

4.2.3 Semi-structured Interview

Semi-structured interviewing (SSI) is one of the main tools in participatory assessments. It is a form of guided interviewing where only some of the questions are predetermined. These interviews do not use a formal questionnaire but at most a checklist of questions as flexible guide.

In contrast to the formal survey questionnaire, many questions will be formulated during the interview. If it becomes apparent during the interview that some questions are irrelevant, they can be skipped. Questions usually come from listening to the interviewees' response, using ranking methods, observing things around and your own background experience

Types of semi-structured interviews include:

a. Individual interview

The individual interview will help to obtain representative information from different households and interaction groups. Information obtained from individual interviews is more personal than from group interviews and is more likely to reveal conflicts within the community since respondents may feel they can speak freely without their neighbours present.

Interviews are conducted with a sample of purposely selected individual respondents. A good sample of fishermen would include fishermen leaders; innovative farmers who have tried recommended technologies or successfully developed improved technologies; women fishers who are both members and heads of households; fishermen who represent major gear technologies in the area; poor fishermen with very limited resources; and traditional fishermen who have resisted new technologies.

Interviewing a number of different fishermen on the same topic will quickly reveal a new range of opinions, attitudes and strategies. The bias of interviewing only men must be avoided. Ask individual respondents about their own knowledge and behaviour, and not what they think about the knowledge and behaviour of others. Many communities have at least one person who disagrees with everything. Responses from this person can provide valuable cross-checks and reveal useful insights that may not be obtained from the other interviews.

b. Key informant interview

A key informant is anyone who has special knowledge on a particular topic, such as a merchant who knows about transportation and credit, a midwife who knows about birth control practices or a fisherman who knows about fish migration patterns. Key informants should be able to answer questions about the knowledge and behavior of others and especially about the operations of broader systems in the area. While there are risks of being misled by key informants' answers, and cross-checking is necessary, key informants are a major source of information.

Valuable key informants are outsiders who live in the community, such as school teachers or people from neighbouring communities, or people who have "married into" the community. As "outsiders with inside knowledge", they may have a more objective perspective on affairs in the community than members themselves.

4.2.4 Historical Timeline

Historical timeline are best carried out with a small group of people who are well conversant with the subject under discussions, particularly the village elders who will remember past events. The historical timeline will help find and establish the historical precedents set, particularly related to wetland resource utilisation, including past preparedness and household coping/adjustment mechanisms. A checklist to guide this includes:

- Fluctuations in resource supply (surplus/deficits)
- Frequency of resource scarcity
- Causes of resource insecurity
- Vulnerable groups or households to resource insecurity
- Coping mechanisms

4.2.5 Transect Walk

A transect walk is a one-dimensional map of a path cut through a wetland, It is a cross section of an area where a number of issues can be recorded. It is a useful means of getting to know the community surroundings and resources and will help in building the wetland resources map.

The transect walk will enable the interaction groups to explore, compare, as well as observe features raised during previous exercises and will also help set the conditions and preparedness, of the community.

1. Select a multi-disciplinary team, including members of the community, to walk to the peripheries, exploring differences in land use, vegetation, soils, storage facilities, drainage, cultural practices, infrastructures, trees, live stock, water sources, problems and opportunities.
2. One or two team members volunteer to make notes.
3. As the group walks the transect, discuss issues as they are observed; the team will observe, ask and listen.
4. After the walk, compile notes and draw a linear map marking rough estimates of scale of the transect.
5. Identify the main natural/agricultural zones and distinguishing features, such as:

Fishing Soil and land use Problem Opportunities Livestock Solutions

4.2.6. Social Mapping

The social map will help facilitators and the community develop a basic structural picture of the community and households. It is usually one of the first exercises to take place because it is easy to understand, it is somewhat neutral and it will help mobilize people to take part in activities. The map provides the social conditions of the community and will help to identify different types of households, including wealth groups, heads of households and positions in community.

Steps to follow:

1. Divide the group between men and women and assign each to draw or make a model of the wetland.
2. Allow the community group to draw a map as a team and share information about community issues, such as wetland resources, socio-economic

infrastructures and community social services. People should show the location of households.

3. Depict variables including source of income, fishing, farming families, forests, boreholes/wells, health clinics, shops, available skills and location of IGAs.

4.2.7. Wetland Resource Map

The wetland resource map will help people analyse the resource-base and resource opportunities within the wetland. Generally, the resources map will use the social map, although sometimes it can be used alongside the social map, completed by two different interaction groups. Maps can include.

- Infrastructure (roads, houses and other building)
- Water sites and sources
- Agriculture lands (crop varieties)
- Dimba land
- Ecological zones (Water, soils, slopes and elevations)
- Forest land
- Grazing areas
- Other social facilities (if missed by the social map: schools, health centers)
- Ceremonial places (cemeteries, shrines)

Like the social map, the resource map is useful to undertake when first getting to know the community, because people enjoy taking part and many people give their input. However, caution should be taken not to allow too much time on the map as experience in Malawi has shown that the maps generally consume quite a lot of time.

Communities should analyse their livelihood systems, including the strategies and experiments that have helped them adapt to the changing social, economic and environmental conditions of the village.

4.3: Mobilising People & Discussing Wetland Development

In this section: How to reflect with the community on issues that affect people's development in the wetland

1. Questioning and problem solving
2. Creating a team atmosphere
3. Values, identity & attitudes with the Onion Skin
4. Change

The participatory process is meant to be a way for the natural resources management officer and members of the community alike to reflect about wetland resource, dependency and change: what it means to people and what the community envisions of wetland management. The way community members get to this realization will mean the difference between a passive knowledge and an inspirational knowledge, where one takes up action. Questions such as – *what factors cause this situation*? - could, in turn, lead to understanding of opportunities and solutions to the problems.

To help facilitate these discussions, it is important to consider ways people can be encouraged to take part in activities. The purpose of "mobilizing" people is to encourage wider participation of more people in the community. If an activity is interesting and informative, more people will want to take part. Therefore they will be given a voice in the decision making process of community organization. If an activity is uninteresting, only those community members with a vested interest will take part, if at all.

Self discovery tool:

Questioning and interpreting is part of a " problem-posing" approach that involves the group in a dialogue to help them discover what is relevant to them. The sequence of questions:

4.3.1. Questioning and Problem Solving

1st Question: 1st description: *What do you see happening?*

2nd Question: 1st Analysis: *Why is it happening?*

Why are these people burning the bush?

3rd Question: Real life: *Does this happen in your situation*

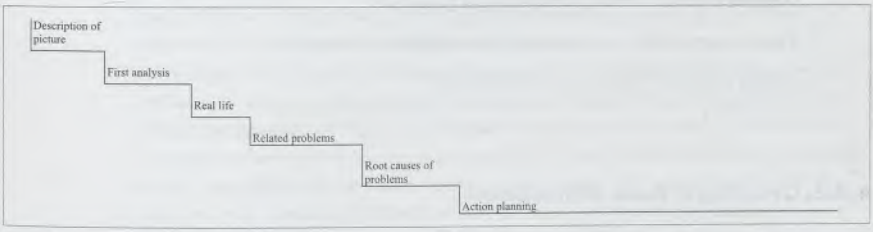
4th Question: Problem arising: *What problem does this lead to?*

5th Question: Root Causes: *What are the root causes of this problem?*

6th Question: Action planning: *What can we do about it?*

Here we come to the testing of commitment of the group, which can be observed in their willingness to take responsibility for actions. Questions include: who will do what/ when/how? When should we review, keeping in mind that principle action is followed always by reflection within a specified period if possible and then evaluation.

A discussion moves down step by step in about six stages, as in the following pict



Description: Description is the easiest discussion for any group, especially in small group. Ask questions like: What *do you see in the picture?*

First Analysis: Ask for an interpretation of the scene. *Why are people doing what they are doing?* The group is challenged to move from observing to thinking about what is happening in picture. The key is to identify the main problem being posed; interpreting is done at this stage.

Real life: When the group is thoroughly involved and has focused their attention on the main issue, one can move to the next level by asking, *Does this happen in real life?* If the picture has hit on generative theme, the answer will usually be "every day" or "all the time". It is good to give people examples and describe some real life situations, to bring the discussion to reality.

Related problems: People will move naturally to other problems related to the initial symptom portrayed in the photograph. However, sometimes that problem is so central to a community that one should stick with it. By relating the problem with other conditions, people will increase their understanding and awareness of the gravity of the problem.

Root causes: The group is now challenged to analyse on a much deeper level, going beyond the symptoms to diagnosing the causes. Getting to the causes will be the only means of finding a cure. *This question is the heart of conscientisation.* The key question is why? but why? Analysis of the "but why?" will help develop a cause-effect relationship to use in wetland planning.

Box Note: Questions and Problem Solving

The different steps can be summarized in the following questions:

Description—What do (did) you see happening in the poster

First analysis—Why is it happening?

Real life—Does this happen in real life?

Related problem—What problems does it lead to?

Root causes—What are the root causes of these problems?

Action planning – What can we do about it?

4.3.2. Creating a Team Atmosphere

It is very important to develop trust in the group. People need to be sensitive to group needs. This includes a better understanding of the roles of people in the group, such as how women are working and speaking in relation to the men in the group. Building trust, openness and honesty between people is a critical element for community action.

Community facilitation is a process of continuous learning and trust and is a process of continuous building. The needs of the group include:

Acceptance: The facilitator has a special role and responsibility in developing a climate that allows people to feel safe to say what they really think and feel. A spirit of respect and acceptance will allow people to be free to learn, rethink their opinions, change and grow and share

Sharing information and concerns: People need information- about each other, their experience, their ideas, their values and opinions and about the issues which they consider to be important in their lives.

4.3.3. Values, Identity and Attitudes

People need to realize that they are the most important stakeholders in the integrated wetland management in their village or areas. There is therefore need to impress upon them that they should not always look for external assistance for them to embark on wetland management.

In order to achieve this, the following self-discovery tool will be used:

First draw two lines fairly wide apart on the ground to represent banks of a river (with chalk, ashes, string or sticks). Place stones inside the lines to indicate stepping-stones with one large island in the middle.

Two people come to the river and look for a place to cross; the current is very strong and both have failed to cross. A third person comes along and recognizes their difficulty. S/he leads them up the river and shows them the stepping-stones. S/he encourages them to use the stones to cross but both are afraid. S/he takes one on his/her back as far as the island, becoming tired as s/he gets there. S/he goes back to collect the other still on the bank, but rather than carrying him/ her on his/her back, s/he instead offers his/her hand and encourages him/her to walk on the stones. Halfway across, the second person realizes s/he can manage on his/her own and they both cross the river. Once across, they are very pleased with themselves and forget about the person left on the island as they head off together. The person on the island tries to get attention with no avail.

Interpreting the river crossing

1. What did you see happening in the play?
2. What different approaches were used to help the two people across?
3. Who do you suppose was really helped?
4. Who could each person (helper, person carried on the back, person carried on the back, person held by the hand) represent in real life?
5. What does each side of the river represent?
6. Why are some people left in the river?

7. If people are left in the river, (that is: if their problem is not solved) what happens to them?
8. In what ways do projects build a sense of dependence?
9. What can we do to help those we work with develop a sense of independence?
10. What changes do we have to make?

Participation is an attitude, or approach to work, not a fixed activity. The onion model provides a graphic illustration of these ideas of the community, its individuals and layers of development.

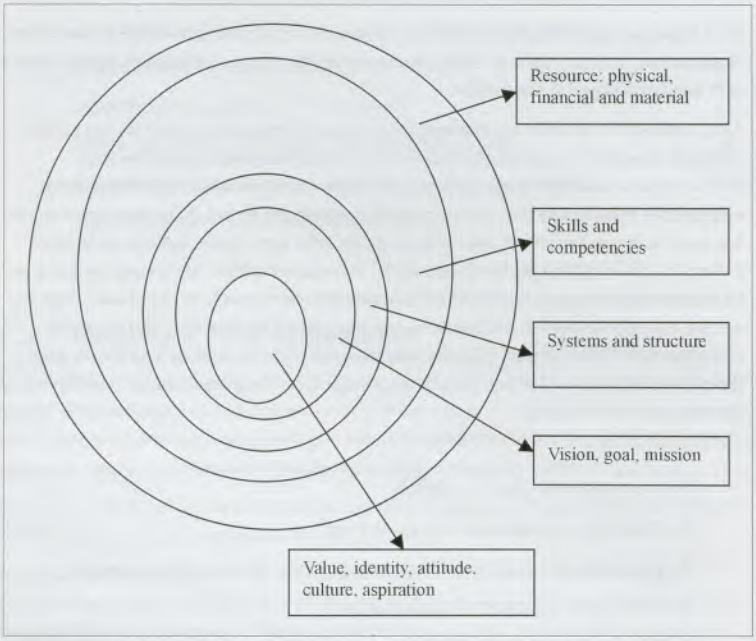


Figure 4.1: Onion Skin

The outer layer: Specialists coming from outside the "onion" look at the outer layer. They see issues, which only affect people from outside, in the physical realm. These are tangible issues which are, to some extent, systems of underlying problems, such as material resources, financial resources, social infra-structure, which are easy to

see and somewhat easy to fix. Collectively, the community as well, might see only the outer layer, the more tangible, material, physical resources while failing to perceive the underlying causes of the situation. Causes are in a more abstract dimensions and are more difficult to penetrate.

The second layer: Underneath the outer layer are skills and competence.

The third layer: Rarely do outsiders examine the systems and structures in the community and see how people are organized and how they run things

The fourth layer: Even more than the systems and structure is the vision and strategies of community. These remain unknown to the outsider and are often not articulated by community themselves.

The core: Change is rooted in individual transformation. Yet the core of people and their attitudes are difficult to touch under the layers. This is the personal level, where attitudes affect culture, identity, aspirations and belief systems. Opportunities and needs in this realm are rarely identified and analysed.

4.3.4 Change

A necessary part of community development is positive change. Change may be required within the community, between people, within a person or in the state. For change to have a lasting and positive impact, it needs to penetrate to people's attitudes, beliefs and culture.

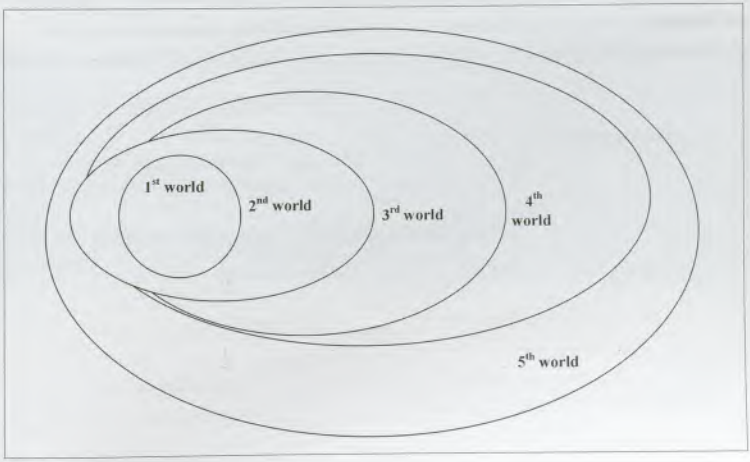


Figure 4.2
Five Worlds

Key for Figure 4.2	
1st world:	*I, as a person in my world of attitude, beliefs, culture*
2nd world:	I, together with small face to face groups, building a common vision
3rd world:	the institutions I am part of, organizations at various levels: from attitudes to physical resources
4th world:	the country at large the larger world at various levels
5th world:	environment

1st World: The individual. Positive change will never take hold at any level unless the individual has changed.

2nd World: Face to face groups. Change in this world will necessarily influence other individuals in the groups people are a part of; if the change at the individual level has penetrated, the vision of individuals will also reach this level. From here a common vision will be built.

3rd World: Institutions and organizations. Unless change also reaches the structures of society, it will not be maintained. Transformation needs to take place in institutions and organizations of society.

4th World: Almost as if by a ripple effect, the change brought about in the first, second and third world will reach as far as whole country, the larger world and international organizations.

5th World: Environment. Whatever is accomplished will have repercussions on the environment and therefore the world.

4.4: Questions For Assessing Wetland Systems

In this section: Recommended questions with suggested participatory tools for a community assessment of wetland systems.

1. Physical profile
2. Socio-political profile
3. Livelihood profile
4. Household food security & nutrition profile
5. Natural resource profile
6. Communications profile

The process of participatory assessment will help facilitate a community analysis of their wetland system. This includes an analysis of the strategies and experiments that have helped people adapt to the changing social, economic and environmental conditions of the wetland.

These questions are valuable for creating profiles with the community. Discussions arising from these questions should help people to make connections between issues, which affect their livelihood systems.

The suggested tools are listed in the side column labeled "Tools".

I. Physical profile: Establish the physical community setting	**Tools**
1. Housing: How many houses are in the wetland? What types of housing: thatched, iron roof, other? How are houses clustered? What are the patterns of housing? What are the qualities of the houses? Are they permanent or temporary?	**Social mapping**

2. Education: What are the levels of literacy by age and sex? What are the enrolment in schools of boys and girls? Where do people learn?	**Social mapping** **FGD**
3. Orphans: Why does the community have orphans? What are the strategies for dealing with orphan population?	**Social mapping** **FGD**
4. General health: What is the incidence & prevalence of diseases for the whole community? What are the main diseases? How does this vary by season? What do people do in the case of diseases? Who decides? Do people rely on traditional medicine or western medicine? In what combination? What are the main causes of death (malnutrition, witchcraft, diseases)? What is the community knowledge of death? What are the strategies adopted for dealing with health problems as they arise?	**Semi-structured Interviews (SSI)** **FGD**
5. Environmental health: Where does water supply originate? How does water supply vary by seasons? What are the implications on time for collecting water? What are people's perceptions of quality/ quantity of water supply? What is the condition of people's homes/ shelters? How is rubbish disposed?	**Key informants** **FGD** **SSI**
How is wastewater disposed?	**Key informants**
6. What are the burning issues related to the village population?	**FGD** **Listening surveys**

II Socio-political profile: Establish socio-culture, political makeup, how the community is organised and how roles are shared among members.	**Tools**
1. Ethnic groups: What is the ethnic makeup of the community? How many of each? How does the variation in ethic groups affect the cohesion and relationships in the community, if at all?	**Social mapping** **FGD**
2. Traditional leadership: Who is the headman of the community? What kind of leadership does each offer (TA, GVHM, VHM)? Is it a strong, positive leadership? If not, why? What kind? What is the relationship between the TA, the GVHM & the VGM? What is the political and social role of each?	**FGD**
3. Traditional and cultural beliefs: What are the different religions in the community? How many different religions exist in the area? Where are they located? How many people of the village go to each one? Are the mission supporting the churches? Which ones? What are some of the church activities? What are the traditional belief systems outside of the church? How prevalent is witchcraft? How are belief systems used as a means of social control? Does this have a negative or positive impact?	**FGD** **Key informants**

III. Livelihoods profile: Establish economic activities carried out by people in the community **disaggregated by gender.**	**Tools**
1. Employment:	
What are the professional/ skilled opportunities in the wetland?	**Key informants**
How many and who is employed in a technical job? What kind?	**SSI**
How many people are employed as civil servants, such as nurses, teachers?	
How many people are employed in private industry, in trade, commerce, manufacturing, processing?	
How many people are employed by ganyu labour? When do people do ganyu? Why? What activities? Who does ganyu in the family? How many men/ women? Who cares for the family while members are doing ganyu?	
What is people's knowledge of employment opportunities in the community or surrounding area?	
How have employment opportunities changed in the last five to thirty years?	
What are people's aspirations for employment?	
2. Private enterprise:	
What type of opportunities are offered for private enterprise?	
Who offers?	**FGD**
What do people know about opportunities for private enterprise?	**Key informants**
How have opportunities changed for private enterprise in the context of changing political situations?	
What kind of businesses are people waiting to begin? What are their aspirations?	
3. Farming:	
How many people are subsistence farmers?	
How many people are commercial farmers?	**FGD**
What are the types of cash crops grown? How much is sold?	**Key informants**
What kind of crops are people growing for cash now that they would not have done in the past?	
How has farming been changed or adapted to the changing ecological climate?	
Do many people want to farm but have no access to land?	
What are the alternatives to farming in the village?	
What are people's aspirations for faming/ what vision do they have for agriculture production?	

4. Purchasing: What food items do people buy? Why these items? How does this vary among the different income groups? Where? How much does it cost? How much does price vary during different seasons? How often is food purchased? How long does it last?	**Seasonal Calendar** **FGD** **Participant observation (visit to market)**
IV.Household food security and nutrition profile 1. How do people define food security?	**FGD**
2. Coping strategies: How do people cope with food shortages? (Seasonal hunger, bad years: coping mechanism) How does this vary by economic/ social class? (Split coping mechanisms into vulnerable groups) Who decides when to adopt coping strategies? How do people experiment with new foods, growth or storage in order to adapt to the changing ecological, socio-cultural or economic environment? If one of the coping strategies is ganyu labour, what is the impact of ganyu on household food security? Who cares for the gardens? Who feeds the children if the mother is busy with ganyu labour?	**Coping strategies** **FGD**
3. Malnutrition: Do people know the symptoms? Causes Consequences? What kind of treatment do community members advices? How, if at all, does malnutrition vary by season? Who in the household is malnourished? Why?	**SSI** **FGD**
4 Food aid: What are the historical patterns of food aid?	**Historical timeline**

V. Natural Resources profile: **1. National parks or reserves:** How many national parks or reserves are in the area? What type? How popular is this park/reserve to tourists? Are the community members involved in managing the area? What is the communities' understanding of parks or reserves? What are peoples' experiments and experience with the parks or Reserves? What does the community understand about a park or a reserve? What are their impressions? Do parks and reserves present potential source of income? What are the resource use and benefits of parks and reserves?	**Wetland resource map** **Transect walk** **FGD**
2. Wildlife resources: Approx. number & what types existing inside and outside of parks and reserves (according to the community and triangulated with figures in the parks or reserves)? What are the community relations with the animals? What are the local beliefs related to these animals? During what times of year are the wildlife commonly seen? Where are animals mostly seen?	**Wetland resource map** **Transect walk** **FGD**
3. Local knowledge of the environment: What are people's perceptions of degradation to the environment? What are local practices related to environmental protection & degradation? What is people's knowledge about solutions to environmental degradation? What are the strategies or experiments in natural resource management? Where did this knowledge come from? (School, extension workers, etc.)	**FGD**

4. How has the community adapted to or adjusted to changes in the environment, such as with forests, soil fertility, rainfall? What are the social mechanisms that have lead to different responses of the community to the changing environment, such as activities of community groups discussions	
5. Burning issues related to the environment.	**Listening surveys**
VI. Communication profile **1. Available information, education and communication:** Originating from which sources? Extension services available: Forestry, agriculture, health, etc.	**FGD**

4.5 Identifying Opportunities

In this section: Identifying opportunities and problems

1. Selecting and ranking issues for importance
2. Using the problem tree
3. Problem solving.

To identify opportunities in the community, it is important to look at means of addressing the problems that have arisen during assessment. The way of identifying problems and opportunities can be divided in three phases:

1. Identification of issues or problems;
2. Analysis of issues through cause-effect relationships; and
3. Development of a problem solving strategy that will begin the process of planning.

As issues are identified and discussed during the livelihoods assessment and analysis, communities should explore means of solving problems and discovering opportunities. A cause-effect analysis is necessary means of helping people develop an understanding of a situation and its implications.

One way of undertaking an analysis is through use of a problem tree. The problem tree is useful because it provides a comprehensive picture of asituation and it helps identify the roots of the problems that will be important during the planning phase. Issues on the problem tree are based upon the issues discussed by the community, heard in the listening survey (recorded on the NOPS chart) and identified from the information generated from the livelihood analysis.

4.5.1. Selecting and Ranking Issues

Issues will have arisen during the listening surveys and information gathering. Some problems will be very specific to a particular interaction group or relevant to the whole community. These are the critical problems that could have many negative effects on people. They are also the issues, which will help highlight the opportunities that exist in the community. It is important to consider how a single problem can be responsible for a number of factors, which can cause other problems, which are not visible at first glance. Individual analytical skills and the community judgement will lead the process to identify the main problems; these are

crucial problems that carry a heavier weight than others. There is no predetermined formula that can be applied to identify and select the main problems.

These issues should be highlighted, discussed and ranked by importance by the interaction groups and then the community as a whole can prioritise which problems are most important to address and discuss further. These issues will become the starting point for the problem tree, or the main problems.

4.5.2. TOOL: Problem Tree

The problem tree is a tool used for analysing the causes and effects of identified problems; it is used to explore linkages and to identify and assess priorities. It is a graphic representation highlighting the needs and problems perceived by the community. These are visually represented by the branches of the tree. Causes are represented by the roots.

The steps are as follows:

1. Develop the main problems;
2. Each interaction group should be given a main problem to analyse and to develop a problem tree illustrating the causes and effects of the problem under consideration. Groups should also propose which of the causes of that problem are considered to be the focal ones;
3. For the tree, draw a square representing the main problem at its centre;
4. Above the central square draw the branches of the tree which represent the effects experienced as a consequence of the main problem;
5. Below the central square representing the main problems; these tend to be other, although less significant problems.

The most important tool to keep in mind is the repetition of a single word; "WHY"? Asking "Why "will often provide unexpected insights, which help develop a better strategy. The community should never be afraid of asking or wondering why something is happening, even if it seems obvious.

A complete problem tree full of branches will show the effects due to the main problem with many roots and will state the causes of the main problem. This is a visual representation of main problems and their cause-effect relationships.

4.5.3. Problem Solving

Having undertaken the cause and the effect analyses and prioritised the issues, action planning can begin. Assemble priority problems of different groups. Identify local adaptive, adjustment and coping strategies for dealing with problems and identify opportunities to address these problems. Solutions should be prioritised to help people decide what interventions would be the most effective in solving their problems.

During community analysis, solutions that are suggested should focus on eliminating or alleviating *causes* of problems. It is misleading to focus on actual problems because it may miss out on some causes. Also problems should not be presented as negatives because this may imply that no solution can be found. For instance, a "lack of seed" should instead either be: "seed is expensive" or "sources of seed are very far" or "seed is available in too small quantities".

These solutions will form the main components of the plan in the next module. The elements, such as the goal, objectives, beneficiaries, outputs, activities, inputs, should be redefined from the problem tree developed during the participatory assessment in the field.

Practical:

After this, participants would be asked to complete the following table based on their field work:

Issue: Problem/Opportunity	Causes	Developmental Objective	Immediate Objectives	Strategies

4.6: IWM Planning

In this section: Turning issues into positive action

1. Activity: Force field analysis
2. Setting objectives for action
3. Identifying who will benefit
4. Defining output
5. Defining activities
6. Identifying material and human resource needs
7. Setting timeframe
8. Developing a detailed work plan
9. Defining expected results and indicators
10. Grassroots indicators
11. Assessing sustainability
12. Reviewing the work plan

Realistic and sound planning is the most important stage in participatory community development. Detailed planning helps people make decision on the best direction and determine the objectives, beneficiaries, output, activities, inputs, indicators and timeframe. In analysing people's adaptive strategies, opportunities are created for people to seek ways of reinforcing their livelihoods.

IWM action plans should represent local initiatives for strengthening these livelihood systems. Because of this, planning can represent the priorities and interest of different interaction groups in the community, while uniform community consensus is important.

Planning should take place as part of a larger programme of activities that will be geared to helping communities follow through with the action plans they develop. But planning can also help people come up with local activities for solving problems that have local solutions.

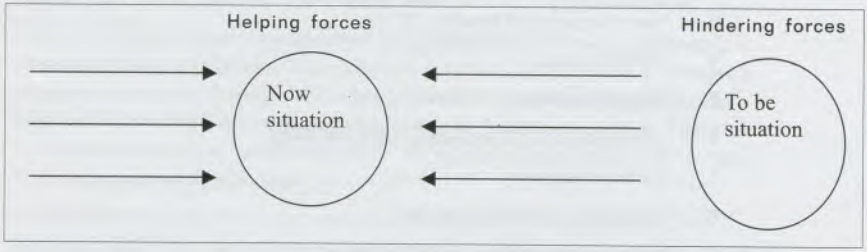
4.6.1. TOOL: Force Field Analysis

The force-field analysis is a useful technique to identify the factors that will help or hinder participation and hinder the overall success of wetland management. This will

help facilitators and community members discuss items that may be left out of a plan and also focus attention on finding not only root causes of problems but also their related effects.

The steps are as follows:

1: Draw a diagram of the force field to help facilitate the discussion.



2. The first step in the analysis is to define the purpose or the "to be situation"; this is the ideal situation. In the context of planning, the purpose is to secure the full participation of members of the community to implement the IWM plan.

3. The next step is to come to a consensus with the community as to where the IWM stands now or the "now situation". The now situation is in regard to people's support. Participants should visualise the "now situation" in terms of people's participation.

4. There are many factors operating that determine the "now situation"-political, social, economics and psychological factors. These will either help or hinder the forces that have placed the IW programme in that position. The present status of the programme is the result of these "push and pull" forces.

5. It is important to identify both categories of forces and what should be done to further strengthen the helping forces and weaken (or get rid of) the hindering forces.

6. Brainstorm ideas for getting rid of the forces that keep the programme from reaching the "to be situation" and list these.

7. Review the hindering forces and pairwise rank these forces. Then differentiate the forces according to those that are easiest to change; hardest to change and beyond the control of the group.

8. Divide participants into groups and assign each group from the first category of easiest to change. People should brainstorm ways to weaken or eliminate the impact

of that force. Ideas should be presented and discussed by the group on how to overcome the hindering forces.

9. Reviewing the helping forces identified. Have people get back into their groups and assign two helping forces to each group. People should brainstorm suggestions that could further strengthen these forces.

4.6.2. Set Objectives

For every activity, it is important that community members understand what they want to achieve by opting for such actions. Objective setting for every action should be done in advance so that the rest of the plan flows with ease.

Objectives should be *SMART*: Specific, Measurable, Achievable, Realistic and Time bound. These objectives should be derived directly from the problem tree by inverting the identified causes of the problems into solutions to be achieved. Pretend, for instance, that in the problem tree, one of the causes of deforestation was lack of awareness. The objective will now be to increase by 50% the awareness on appropriate tree harvesting strategies among communities that survive on wetland forests within a year. The objective is not only expressing what should be done (increasing the awareness), but provides a measurable indicator (increase by 50%), defines the interaction group (communities that survive on forests) and finally, provides the timeframe (within one year).

4.6.3. Identifying Beneficiaries

Some issues affect the whole community while others affect a section of the community. It is at this stage that beneficiaries and the interaction groups of a particular action are identified and agreed upon by the community, such as the entrepreneurs, women, youth, fishers, farmers or whole community. This helps to focus the activities and subsequent monitoring and evaluation of impact.

4.6.4. Define Outputs

Having set the objective and defined the beneficiaries, the next step is to define the output expected. Outputs are the physical outcome that people intend to achieve through the planned activities.

4.6.5. Define Activities

When the beneficiaries of the action have been clearly identified and the output set, the activities will show how each action shall be implemented, including:

- What to do to get action started;
- Interactive participation in action; for instance, electing a water and sanitation committee and having the chief call the first meeting to hold elections.

Activities are tasks to be carried out in order to produce the output needed, which are then needed to achieve the objective. Do not leave anything suspended but make sure responsibility for the implementation of each activity is openly discussed and assigned through consensus.

4.6.6. Identify Inputs: Material and Human Resources

This step looks at any materials and equipment needed to carry out the related activities. It should define who is to provide what materials and equipment and the budget needed to cover the expected costs. Human resources form part of this discussion. This is where most communities tend to lean too much towards external help instead of looking around for materials, equipment and human resources they can source locally.

At the same time, villages may genuinely be unable to provide everything on their own, but many wish to identify external sources for which they may lack capacity. These sources should be specifically identified

4.6.7. Timeframe

This is the length of time which implementation of the plan of action is expected to take, thus providing the date for the beginning and the termination of the implementation of activities. This must be realistic and achievable.

4.6.8. Detailed Planning: Work Plan

Once all elements are in place, the detailed, sequential work plan can be drawn up. Each step must be logically interlinked to form a plan of action. It should have the following elements and be synthesised into a chart, as follows: objectives, Beneficiaries, Output, Activities, Input, and Timeframe.

4.6.9. Expected Results and Indicators of Success

For every action agreed, it is important that people agree on what indicators will show how the objectives have been achieved. These form the basis for monitoring progress and evaluating impact. Make certain that indicators of success mentioned are measurable and are visible and that expected results are realistic. For each action, a person or a group of persons should be put in charge of monitoring, so that they may have the responsibility of monitoring and reporting periodically to the rest of the community.

4.6.10. Grassroots Indicators for Participatory Evaluation and Corrective Actions

People should develop a means of evaluating and making corrective action. Having agreed on indicators of success, it is necessary that an agreement be reached on who will see if the indicators have started showing at some point. Communities should be prime actors and a participatory monitoring and evaluation programme should be encouraged.

If there is a need for corrective action, it will mean going back to the drawing board to adjust the action plan based on the findings of the evaluation. The objectives of participatory planning is to build the capacity of the communities so they realise they are able to initiate and carry out planning processes in the future.

4.6.11. Sustainability

The question of sustainability will be posed to agree on mechanisms to be put in place to ensure that the plans are sustainable, meaning that they are feasible and can be supported by the community over a longer period of time. Each action will be looked at and sustainability aspects agreed in the community's context.

4.6.12. Review of the Work Plan

In this activity, all issues still outstanding shall be explained and a review of the whole process done. It is also important that it should be explained how the plan will be used at the district and national levels. Consensus throughout the process is of fundamental importance so it is binding to the whole community.

Module 5

Conflict Management And Resolution

Introduction

In this module: Managing and resolving conflict in groups of in the community Defining conflict and seeking resolution

Conflict is a natural part of human development and experience. However, conflicts that are not dealt with well can create a destructive atmosphere and inhibit participation by all involved. A conflict may indicate a real need within a group or in the community and therefore should not be ignored.

At the same time, dealing with conflict, either within a community or within a team, does not have to be negative as it can be a way of learning about the dynamics within a community, a team or people. Conflicts are dynamic, and positions and alliances will continually change.

Wetlands have many users and their relationships may be complimentary while at the same time at variance. Users of wetlands include:

Fishers	Hunters
Tourists	Farmers
Herbalists	Gatherers
Transporters	Researchers
Traders	Municipal councils
District Assemblies	

Depending on their interests, users may be in conflict with each other or among themselves.

Levels of Conflicts:

Conflicts may occur at the following levels

- Internal (Individual versus Individual within the same user group)
- Individuals from different user groups from the same community
- Individuals from different communities
- Different user groups within the same community
- User groups from different communities

Sources of Conflicts:

Conflicts may arise from a lot of situations. These include:

- Ownership: For example, some communities feel that they own some resources that have been appropriated by the government. The resultant conflicts have been Government departments and the Communities; and Communities and Communities. For example, in Tanzania protected areas were taken away from the communities and in the process the communities were relocated. The communities are now demanding access to the areas because they believe that they own the resources. They want to visit the graves of their ancestors and also want to be buried there.

- Management regimes: For example, rules and regulations governing fishing, the closed and open season of fishing is an example in context. This has resulted in conflicts between The Fisheries department and the Fisher community; The Beach Village Committee (BVC) and the Fisher community. Conflicts on management regimes have mainly stemmed from poor flow of information. There has been little contact between the Fisheries department and the Fisher community for both of them to come up with a consensus on management regimes.

- Scarcity of resources: If resources are in short supply, there will be competition among users as each and every one would want to get the most out of it. Conflicts among the users themselves are quite common and also conflicts between Government departments and the user communities.

- Marketing: This may mainly be in tradable goods. For example a conflict may arise between fish traders and fishers. Fish traders always want to buy fish at the lowest possible price making fishers loosers in the process. Fish traders want to set the price of the commodities.

- Method of harvesting: The conflict may mainly be internal, between those who use traditional gears and those who use modern technology.

- Ethnic identities: People of different ethnic groups may be in conflict with each other because of their differences in perception, utilization, exploitation, use and management of the resources.

- Land use: Conflicts may be between different users of the same resources

- Institutional affiliations: Different institutions may perceive a resource differently and this may result in conflicts.

- Alliances: The nature of the alliance may determine your perception of the resource.

- Religious identities: The values of a particular religion may be a source of conflict
- Professional differences: The way different professions perceive a resource could also be a source of conflict. Some professions believe in co-existence between nature and human beings while others do not believe that.
- Personal differences: Generally, it is difficult to find people who agree on each and every thing. Differences in opinions, beliefs, backgrounds etc is a potential source of conflict.

Defining Conflicts:

The circumstances of conflict and the obstacles to reaching agreement vary from one case to another. Disputes may involve many or few parties, problems maybe more or less urgent, emotional investment of the stakeholders may vary, the public interest may or may not be at stake, and the factors may well be understood or more uncertain. It is important to sense the nature of the conflict. While the symptoms may be easy to spot, the root causes are more difficult to discover and sort out. In some cases, individuals may have hidden agendas that have little to do with the objectives of the development exercise.

Positive Aspects of Conflicts:

- Starting point of positive changes
- People become realistic
- Provides checks and balances
- Source of knowledge
- Leads to better management strategies

Negative Aspects of Conflicts

- Expensiveness
- Delays progress
- Brings in new conflicts (spill over conflicts)
- Brings unemployment
- Lack of unity
- Destruction of habitats

Seeking Resolution

There are necessary trade-offs between individual objectives and group objectives. Discussions may not then be about building consensus but developing an understanding and should revolve around making decisions, assessing the evidence and/or formulating conclusions. The problem-solving and decision-making methods most often employed in conflict management are conciliation, negotiation, mediation and arbitration.

Conciliation is an attempt by a neutral third party to communicate separately disputing parties for the purpose of reducing tensions and agreeing on a process for addressing a dispute.

Negotiation is a voluntary process in which parties meet face to face to reach a mutually acceptable resolution of issues

Mediation involves assistance of a third party in negotiation process, where a mediator assists the parties in reaching their own agreement but has no power to direct the parties or attempt to resolve the dispute

Arbitration is a process of settling an argument between two people or groups by a third person (who has been chosen by them).

These processes are found in traditional and modern community dispute resolution systems. Many traditional leaders have extensive experience in dealing with dispute within their own communities or between a particular community and outside interests, though not enough information is available about how these and other processes are carried out by local political systems in addressing disputes.

Managing conflict in alternative ways seeks to find ways of how people can make better decisions together, particularly on difficult, contentious issues in a conflict through a facilitator, while building the following:

Trust: Among the parties involved in conflict, create an atmosphere and relationship of trust and co-operation that is conducive to fruitful negotiation and dialogue.

Understanding: Help bring parties, through improving communications between them, to identify and interpret the underlying issues of the conflict and possible options for a peaceful and sustainable solution.

Legitimacy: Enhance the prominence and efficacy of local actors (local organizations or groups) in playing a constructive role in the resolution of conflict.

Conclusion:

A key concept to develop with communities is their "right to constructive conflict". Too often, communities have been given the message that their rights are not important, or that their needs are inconvenient, unwelcome, or inappropriate. Contact with peer group that have succeeded in resolving problems against great odds can strengthen community self-confidence. Access to the legal tools and information base that will help them promote their own solutions is essential.

Conflict may be beyond a natural resources management officer's ability to resolve. In this case, it is important to understand this limitation, and call for outside arbitration or negotiation.

Module 6

Transboundary Natural Resources Management

6.1 Introduction

6.1.1 What is Transboundary Natural Resources Management?

The first task is to have a common understanding on what we try to address in Transboundary Natural Resources Management with particular reference to our regional situation in the SADC Region.

Transboundary Natural Resources Management (TBNRM) attempts to address the challenge of managing resources that are shared across international borders. Examples in our region would be the resources in Lake Kariba shared by Zambia and Zimbabwe, animals crossing the border between Kasungu and Luangwa game resources, the Lake Malawi resources shared between Malawi/ Tanzania and Mozambique.

TBNRM has been defined as "Any process of cooperation across boundaries that facilitates or improves the management of natural resources to the benefit of parties concerned.

6.1.2 What are the Objectives of TBNRM?

History is full of examples of conflicts between nations, which erupted because of differences in opinion on the management/ utilization of transboundary resources in our own region. Water resources in particular are potential sources of conflicts as they are increasingly becoming scarce and are viewed as an important component of national security. In response to the problem of resource management in border areas, initiatives, arrangements and protocols focusing on Transboundary Natural Resources Management have emerged in our region.

The objectives of these initiatives are summarized as follows:

(i) To improve conservation of shared resources that are being depleted or degraded.

(ii) To ensure that communities and other stakeholders benefit from sustain able use of resources.

(iii) To optimize region/ international distribution of benefits from resources use

Of course, we must realize that, specific proponents of TBNRM initiatives may also have their own particular objectives.

6.1.3 Traditional Management of TBNRMS.

Traditionally the people of the region from time immemorial have survived on combination of agriculture and harvesting of forest and aquatic resources.

Communities located near borders constructed by colonial governments, traditionally used the resources that are now separated by international borders. Even within countries, many communities traditionally used areas, which have since been designated as parks or are otherwise officially not accessible.

It is important for resource management initiatives in border areas to recognize how and when communities use resources across borders and if appropriate, to promote this resource use. Yet, these traditional forms of natural resource management are under threat from formalized models of TBNRM driven by the state, NGOs and donors. There are legitimate reasons for promoting these organic forms of TBNRM that have withstood the test of time. Initiatives that exclude communities from accessing resources that they traditionally use are likely to fail to gain community support. These models need to be understood and perhaps improved and not replaced by the more charismatic current initiatives.

6.1.4 Formal TBNRM Initiatives in the Region.

The high population growth rate prevalent in the SADC region has increased the demand and access to resources for sustenance and improved life. Infrastructural development and economic liberalization moves have extended the demand beyond traditional frontiers. Prior to these developments, formal sharing arrangements were generally not as necessary as they are now. Currently, because of greater economic and social pressures there is need for formal TBNRM initiatives in order to minimize conflicts and also to improve management of the transboundary natural resources.

These initiatives can be grouped into:

(i) Transfrontier Conservation areas.

(ii) Transboundary Natural Resources Management areas.

(iii) Regional Authorities and protocols.

(iv) International Convention and Agreements.

Type of initiative	Proponents	Main objective	Main land Use types	Beneficiaries
Transfrontiers Conservation Area (TFCA)	• International Organisations, wildlife departments, donors national governments	• Long term conservation of wildlife	• Protected areas game reserves hunting concessions	• Protected areas interests • Spin offs to communities
Transboundary Natural Resource Management Area	• Communities, NGOs, donors, governments	• Community-based NRM across international borders	• Variable, often community lands	• Local government and local communities
Regional Authority or Protocols	• Bilateral governments or multi-lateral through SADC	• Establish basis for cooperation in management of specific resources such as water and wildlife	• Can be variable but include; water, power generation, wildlife, tourism and trade	• National government with trickle down effects
International Convention or Agreements	• SADC and International Communities	• establish basis for cooperation in management of resources and the environment internationally	• Wildlife, trade in endangered species, water toxic waste biodiversity	• National government with trickle down effect

Table 6.1:

Common types of Formal Initiatives in the SADC Region

Transfrontier Conservation Areas (TFCAs) also known as Transborder Conservation Areas (TBCAs) are based on linking one or more protected areas in neighbouring countries. These initiatives have focused predominantly on large animal populations that require large contiguous areas of habitat. The private sector has been very actively involved in TFCAs in an effort to generate revenue through tourism.

Several principles that guide the implementation of TFCAs process have been identified. These are;

(i) Agreeing to participate in a Transfrontier Conservation area.

(ii) Participation does not lead to loss or dilution of national sovereignty

(iii) Each country is not required to pursue a particular model of conservation in its park

In this type of arrangement, it provides the opportunity for the integration of local communities and could allow related communities in neighbouring countries previously separated by the park and international boarders to re-establish links. In practice, however, TFCAs have been pushed forward at a rapid pace without much time for consultation with communities and other stakeholders.

6.1.5 Transboundary Natural Resources Management Areas

Transboundary Natural Resources Management Areas (TNRMs) include any area straddling a border in which there are management of transboundary resources. One example is the ZIMOZA initiative (Zimbabwe, Mozambique and Zambia) where the three countries aim at improving sharing, exchange and management of resources and tradable goods among communities in the three countries. This initiative is driven by communities and the state, and does not involve any protected area.

6.1.6 Regional Authorities and Protocol

Various regional and subregional authorities, protocols and other agreements have been made that commit nations to cooperate on management of transboundary resources. Management bodies such as Zambezi River Authority (ZRA) involve two or more countries and transfer decision-making power from nations to subregional bodies. In the case of ZRA, upstream actions can have a major transboundary impacts on down stream Mozambique.

In general, these protocols commit a country at a general level but do not include specific recommendations that are binding.

6.1.7 International Convention

International conventions and treaties exist which bind nations in SADC and else where, to a particular commitment aimed at conserving specific resources. For example, the Convention for International Trade in Endangered Species (CITES) controls opportunity for trade in animal products among nations and therefore limits opportunities for wildlife used by communities.

6.2 The Importance of TBNRMs

6.2.1 The Role

There is a strong need for formal management of transboundary resources, based on the theory of common property, and the so-called "tragedy of commons". The theory was proposed by Hardin (1968) and holds that resources such as rivers, lakes, oceans, grazing lands that are not privately owned or controlled are susceptible to overexploitation. The underlying factor is that individual resource users gain full benefits of using the resource but only bear a portion of the costs of overuse. Individual users will continue to use the resource even if the collective rate of resource use is unsustainable.

Natural Resources which are shared across international borders can also be characterized as commons because users cannot control use or impacts caused by other actors on the opposite side of the border. As pressure on natural resources increases in the region due to human population growth, poverty, and other factors there is growing concern about the sustainability of transboundary resource use. Many resources are shared across international borders in the region. For example, several countries in the SADC Region, share a major river basin with at least another country. The Zambezi River basin alone spans eight countries in the region. Resources such as drinking water, fish are therefore held in common among nations. Other resources such as wildlife populations are also shared across borders because of migratory behaviour and other characteristics. Even resources that are stationery such as forests are often regarded as transboundary if they have traditionally been accessed by cross- border community.

Overcoming the tragedy of commons through management has its own inherent problems. First, while the governments generally have power on use and authority to regulate resource use within their borders, they do not have authority and power to regulate resource use across borders. Thus boundary resource management requires cooperation among governments, which is voluntary and not mandatory. In the case of Zambezi River basin, the Zambezi River Authority was established between Zimbabwe and Zambia to manage the Kariba dam and to develop other dams along the river where it flows between the two countries. Second, actual or perceived inequities in resource use between nations can inhibit cooperation. Third, scientific uncertainties about the status and trends in resource abundance hinder decision-making and therefore often contribute to overexploitation. Often data on resources are incomplete and uncertain. Fourth, uncertainties also complicate attempts at international cooperation over environmental issues because nations are

unsure and therefore disagree over the consequences of agreements for themselves and other nations. Fifth, international law for management of transboundary resources is poorly developed in Southern Africa. It is believed that weak polices and legal frameworks are largely responsible for poor management of shared resources.

6.2.2 Promotion of Peace and Security

A further justification for transboundary initiatives is peace and security. TBNRM provide a non-military model for addressing conflicts and promoting stability in the region, while some of the factors contributing to human insecurity in the region are natural disasters such as floods, cyclones, drought, many are human induced such as pollution, and natural resources degradation. Inter-state conflicts and competition over control and access to natural resources are likely to escalate as the region's population increases. The situation is exacerbated by a history of civil war and destabilization that has displaced many families within their countries and at times has forced many others into refuge camps in neighbouring countries. While the region has finally emerged from a protected period of liberation- inspired by armed struggle in Angola, Mozambique, Namibia, South Africa and Zimbabwe, military conflicts have not disappeared. The region has been and is experiencing violent post independence military conflicts.

Examples are:

(i) Civil war in Angola with some incident, spilling over to Namibia and Zambia

(ii) Namibia itself was threatened by civil war in August 1999 when a separatist group attacked the town of Katima Mulilo in the Caprivi Strip demanding cessation

(iii) Democratic Republic of Congo has been at war since the overthrow of Mobutu in 1998

(iv) In September 1998 a combined force of South Africa, Botswana forces entered Lesotho to prevent the overthrow of the government

While the region is connected in many ways ranging from shared cultures and tradition to infrastructure (roads, rail and electricity grids), trade and shared resources, many SADC countries are competing for shared water resources. At least 15 major river systems in SADC are shared by two or more riparian states. These river systems define the international boundaries of most of these countries adding another potential point of conflict since it is sometimes difficult to define the

precise location of international boundaries allocated along river systems. Example of such boundary disputes include:

(i) Sedudu/Kasikiti Island between Botswana and Namibia

(ii) South Africa and Namibia on Orange River - both agreed to relocate the boundary at the deepest part of the channel

(iii) River Songwe on Tanzania/Malawi border

These realities are worrying for natural resources management.

6.3 Key Issues and Concerns

Transfontiers arrangements are opportunities for building upon past experience of Community-Based Natural Resources Management (CBNRM) in the region, enhancing biodiversity conservation and creating economic opportunities for private investments. It is hoped that these TBNRM initiatives will contribute to the improvements of quality of life to people of the rural areas. However, history of several TBNRM raise a number of concerns.

6.3.1 The Pace of Implementation

The urgency and the pace at creation and implementation of transfrontier conservation areas raise serious areas of concern. The region lacks experience in managing mega conservation areas and yet in 2000 two agreements were signed, creating the Kgalagadi (Botswana and South Africa) and Gaza - Kruger - Gonarezhou (GKG) (Mozambique, South Africa and Zimbabwe) transfrontier parks. The GKG is reportedly expected to cover an area of 100 000 sq. km and is likely to involve the removal of local communities to make it a reality. Despite benefits to community interests, there is no evidence that local communities have been consulted and are aware of the long-term implications. Without the benefit of past lessons and experiences there are several other TFCA initiatives that have been identified and await formal agreements. This include:

- Limpopo/Shashe TFCA (Botswana, South Africa, and Zimbabwe)
- Richtersveld/Ai - Ais TFCA (Namibia and South Africa)
- Maloti/Drakensberg TFCA (Lesotho and South Africa)

All three promoted and supported by the Peace Parks Foundation, a South African based non profit organization. These initiatives show clearly that South Africa through Peace Parks Foundation and some key donors are driving TFCAs in the region.

The main concern regarding the current approach by NGOs, the private sector and donors is ill-defined framework and context. In the past these initiatives have yielded lopside benefits in favour of initiators although claiming to be strengthening human rights of local communities,and enhancing their control over local resources. If the time is taken to legitimately frame and construct these initiatives, TBNRM can contribute to natural resources management.

6.3.2 The Role of the State in TBNRM.

The role of the state in TBNRM is important since cross border resource management improvises on issues of sovereignty and national security. For instance, many of the parks proposed as frontier conservation areas are also sites of national security management in curtailing insurgency and poaching. Under CBNRM the role of the state has been challenged, and at times reduced to that of a "facilitator ", guarantor and enforcer of rights. TBNRM, on the other hand will challenge the power and nature of national state. This raises the question of the extent to which SADC member states are willing to cede power, or autonomy to regional supra-national structures.

Furthermore, cross-border cooperation is creating new patterns of resource ownership and placing additional demands on national governments in terms of administration and technical capacity. The supporting technical capacities that these resource arrangements demand at regional or global levels require matching skills in terms of enabling policies and negotiations. Experience of the past indicates several national governments in the region are struggling to cope up with the new burden. There is therefore a threat to the success of TBNRM initiatives in form of unequal implementations, which may become a potential source of conflict.

6.3.3 The Shift from Agriculture to Wildlife and Tourism

Many TBNRM initiatives are focused on trying to convert the rural areas into tourist destinations. The approach is generally to try and generate income primarily from wildlife and not crop and livestock production. It is hoped under such scenario that rural communities could act rationally, use economic benefits from ecotourism and big game hunting to buy food. This rationale led to the creation of CBNRM initiatives such as Communal Areas Management Programme for Indigeneous Resources (CAMPFIRE) in Zimbabwe.

There are several problems with the rationale. First, there are social disruptions and displacement of people. In the case of Zimbabwe, the establishment of campfire areas required partitioning of land for wildlife and agriculture. This led to the displacement of people from their established homes, fields and grazing areas to make way for wild animals.

In Mozambique, communities residing in Coutada 16, face possible eviction if the proposal by the Gaza - Kruger - Gonarezhou TFCA to fence Coutada 16 as an extension of Kruger National Park goes ahead. People will be moved to make way for the relocation of about 1,000 elephants.

Another area of concern, the switch from agriculture to tourism as a source of livelihood makes communities vulnerable to shifts in the tourists which are outside of their control. When tourism revenue decline due to political unrest or to changes in preference in tourists, communities could easily be faced with food security problems. It is appropriate to question whether it is right from a human security perspective for communities to rely on a source of livelihood that is largely outside of their control.

6.3.4 Poor Community Consultation and Participations

Many of transboundary initiatives make references to involvement of local communities. The nature of this "Community involvement" needs to be articulated since such involvement could be limited to the extent to which local communities act as a labour pool. For the success of these initiatives, they should address local community values, interests. The benefits of such initiatives must outweigh the costs from the community's perspective.

Another area of concern is relating to the unequal power relations between the potential parties interested in formalizing TBNRM. The state and private sector have greater lobbying capacity and power to influence direction of policy. NGOs can represent the interests of communities provided they do not allow their internal agenda to undermine their credible role as a mediator. Thirdly, the poor harmonization of policy and legislation between neighbouring countries may result in conflicts between users of resources such as fish quotas where two countries establish different quotas.

6.3.5 Inter-state Inequalities

The problem of distribution of and access to finance, technology and skills is not limited to inter- state inequalities. At regional level inter- state inequalities may arise from differing endowments and the dominance of the larger and economically powerful states like South Africa and to a lesser extent Zimbabwe. These differences tend to be a source of resentment among states in the region. The implementation of TBNRM initiatives could easily be undermined by the fact that South Africa and some donors have emerged as key proponents of TFCAs. This also raises concern that the justification for TBNRM is located externally to the region and is being driven by international trade and particularly interested in tourism at the expense of community.

6.3.6 Poor Devolution of Rights

One key failure of CBNRMs which persists in case of TBNRM has been poor transfer of rights of land, resource and decision-making powers to local actors. In most countries in the region, NGOs and donors have been instrumental in driving the CBNRM agenda towards greater local control over natural resources. Despite these efforts, transfer of rights to local actors in most countries has been partial and mainly to diffuse conflicts between the state and rural communities. Further, there is generally lack of commitment by the state to release power to local actors, despite numerous policies advocating devolution. Under such condition it is doubtful to accept TBNRM to go beyond unfulfilled promises of CBNRM.

6.4 The Way Forward

Based on experience of the past four years, there are a number of suggested recommendations regarding the way forward for TBNRM in South Africa.

6.4.1 Building Capacity

The success of transboundary initiatives will depend largely on the capacity of national governments to facilitate national level dialogues, provide meaningful and informed inputs in the design of initiatives and negotiate with other countries. As stated in previous sections, unequal partnership will undermine the success of transboundary initiatives.

Secondly, transboundary initiatives are creating new and additional demands on skills. This means that the countries of the region must develop a new cadre of expertise capable of handling transboundary complex issues.

6.4.2 Slowing the Pace of Implementation

There are a number of reasons for slowing the pace of signing and implementing transboundary agreements, these include the need to:-

- Consult and ensure broad participation in policy and specific initiatives within and between countries
- Incorporate lessons from past experience into the design and planning of new TBNRM initiatives
- Build capacity among interested parties so that the skills of potential partners do not skew power relations and the outcome of any agreement
- Collect and analyse baseline information and to share that information with all stake holders.

6.4.3 Documenting Lessons from CBNRM

Over the past few years many Community- Based Natural Resources Management initiatives have been implemented which attempt to facilitate the sustainable use of local resources by communities. CBRNM policies are still evolving in many countries in Southern Africa. Experience in Zimbabwe and Namibia offers examples of where considerable progress has been made but also illustrates some difficulties that must be overcome if CBNRM is to become a meaningful option for both

communities and environment. Although these initiatives do not necessarily focus on transboundary resources, many of them do include transboundary resources depending on location of communities. The experiences of CBNRM are basis for the enthusiasm in TBNRM. Given the wide range of CBNRM initiatives, there are lessons which must be learned such as:-

(i) Devolving rights and powers to the local communities

(ii) Gaining legitimacy so that partnerships are mutually beneficial and not dominated by the powerful and elite

(iii) Consulting and evolving a management system that is inclusive

(iv) Demonstrating community benefits in order to ensure community participation

6.5 Conclusion

In Southern Africa TBNRM is a reality and offers an opportunity for managing transboundary resources effectively. The challenge is not to frustrate the progress to date but rather to ensure that its design is right.

MODULE 7

Institutional, Policy and Legal Framework in Wetland Management

7.1 Background

Wetlands have fundamental ecological functions, as regulators of water regimes and as habitats supporting a rich biodiversity. They constitute a resource of great economic, cultural, scientific and recreational value that must be maintained. Progressive encroachment on, and loss of wetlands constitute serious and sometimes irreparable environmental damage that must be avoided. Wetlands should be restored and rehabilitated, whenever possible. In order to maintain wetlands for their functions and values, different member states are contracting parties to the Ramsar Convention. The Convention was adopted in the Iranian city of Ramsar in 1971, and came into force in 1975. As of 1st March 2000, 119 states were Contracting Parties and many others were poised to join. Ramsar is the only global environmental treaty dealing with a particular ecosystem.

The Convention's mission is the conservation and wise use of wetlands by national action and international cooperation as a means to achieving sustainable development throughout the world. Wetlands should be conserved by ensuring their wise use. Wise use is defined as sustainable utilization for the benefit of mankind in a way compatible with the maintenance of the natural properties of the ecosystem. Sustainable utilization is understood as human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. Wise use may also require strict protection.

The Convention on wetlands of international importance especially as waterfowl habitat is an inter-governmental treaty popularly known as the Ramsar Convention. At present the Ramsar criteria for wetlands of international importance include four clusters: unique wetlands, wetlands supporting specific species of plants and animals, wetlands supporting waterfowl populations and wetlands supporting fish.

Contracting parties of the Convention commit themselves to designate at least one site that meets the Ramsar criteria for inclusion in the List of Wetlands of international importance (the Ramsar List), and ensure the maintenance of the ecological character of each Ramsar site. Countries are expected to include in the List as many wetlands that meet the criteria as possible. As of 1st March 2000, the List included 1,021 wetlands (with a surface area of 75 million ha). Listed sites do not necessarily require protected area status, provided:

- Their ecological character is maintained through a wise use management approach
- Include wetland conservation within their national land-use planning, so as to promote the wise use of all wetlands within their territory
- Establish nature reserves on wetlands, and promote training in wetland research, management and wardening
- And consult with other Parties about the implementation of the Convention, especially with regard to transfrontier wetlands, shared water systems, shared species, and development projects affecting wetlands.

Furthermore countries are encouraged to establish Ramsar Committees, involving all relevant government institutions at central and lower level, dealing with water resources, development planning, protected areas, biodiversity, tourism, education, development assistance etc. The participation of NGOs and interest groups is also actively encouraged.

The significance, functions and values of Wetlands call for proper and appropriate management strategies in order to achieve the wise use concept of the Ramsar Convention. While the majority of the Wetlands in Africa are located in National Parks and have legal protection status, some are open access common resource. Therefore the management and conservation of Wetlands has to be understood within the institutional, policy and legal framework.

7.2 Institutional Framework:

Institutions are very important because they help us in achieving our objectives. For example, in order for contracting parties to achieve the concept of wise use, they need an institution or institutions to ensure this. Because of the natural properties of the ecosystem, many institutions are supposed to take part in the management and conservation of wetlands. By being party to the Ramsar Convention, it means that the contracting parties have agreed to manage and conserve wetlands in collaboration with the international community. The Ramsar Convention encourages the establishment of National Wetlands Committee, or Ramsar Committees, which can provide a focus at national level for the implementation of the Convention, involving all relevant government agencies, scientific and technical institutions, regional and local authorities, NGOs, community-based organizations, and the private sector, to deal with such issues as:

- National wetland policies
- Management of Ramsar sites and other wetlands
- Inclusions in and deletions from the Montreux Record of sites with particular conservation problems
- Inclusion of new sites in the Ramsar List of Wetlands of International importance
- Submission of project proposals for the Ramsar Small Grants Fund

Each contracting party is invited to designate a national governmental agency to act as the Administrative Authority of the Convention in the country. Since in some countries wetlands fall within National Parks, the Government's Department responsible for National Parks takes the responsible for the management and conservation of the wetlands. The Department of National Parks and Wildlife as the Administrative Authority of the Convention in a country may work with other collaborating agencies in order to achieve wise use concept.

In countries where the Wetlands are not within a designated protected area, an Administrative Authority is of critical importance. At the local level, there is also need to establish institutions that will manage and conserve Wetlands at that level, the Administrative Authority may be at the central government level while the other institutions should be at the local government level. Institutions can be formal or informal and some can be recognized while others not, but in whatever form, institutions should be created in order to achieve our objectives.

7.3 Policy Framework:

Policy is a course of action aimed at achieving one or a set of objectives and (usually) adopted on the basis of an assessment of opportunities, constraints and alternative options (Barley & Pullin, 1999). Thus, policies involve clearly stated objectives, choosing among options based on opportunities and constraints, strategies to implement them, and instruments that facilitate implementation and resolve conflicts. In order to progress towards policies, it will be necessary to understand the resources that humans wish to use and conserve and to understand the institutions that will be involved. Most of the time, policies for the conservation and sustainable use of Wetland resources are poorly developed and in some countries, policies on Wetlands do not exist. As such there is need to examine policy development more closely by including legal, political, ethical and economic issues in conservation and use scenarios, and to acknowledge that action is needed urgently, despite scientific uncertainty.

Wetlands provide a wide variety of biophysical and socio-economic functions. However these benefits may be in jeopardy due to poor management practices. Many countries like Uganda, the UK and Australia have adopted National Policies for the conservation and management of Wetland Resources to promote their conservation in order to sustain their values for the present and future well being of the people. Uganda is considered as a world leader in policy planning.

Although Wetlands conservation and management is a shared responsibility for all people, the government has a leading role to play. The various functions and related problems of Wetlands are critical for their sustainable use and the general socio-economic development of the nation. It is also an international responsibility of government to conserve wetlands and sustainably utilize them under the Ramsar Convention on wetlands of international importance especially as waterfowl habitats, of which many countries like Uganda, Malawi, Botswana, Namibia, South Africa, Zambia are a signatory and Contracting Parties.

In the case of Uganda, for the government to carry out these shared responsibilities with respect to the country's wetlands, it has outlined broad aims, which are also supported by a number of specific goals. Further, guiding principles will be presented to govern the manner in which the national policy for the conservation and management of wetland resources will be implemented.

For some countries the national policy on the Conservation and Management of the Wetland resources complements the goals and objectives of the National Environmental Action Plan (NEAP) process and sectorial policies including those of

fisheries, forestry, wildlife, water, land tenure and soils, among others, as well as the Ramsar Convention on wetlands of international importance especially as Waterfowl Habitats as in the case of Uganda National Policy. The Chinese government has recently published its National Wetlands Conservation Action Plan and has designated the State Forestry Administration, as the focal point for Ramsar implementation. The country has considerable problems in wetland management, especially from the serious threats caused by human activities and it is believed that the Action Plan would be helpful for awareness strengthening and government guidance.

The beauty of policies is that institutions are easy to develop as each goal has its own strategies and one just picks which institution should implement the goal. Policies can be public or private. National Policies on Wetlands are public. Policy must have the support of those that must follow it. This support will only come from understanding the issues, understanding the underlying basis for policy decision, and having confidence in decision makers. Policy must be underpinned with science, but with awareness that the public expect policy to reflect the information they get from others and personal experiences.

7.4 Legal Framework

This largely entails the legislation, the ownership, use and access to wetlands and their resources, culminating into an Act of Parliament. Before the law can be applied to an area of wetland we must be able to legally define what a wetland is and how the boundary between the wetland and the dry land can be identified and located on the ground. In most countries like Uganda, Wetlands are not and cannot be owned by any person or individual. No one person can lay claim of any wetland or part of a wetland if that claim was made after the coming into force of the constitution of 1995.

For people whose land already has wetlands in it before the coming into force of an Act they are under an obligation to observe sections of the Act. The Government and Local Governments hold wetlands in trust for the good of all citizens

In July 2000 Australia's national government announced landmark legislation – the Environmental Protection and Biodiversity Conservation Act 1999 – which gave special legal status to Wetlands of International Importance and migratory birds, which are declared to be of "national environmental significance" and given protection.

Acts of Parliament set out the legal obligations for Ramsar sites, which include describing and maintaining their ecological character, formulating and implementing planning to conserve them and promote wise use, preparing a management plan and the standards of impact assessment which will apply should this be required. The Act of Parliament has a legal mandate to enforce its activities.

Wetlands, as such, have lacked comprehensive treatment by lawmakers. The many types of threats to, and potential uses of, aquatic resources have tended to trigger their own responses – sometimes complementary, sometimes overlapping. The Convention on Biological Diversity (CBD) has three principle objectives, set forth in its first article. These are:

1. the conservation of biological diversity;
2. the sustainable use of its components; and
3. the fair and equitable distribution of the benefits arising out of the utilization of genetic resources.

Under article 8, countries are obligated to establish *in situ* conservation strategies. This includes the development of protected area systems (article 8a); however the

obligation to regulate and manage "biological resources important or the conservation of biological diversity" applies both within and without protected areas (article 8c), including such requirements as the maintenance of viable populations of species in natural surroundings (article 8d) (Leria, 1999). The National Assembly, also known as Parliament has a sole mandate of enacting Acts as it is the only body that can make laws. For countries like Uganda who have laws in place that deal with Wetlands, they have legal basis of demanding utmost care from users of Wetlands.

There is need to sensitize our members of parliament on the existence of wetlands in our respective countries, their functions and values and also the Ramsar Convention of which many countries are signatories and contracting parties.

Biophysical Assessment of Wetlands and Catchments

Introduction

Presently, the use of wetlands is often planned from the narrow perspectives of those who use the wetland directly (e.g. for pasture production). Little attention is generally given to the impacts of land-use activities on indirect wetland benefits to society (e.g. water purification and biodiversity support).

In response to this situation, a wetland management decision support system is used to assist extension workers in providing sound land-use advice and encouraging wetland users/owners to give consideration to the impacts on indirect benefits provided by wetlands. The system has two components, the first deals with the biophysical aspects of wetland management and planning and the second dealing with the social and organizational aspects.

A. Wetland Site Information

Requirements:

Determine What You Would Require for this Practical

How to gather information:

1) Do a preliminary delineation of the wetland boundary on the map.

2) Read through Descriptors to see what information is required.

3) Always obtain permission from the landowner/authority to visit the wetland.

4) Inspect the wetland in the field with the aid of transects. Complete each transect by starting outside of the wetland, finding the boundary of the wetland and walking in a straight line across the wetland. At least one transect every 500 m to 1000 m of the wetland is required, depending on how varied the wetland is. If the wetland is very varied and has many land-uses applied to it then transects at more regular intervals are likely to be required. Mark the transect/s on the maps. For each transect note the percentage distance occupied by the temporary, seasonal and permanent zones respectively. To help you identify the zones take soil samples along the transect. Also, take particular note of features not easily visible from the air-including: artificial drains; the extent and species of alien plants; details of crops (e.g. annual or perennial) and important localized features such as headcuts of erosion gullies and point sources of pollution.

5) Mark the location of the important localized features (e.g. headcuts of erosion gullies) on the map and take photos of those that may require management attention.

6) From a vantage point take a panoramic photo of the wetland.

7) For particularly large wetlands (i.e. > 50 ha) complete separate data sheets for the different portions of the wetland.

1. Date/s of site visit/s .....

2. Name, address & tel. of:

2.1) Wetland assessors

.....

.....

.....

.....

2.2) Wetland owner or management authority

.....

.....

.....

.....

2.3) Wetland name

.....

3. Geographical coordinates .....°.....'S.....°.....'E

B. Local Soil Types and Water Table Regimes

Information Gathered for Water Table Regimes of Individual Transects

Transect Number	Percentage distance			Notes
	Temporary	Seasonal	Permanent	
1				
2				
3				
4				
5				
6				

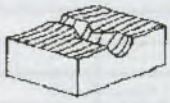
Soil Types

Transect Number	Soil Type			Notes
	Temporary	Seasonal	Permanent	
1				
2				
3				
4				
5				
6				

Landform Setting/s Which Best Describes the Form of the Wetland

Channel: a water course, which may be shallow or deep but always has clearly defined margins .....

Hill slope: situated outside of valley bottom areas and is characterized by colluvial (i.e. transported by gravity) movement of material .....



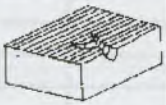
Channelled valley bottom: a valley bottom area, often described as a floodplain, through which a channel passes.....

* flooding from the main channel is frequent (i.e. more frequently than one out of every three years) .....

* flooding is infrequent .....

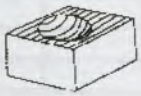
Valley bottoms are the low-lying areas of a valley characterized by the alluvial transport and deposition of materials by a stream/river.

Flow concentration area: that area where diffuse flow, either across a non-channelled valley bottom or down a slope, concentrates to flow within a channel. .....



Non-channelled valley bottom: a valley bottom area lacking a channel (and therefore characterized by the diffuse flow of water across its surface).....

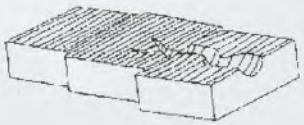
Depression: a basin shaped area which is inward draining and has no outlet and usually does not have clearly defined margins.....



*found within a valley bottom area .....

*found outside of a valley bottom area .....

Remember that a wetland may consist of a combination of landforms. One of the commonest of these, particularly in large wetlands, is shown here: In this case you would mark all of the three landforms as present.



C. Forest Resources, Species Composition/Diversity

Transect number	Forest resources composition				Notes
	Species composition %	Stand Class*	Stocking factor**	Natural vs Artificial (%)	
1					
2					
3					
4					
5					
6					

Stand class: This is a rating of site productivity or site class. A site class 1 would be the most productive for the species, a site class 3 the least productive. Site class 2 is average.
**Stocking factor:* This is the stocking factor, compared to what the stand could actually support. A stand that is normally or fully stocked would have a stocking factor 1.

Vegetation Type

Transect number	Vegetation Type
1	
2	
3	
4	
5	
6	

Recorded **Red Data** (threatened) animal and plant species found in the wetland

1. .....
2. .....

Note: a single site visit is not sufficient to identify all Red Data species that may be present, as some are difficult to observe and are not identifiable or are absent during certain seasons. Consult the relevant Offices for Information.

D. Water Quality Parameters

Basic Water Quality Parameters

Station number	Basic water quality parameters				
	Air Temperature °C	Water Temperature °C	Dissolved Oxygen (mg/L)	Conductivity µS	pH
1					
2					
3					
4					
5					
6					

E. Existing Fisheries Resources

Station Number	Fish species
1	
2	
3	
4	
5	
6	

F. Wetland Habitat Locations for Wildlife Within the Transects

Transect Number	Wildlife species
1	
2	
3	
4	
5	
6	

G. Aquatic Macro-benthos

Station Number	Benthos
1	
2	
3	
4	
5	
6	

Percentage area and Rating of On-site Land-use Impacts on the Indirect Wetland Benefits

	Percentage	Level of impact*			
		Negligible	Low	Med.	High
Dams					
Weirs					
Planted pasture					
Subsistence crops					
Commercial crops					
Forest plantation					
Building/infrastructure					
Informal settlement					
Eroded land					
Alien invasive species					
Natural vegetation					
Livestock grazing					
Deforestation of natural vegetation					
Hunting					
Fishing					
Medicinal plant harvesting					
Water abstraction					
Bird-watching					
Solid waste (litter)					
Roads					
Powerline					
Other(s)					

Note: "impact" refers to an effect which reduces the indirect benefits supplied by a wetland.

What is the frequency

(e.g. every year) and timing (e.g. dry/rainy) of burning?.....

Land ownership types in the wetland and estimated % contribution of each land ownership type (indicate the boundaries on the wetland map)

Privately owned land .....

Declared protected area .....

Government owned/ municipal land .....

Natural Heritage Site*.....

Communally owned tribal land .....

Site of Conservation Significance* .....

*These are not land ownership types but are of relevance to the use of land.

Is there evidence of high nutrient concentrations entering the wetland (e.g. algal blooms or actual measurement of high concentrations)? .....

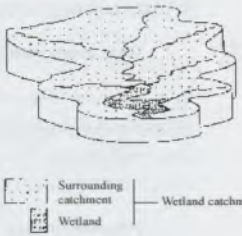
Is there evidence of waterborne toxicants entering the wetland (e.g. fish kills or actual measurements of hazardous concentrations)? .....

Water-associated diseases (e.g. bilharzia) known to be present in the wetland. .....

Is the wetland culturally important and, if so, for what reason (e.g. it is a site for religious ceremonies).....

H. Catchment Information

Requirements: Map. The "wetland catchment" refers to the area up-slope of the wetland (from which water flows into the wetland) and includes the wetland itself. The "surrounding catchment" excludes the wetland itself.



1. Land covers in the surrounding catchment and the approximate % area under each.

C1. Land covers in the surrounding catchment and the approximate % area under each.

		With irrigation?				
Planted pastures	☐ .....%	Yes ☐	No☐		Dams	☐ .....%
Subsistence (non-mech'ed) crops	☐ .....%	Yes ☐	No☐		Eroded land	☐ .....%
Commercial (mechanized) crops	☐ .....%	Yes ☐	No☐		Buildings & informal settlements	☐ .....%
Commercial sugar cane	☐ .....%	Yes ☐	No☐		Mining	☐ .....%
Forest plantations	☐ .....%				Natural vegetation	☐ .....%
					Other:	☐ .....%

2. Extent to which the natural runoff is being reduced by land-uses in the catchment that reduce runoff (i.e. damming, irrigation and afforestation).

Negligible .....

Low .....

Moderate .....

High .....

3. Level of sediment input into the wetland. Sources contributing sediments in the wetland's catchment include: areas (>0.5 ha) which are cultivated or eroded land, roads, surface mines and forest plantations.

Negligible .....

Low .....

Moderate .....

High .....

Note: the closer a sediment or nutrient/toxicant source is to the wetland the more likely it is to contribute to input into the wetland, particularly if it is connected directly to the wetland by a stream.

4. Level of nutrient/toxicant input into the wetland. Non-point sources in the wetland's catchment include areas (>0.5 ha) of fertilized crop or pasture land; areas (>0.5 ha) where the density of houses with septic tank systems exceeds 6 houses per ha; Point sources in the wetland catchment that may contribute pollutants include sewage or industrial outfalls, dairies or feedlots.

Negligible .....

Low .....

Moderate .....

High .....

5. Based on the descriptor values for 3 and 4, indicate the level of combined sediment and nutrient/toxicant input.

Negligible .....

Low .....

Moderate .....

High .....

I. Downstream Information

Requirements: determine the requirements

All wetlands are considered to be hydrologically important, and the two descriptors below seek to determine whether a wetland is particularly important from the point of view of having *identifiable* downstream beneficiaries. This concerns the extent of water use and floodable properties downstream of the wetland. This information is useful in determining the hydrological benefits currently being provided by a wetland. Although enhancement of sustained streamflow is not considered specifically, water users deriving benefit from water purification are also likely to derive benefit from sustained streamflow. Ability of a wetland to influence water quality and attenuate floods decreases with increasing distance downstream of the wetland outlet, and from an assessment point of view it becomes increasingly impractical to assess downstream influence as downstream distance increases. A cut-off of 12 km is used. It should be emphasised, however, that there are several interacting factors determining the wetland's distance of influence, including the size of the wetland and the influence of tributaries entering downstream.

1. Is there direct use of stream water downstream of the wetland by people for irrigation, stock watering or, particularly, for domestic use?

Yes .....

No .....

2. Is there floodable property downstream of the wetland?

Yes .....

No .....

J. Overall Current State and Future Threats

1. Assess the overall level of impact on the wetland based on on-site and catchment impacts.

Negligible .....

Low .....

Moderate .....

High .....

2. Likely future changes (notably, active erosion and further invasion by alien plants)

.....

3. Which are the priority management activities that need to initiated? where

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Course Evaluation

13 participants attended the course from 10 SADC member states. These are their views summarised from the course evaluation conducted at the end of the course.

Course Logistical Arrangements

This section dealt with how transport, accommodation, meals and workshop venues were arranged.

Transport Arrangements

On transport arrangements many participants (69%) felt that the arrangements were just average. Despite this rating, some 30% felt that the transport to and from the venue usually delayed.

Accommodation

62% indicated that accommodation conditions were above average while 23% showed that the conditions were average. Some suggested that accommodation would be further improved by providing participants with self-contained rooms contrary to what was the case whereby a few did not have self-contained rooms. Cleanliness of the rooms was another area that needed improvement.

Meals

53% of the participants rated the meals as being average while 38% thought the meals were above average. 8% felt that the food was very poor. 23% indicated that the choice of what to take during the meal times was very limited.

Workshop Venue

The workshop venue was rated above average by 69% of the participants while 38% thought it was average. Some thought that the venue was far and therefore time was wasted travelling to the venue and some thought sanitation at the venue needed improvement.

General Course Review

Having attended this training all participants felt that they were confident to apply the tools and techniques acquired for planning and managing wetlands. All participants also indicated that they had good understanding of the main problems of and opportunities of integrated wetland management planning. They also indicated that they were able to explain better the concept of integrated wetland management to others in their communities and workplaces.

Course Design

92% of the participants were convinced that the course was more than relevant; it was very and absolutely relevant. As regards facilitation of the workshop, 46% thought it was averagely facilitated while another 46% indicated that the workshop's facilitation was above average. All participants felt that the course was applicable. Some liked the idea of using examples of wetlands from within the SADC region. The course content was rated by 85% of the participants as being at the right level. The teaching method was considered by 8% of the participants as being less appropriate for this course while the rest thought the teaching method was appropriate. To support this indication participants noted that the use of power-point presentations consolidated understanding of the course material yet others liked the balance that was there between lectures, practical sessions and group discussions. One participant thought there was too much spoon-feeding while another indicated that visiting a single wetland was not appropriate, several wetlands in the country should have been visited.

Course Style

All participants felt that the course style helped them to get to know other participants because there was sufficient time for interaction during group discussions as well as after lessons. The availability of more time for discussion also encouraged them to share and discuss their ideas and viewpoints. They also showed

that issues and examples used related to their experiences and there was enough time to reflect upon issues being taught.

General Comments

How useful was the course?

8 participants felt that the course was useful because they had learnt how other countries manage wetlands while four thought that the course was useful because they learnt how to do a state of the environment and management plan for wetlands and also how to involve communities in the process of wetland management planning. The thirteenth participant indicated that the course was useful because he had learnt a lot though he already had experience in wetland issues.

What have you liked most about the course?

The participants liked most the following:

- The free atmosphere to express oneself during the course (2 participants).
- Presentations and facilitation of topics such as transboundary issues, wetland types, information gathering, conflicts management and values, threats to wetlands, wetland management, planning and getting to know the wetland (6 participants).
- Handouts (1 participant).
- Integration of lectures with practical sessions (1 participant).
- Group discussions and presentation (1 participant).
- Knowledge gained during this course (1 participant).

What have you disliked most and why?

The participants disliked the following:

- Improper flow of information on timetable changes (7 participants).
- Time waster during travelling to and from the workshop venue (3 participants).
- Time allocation to practical sessions – less time was allocated to field sessions (1 participant).
- Power failure (1 participant).

What General recommendations would you make about the course?

- The course was relevant and there is need for a follow-up course/workshop (4 participants).
- All countries should respect Ramsar sites (1 participant).
- The course was well organised – a job well done (1 participant).
- Increase practical time (1 participant).
- Duration of the course should not exceed one month (2 participants).

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