THE IMPACT OF RURAL LIVELIHOOD STRATEGIES ON THE ECOLOGY OF ZAMBIAN WETLANDS: POLICY AND INSTITUTIONAL MANAGEMENT IMPLICATIONS [1]

by

Misael Kokwe[2]

[1] A paper presented for the Fifth Annual Common Property Conference of the International Association for the Study of Common Property, Bodø, Norway, 24-28 May, 1995

[2] Farming Systems Agronomist / Agricultural Coordinator, German Development Service - Zambia

ABSTRACT

RURAL LIVELIHOOD STRAGEGIES EFFECTS ON TE ECOLOGY OF ZAMBIAN WETLANDS: POLICY AND INSTITUTIONAL MANAGMENT IMPLICATIONS

BY MISAEL KOKWE - ZAMBIA

This paper presents an analysis of the linkages between the livelihood strategies of the rural communities and their environmental impact on the wetlands (common property) of Zambia. The biophysical and functional classification of specific wetland types is presented in a livelihood framework to illustrate their importance.

An analysis of the policy and institutional management implications for achieving sustainable livelihoods that do not undermine the ecological and social stability is presented. The focus of the policy analysis is on the environmental implication of the land tenure system where wetlands are mostly common property, legislation on natural resource utilization and the economic reforem programme being pursued by the Zambian Government. These policy implications are anlysed in the context of their negative environmental effects and suggestions for redressing this situation.

In the final analysis the paper explores the actual perceived roles of a hierachy of important management institutions related to the development of sustainable livelihoods bound to wetland ecology.

The community's role in the wise use of wetlands hasbeen neglected and suggestions for incorporation of people's participation in integrated natural resource management are outlined. The role of the traditional authorites as an effective tool for monitoring and addressing issues of livelihoods and the environment is discussed. The weak public service research and extension services for the development and dissemination of appropriate technologies are discussed in the context of the promotion of holistic and client driven services. The actual and perceived roles of the external development aid is examined and suggestions for redressing their latent contribution to wetland degradation is presented.

1 Introduction

Agriculture is the main livelihood option of the majority of the rural people in Zambia. As a coping strategy for food production and income generation, wetlands and uplands are used in an integrated manner by the rural people to achieve sustained livelihoods.

Wetland utilization has the potential to make a significant contribution to household food supply and cash income. A consideration of how to imporve the complementarity of strategies for food security, income generation and environmental sustainability in wetlands is particularly pertinent in this case. We need to identify key information needs which will enable us to identify the requiremtns for sustainable wetlands management.

The use of wetlands for productive activities is manifold. However, in certain parts of the country, significantly in the Western, Eastern provinces the use of wetlands for agriculture has a long history dating before the colonial era.

On the other hand, the use of wetlands expecially for crop and animal production in the northern half of Zambia is relatively new. It therefore follows that two distinct scenarios exist in the use of wetlands for agricultural production in Zambia. One presents a long history of rural peoples knowledge and social organisation in the utilization of wetlands, while the other presents an emerging use of wetlands brought about by the need to improve peoples livelihoods with influences from natural (eg. droughts, population growth, land degradation) and man made (eg. economic reforms, technology development) factors.

This paper presents an analysis of the linkages between the livelihood strategies of the rural communities and their environmental impact on the wetland common property. The objective of this analysis is an attempt to identify information and action needs in reinventing the commons with due consideration for social, environmental and economic stability of this key common property resource and the people who depend on it in their quest for sustainable livelihoods.

In the light of this objective the paper scrutinizes the policy implications highlighting the advantages and disadvantages of the existing policies and modes of implementation of development strategies for wetland utilization by local and external agents of change.

2 Occurance and types of wetlands in Zambia

Among the wetland types in Zambia two are of significant relevance to the livelihood strategies of the rural people. These are the dambos and floodplains. These will be the focus of this papers analysis.

Dambos are seasonally waterlogged, grassy depressions occurring frequently in the upper basins and around the headwaters of many African streams and their tributaries. Huckabay (1986) describes dambos as shallow linear depressions within the plateau surface into which runoff and seepage waters from adjacent interfluves collect. During and for some time after the rainy season, the dambos are waterlogged or flooded, but during the later part of the dry season most of them dry out at the surface. They are particularly prevalent on level or gently undulating surfaces but are found in a range of forms and position in the landscape.

While forming part of a larger set of wetland habitat, dambos have certain characteristics which place them apart from environments such as alluvial valleys and justify their study as a separate resource (Adams and Carter, 1987).

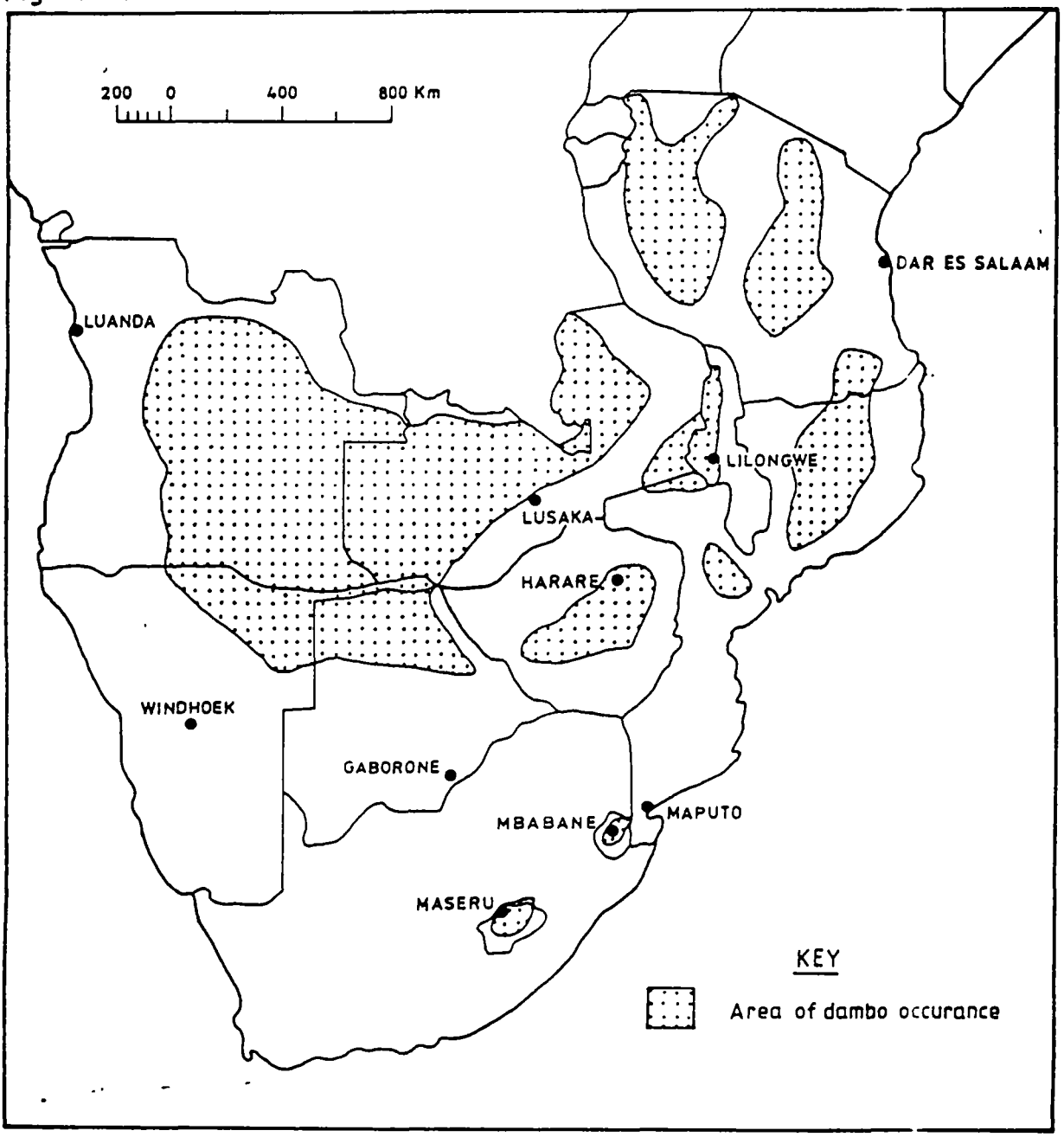
A number of important common features of dambos have been observed. Scoones (1992) outlined these as:

- Areas that act as drainage pathways or sinks for the surrounding dryland catchments.
- Areas with higher levels of soil moisture than the surrounding topland during the dry season and in droughts.
- Depositional areas where organic matter and soil nutrients accumulate, making the soil richer than the surrounding topland.
- Areas that are generally small in relation to overall available area, but have the potential for extended seasonal use and provide the opportunity for diverse usage.
- Areas that are often key components in sustaining rural livelihodds, both in agricultural and pastoral systems, as complements to topland, dryland use.

The general occurrence of dambos in southern Africa is shown in figure 1.

A transverse section of an upland dambo is shown in figure 2.

Figure 1 : THE GENERAL OCCURRENCE OF DAMBOS IN SOUTHERN AFRICA



Source : Chabwela , 1991a

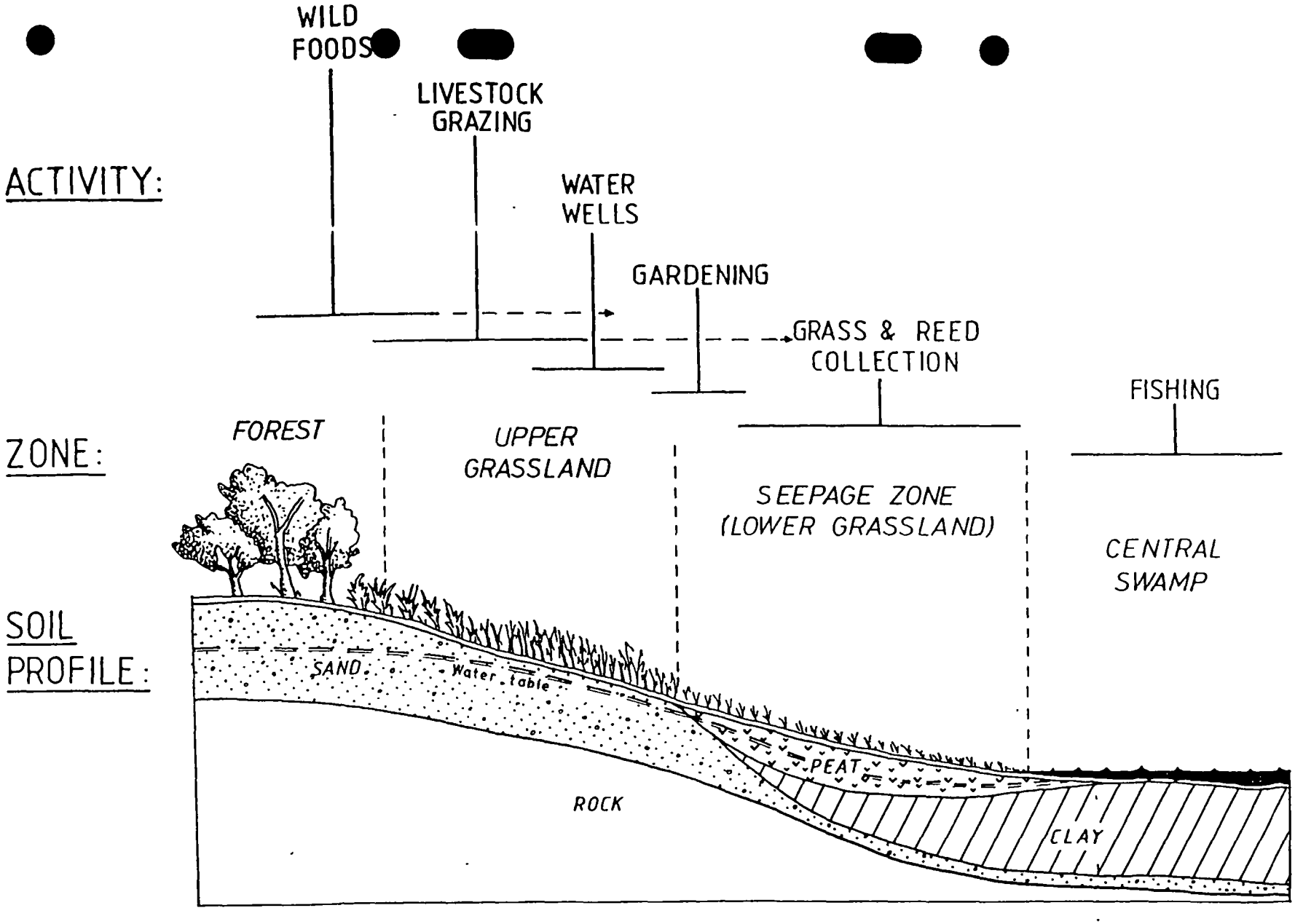


FIGURE 2 TRANSVERSE SECTION OF AN UPLAND DAMBO AND MAJOR ACTIVITIES ON DIFFERENT PATCHES

It is important to note that not all dambos are naturally suitable for agricultural activities. However their is scientific speculation and proof that with some management manipulations most of these dambos can be made useful to the benefit of the rural peoples livelihoods. It is estimated that dambos cover an area of about 3.5 million hectares representing 8.3% of the total arable land.

Classification of dambos

Verboom (1970) classified the plateau dambos into three categories and these are (i) sweet, (ii) intermediate, and (iii) sour dambos. His classification system is based on Soil pH and vegetation. The swamps and flood plains can also be classified in a similar manner.

Sweet and intermediate dambos occur mainly in the southern half of the country. Sweet dambos are found on soils developed from lime-rich rocks with a pH higher than 6.5. The main plant species found in sweet dambos are Acrocers macrum, Paspalum commersonii, Echinochloa pyramidalis, Setaria spp., Sporobolus spicatus and Hemarthria altissima. A feature of such dambos is an abundance of herbaceous legumes. The herbaceous legumes associated with sweet dambos are Teramnus gillettii, Alysicarpus rugosus and Aeschynomene indicus. Acacia trees are normally found on sweet dambo margins. Only a few sedges are found in these wetlands.

Intermediate dambos have soils developed from mixed sediments with a pH between 5.5 and 6.5. The species composition of the vegetation of these wetlands is a mixture between sweet and sour dambo species.

Sour dambos are common in the northern half of the country which receives heavier rainfall. Soil pH in these dambos is below 5.5. In the southern part of the country, they occur also over the granites and basement complex rocks. The vegetation found in sour dambos is characterised by many sedges. The grass species are, Andropogon encomus, Monocymvium cereciiforme, Elyoneurus argentens, Hyparrhenia bracteata, Aristida atroviolacea and Trachypogon spicatus. Desmodium salicifolium is the associated legume.

Crop production on the dambos is done in both the wet season when rice dominates because of its tolerance to waterlogging conditions and is usually planted on flat land. In the dry season vegetable production dominates where the vegetables are usually planted on ridges. Other crops include sugar-cane, bananas, mangoes (on the fringes).
Land preparation methods include;

(a) to burn the dead herbage to the site before hoeing
(b) to hoe in the vegetation as much as possible before raking the remaining loose turfts piles and burning them.
(c) incooperation of the vegetative material and completely covered with the soil as big mounds and left to decompose for some months. Then after decomposition the mounds are broken and the spread over the area to be planted and smaller ridges are made for planting crops.

Water management is usually by the use of simple drainage channels or planting on high ridges to avoid waterlogging but use the residual moisture (capillary action) and planting of crops with tolerance to waterlogging conditions such as sugarcane or rice (especially in the rain season)

Fertilizers and pesticides are commonly used for soil fertility improvement and protection against diseases and pests respectively.

2.2 Floodplains

The importance of floodplains is significant where they cover a large area. In the Zambian case the Zambezi floodplain in Western province, will be the focus of the analysis in this paper.

Two contrasting environments interact in this area (Western Province), the extremely infertile dry sands and the seasonally flooded valley floors with permanent seepage. This variation has resulted in the development of a distinct land usage pattern in which an exceptionally large variety of field (garden) types has evolved (Peters 1960, Shultz 1974). The more common types are described below. Peters (1960) based on survey data collected in 1948/49, estimated the total area under production in the Barotse floodplain as being about 29,000 hectares out of a total area of 74,424 hectares. Recent data (1988/89) indicates that around 40,000 hectares are cropped (Ndiyoi and Heermskerk, 1989).

Sitapa (plural: Litapa)

This field is situated on the fertile alluvial (clay deposits) soils in depressions, old dry river beds, on valley floors and floodplains (Peters 1960, Shultz 1974). The clay and silty loams are fairly high in organic matter and have adequate bases. The seasonal floods form a thin, new sedimentary layer which renews the fertility of the soil (Shultz 1974). The application of animal manure over long periods has also been cited (Ndiyoi & Heermskerk, 1989) as

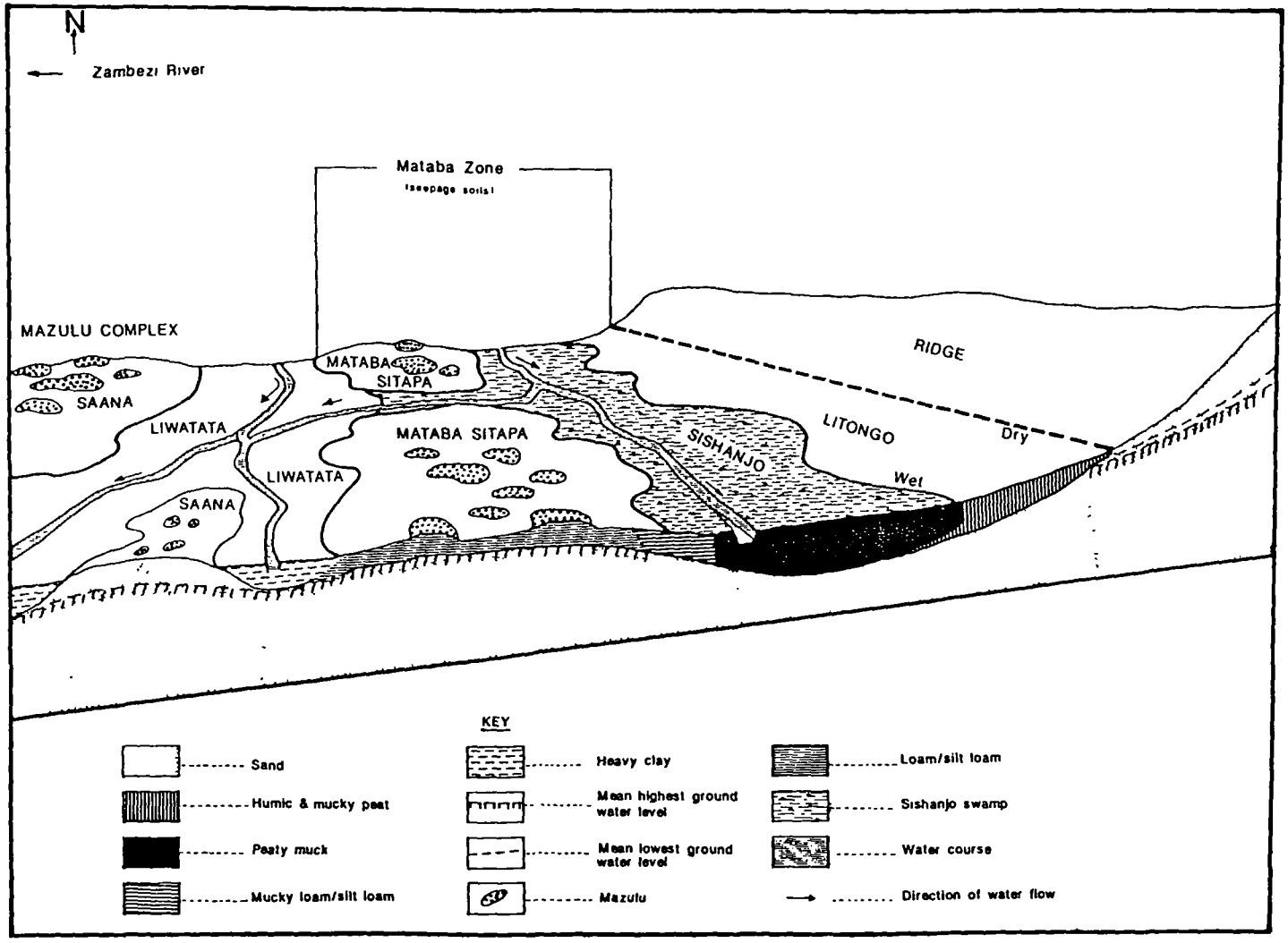


Figure 3 Land facets at the edge of the Barotse floodplain Source Mulungushi 1986

another factor responsible for the fertility of these soils. They have a high moisture holding capacity as a result of a high percentage of humus.

Maize is the main crop grown on the Litapa fields (Peters 1960, Shultz 1974, Ndiyoi and Heermskerk 1989). Other crops include sorghum, groundnuts, weet potatoes and tobacco (Peters 1960). According to more recent information, cucurbits and rice are also found (Ndiyoi and Heermskerk 1989).

The receding flood normally uncovers the Litapa sites in June and they are burnt, ploughed or hoed over the planted in July. The ground water level drops rapidly in the dry season, hence the success of the crop depends on early planting before the top soil dries out too much. It is also dependent on favourable rainfall in the early part of the rainy season to mature the crop before the flood once more covers the field in January or early February. This situation demands that the fields are prepared quickly and consequently the average size of the sitapa field is limited. But certain techniques are employed to increase the area of sitapa under crops. When planting in soil that had dried out at the surface, shallow pits are dug and the seeds, previously germinated in water, are planted in the bottom. Another technique involves planting the lower lying parts of the field first, and sowing them very thickly. Then during August and September the garden is extended on to higher ground. But his ground is not planted until the first rains have fallen, when transplants from the area first planted are used. Both techniques were found by Peters in 1960 and were explained to us during our interviews with farmers in the wetlands. Crop loss is frequent in sitapa cultivation either because the period between successive floods is too short or because the early rains fail. Cropping in the sitapa is therefore relatively productive, but risky under present conditions of crop management and water control. There has been a movement away from sitapa in recent times.

Lizulu (Plural: Mazulu)

Lizulu in Lozi usually refers to a garden made on an anthill of clayish loam soils on the floodplain. On the Barotse plain the Mazulu provide the most prized gardens and the only practicable site for building. Since there are comparatively few areas in relation to the population, they are highly valued.

Mazulu are dome-shaped mounds, typically 20-150m in diameter. Their surfaces are situated 1.5-3.0m above the general floodplain which makes them oftern the site for

settlements. The formation of these mounds have been attributed to semimentation, termites or human construction.

Maize is the main crop grown on the Mazulu and it is normally planted when the rains are well set in (Oct-Nov). Early maturing varieties are used to avoid the effect of the floods. At the centre of the floodplain Mazulu are liable to be partially submerged in February or March when the flood is at its peak. Other crops found on the Mazulu are sorghum and sometimes intercropped maize (Peters 1960, gils 1988) and millet (Gils 1988).

Mazulu are fertile and are cropped continuously for long periods. The Mazulu have loamy soil with a moderate content of organic matter and a fairly good level of bases. Unless manured by staked cattle, they must be rested for two to three years after a period of three to six years cultivation (Peters 1960). However, Gils (1988) reports that many Mazulu in this floodplain are permanently fallow. This is a result of the risk of early flooding, drought hazard after early seeding and accessibility from settlements at the plain edge, where part of the formerly transhumant floodplain population is settling permanently.

It should also be noted here that land rights play an important and crucial role in the optimal utilization of the Mazulu, as absentee owners do not readily lend out the fields as a result of their strong traditional importance, such as being burial sites of their ancestors.

Sishanjo (Plural: Lishanjo)

Lishanjo fields are made on peats derived from the decomposed remains of plant growth, with Syzygium as the dominant tree species followed, towards the plain, by a grass/herb swamp with a hanging groundwater table. These peats have frequently developed on the edge of the floodplain where there is permanent seepage.

To be able to use the peats for cultivation, drainage is necessary. The fields are made by digging deep and narrow drains roughly paralledl to each other, the distance depending on the drainage necessary. Similar drains are dug more or less at right angles so that drains form a rough lattice enclosing small blocks of raised beds (called Mikomena in Lozi). Thus the fields are drained and the water level controlled by a dense, almost rectangular, system of drainage canals. The excess water runs off via culverts which are often long and follow the natural contours. this sophisticated method of utilizing the peat formations is unique in Zambia (Shultz 1974).

The Sishanio field is prepared for cropping by hoeing to a depth of 2 to 3 inches, and leaving the turf reversed. This is done when the land is not too wet and the layer of turf is burnt when sufficiently dry (Peters 1960).

Maize is the main crop grown, but sweet potatoes are often used as an opening crop on a new or recultivated field. Cucurbits are often underplanted and occasionally small areas are used for figher millt (Eleusine coracana), grown for malting purposes. Recent authors (Gils 1988) and our interviews in the area pointed out that rice, wheat and vegetables were the relatively new crops grown on this field type.

Wet Litongo (Plural Matongo

The Wet Litongo has a mucky or peaty top over sandy subsoil and is situated in the drier part of the seepage zone of the scarp and dambo edges. On the Wet Litingo mango, early planted maize, banana, sugarcane, wheat, vegetable, cassava, sorghum and sweet potatoes are grown, the latter two on raised beds, the so-called Mikomena.

The wet organic soils are laborious for cultivation. They are covered by sods of stoloniferous grasses and sedges, which require tough hoe cultivation and burning to eradicate weeds. However, the burning destroys the organic matter.

3. Wetlands as Key Resources for Small Scale Farmer Livelihood Strategies and Environmental Implications.

Economic importance of Wetland

Wetland areas present the opportunity to support a range of livelihood activities: agriculture; livestock rearing; fishing; gathering of wild products, craft and building materials. The importance of a particular livelihood activity will vary according to a household's social and economic position, inter- and intra-seasonal agroclimatic variations and macro policy environment. The value of wetlands therefore is that they add diversity and increase the possibility of different livelihoods and combinations of livelihoods. They are also an integral part of the landscape and utilization patterns. This diversity is expressed spatially through activities taking place in different parts of the landscape, temporally (both seasonally and inter-annually), and socially with different user groups. By recognising this deversity and building on it we can enhance the range of livelihood options which rural households have.

For cultivation purposes the importance of wetland cultivation areas, even if a household plot is very small, is that it allows the planting of crops to occur at times of the year when dryland planting oculd not occur.. Typically in Zambia, the planting of dryland crops can take place from the time the soils have been sufficiently moistened for ploughing to be possible and germination to occur, to a point about mid-way through the period of likely rains, after which the remaining period of the growing season is too short for further crop planting to occur. This planting period may commence in the latter half of October, but commonly begins only in November and ends early in January for some non-staple crops. The dryland planting window usually therefore does not extend beyond two months.

For planting periods to be extednded therefore, there is need for additional sources of water apart from rainfall. In the northern half of the country, where cattle is rarer and soils more acid, ridge and mound forms of cultivaiton are ubiquitous, as is not the case in the south. The planting of beans, sweet potatoes and cassava may occur, for instance, on mounds of vegetation mulch, where soil moisture and temperature levels are kept high enough to allow a crop to continue growing for up to two months beyond the end of the rains.

The availability of water for small-scale irrigation purposes allows crops to be planted over a much wider period, however. Commonly, water provision allows crops to be planted as early as September, once the weather warms up, to provide a green maize, vegetable or bean crop before the end of the year. Water availability beyond the cessation of the rains allows typically dry season vegetables to be grown, though in addition other combined food and cash crops, such as sweet and Irish potatoes, may also be grown.

An example from part of the country can be used to illustrate the contribution of informal irrigation and water use to small scale farmer household food security. In Central Province, for instance, a contrast can be made to parts of Kabwe Rural, where the predominant crop grown is maize and the planting period is ofttern effectively not much more than 6 weeks, with the Teta area of Serenje where water availability and mound cultivation practices extend the planting period to seven months.

In September small dambo gardens of local maize and beans are planted on mulch ridges which in Decembe/January provide important sources of food and cash during the hungry months when food generally is relatively scarce. The dambo gardens may also be used to grow up to three crops of Irish potatoes a year, which have become an important cash crop, marketed

through informal transporters travelling along the Great North Road. In February/March, a late crop of sweet potatoes and beans may also be grown in such gardens.

The survival of livestock in the farming systems of Zambia (eg. those found in Eastern, Southern and Western Provinces) is reliant on adaptive movement in response to the spatial and temporal variability of the resource base. The roles of wetland patches (eg. dambos) in livestock management is often vital, as these areas produce high grass biomass which is available at strategic times. Water provision to livestock especially in the dry season from dambo well and small dams is another important benefit. In Western and Eastern provinces of Zambia the use of wetland patches for dry season grazing and water supply to livestock is evident. In Petauke district of Eastern province, because of the high labour demand for dambo garden fencing and the practice of not herding the cattle (free range) dambos are mostly used by animals as rangeland than people do for gardening. The Bulozi meander belt is the main grazing resource of Western province and is quite resillient to overgrazing due to annual floods, which limit the grazing period. In the Bulozi plain animals graze from June/July until December/January when the plain gets flooded. At the time of the floods the animals are moved to the plain edge and forest areas and stay there until the floods recede. The plain pastures used in the woodlands during the rainy season are inferior to those on the plains, and cattle lose weight until they return to the plains in the dry season. This weight cycle is the reverse of that which occurs elsewhere in Zambia, where cattle lose weight during the dry season when pastures deteriorate. It is important here to point out that cattle play an important role in the overall cropping systems of these areas through provision of drought power, manure (especially for gardens) and income to the households thereby contributing to household food security substantially.

The main fishing areas on the upland dambos is the central swamp. Four principle methods are employed for fishing in the dambo.

Weir fishing is a method in which a basket (Umono) and a weir or fence (Ubwamba) is made of mud in the dambo (usually built on the lower side of the dambo slope). The basket is set between the fence and people drive fish into the basket from the upper side. The catches are usually small resulting in the "serious" fishermen preferring to use this method in shallow stream and river channels rather than the dambo.

As pools and hollows fill with water around January, conditions favour the use of fish poison (Ububa). The people block an area of shallow water and scatter pounded, soaked poisonous leaves or roots into the water. This poison will kill the fish within two to three hours and the fish are then scooped from the surface in baskets. Although efforts are being asserted by the village and fisheries authorities to discourage this indiscrimate fishing method, it still is being employed by the people. This method is commonlyused by women (Imai 1985).

Line fishing is a method in which a single hook is set on a line. The hook is attached with a bait, usually worms dug from the dambo edges. The people will then wade into the water up to waist deep and dangle their bait. This method is used in the months after January as water levels rise slightly.

Basket fishing is the last common method. A selected stretch of shallow water is either surrounded or a line formed at one end by the people. They then move forward, stirring up the water and mud with their feet and scooping up the baskets which will contain some fish trapped in the close weave of the basket.

Fishing is the third most important economic activity in Western Province after Livestock and Crop Production. It is a seasonal activity especially around the Barotse floodplain. It is estimated that between 12,000 and 15,000 tons is the fish yield from the floodplains (Gils, 1989). The acidic nature of dambos has been cited as possible reason for the low output of fish in dambos. Gil nets are the main gear used in the floodplains. The varieties of fish caught include Marcusenius marcroplepidotus (Mintesa), Schilbe mystus (Ulupata), Barbel fish of genus Claria (Milonge).

Fish farming is becoming increasingly popular in the provinces. Most of these fish farmers tend to dig their fish ponds in the dambo sites where water supply is assured throughout the year.

In 1898 Weatherly (quoted by Kay 1964) found the dambos to be vital to dry season water supply; water can be obtained throughout the year from shallow wells in the sands and clays of the major dambos.

Domestic water supply is an important role that the dambos play in the everyday lives of the inhabitants along them. Wells are dug in the dambos and are commonly used for water collection for domestic use in the households.

Cassava is the main starch staple food of the people in Luapula, Northwestern provinces. The processing of cassave into a flour for use in the preparation of Nshima (a thick porridge) involves the soaking of peeled cassave for fermentation. The fermentation is done to remove poisonous alkaloids present in fresh cassava. This important phase in processing is aided by the use of dambos in which the people dig sizeable holes which fill up with water. These are used for fermenting the fresh cassava. For fermentation of cassava, the water must be standing rather than flowing. Holes in the dambo offer a very convenient facility for this purpose, even for people living further away from the dambos.

Wild products provide supplementary food to the rural people. In this respect, dambos also play a role. Available throughout the year are edible roots. The two most important roots found in the dambo, Chikanda and Imbwelenge, are dug from the dambo margin during the dry season. These roots are processed to make delicacies that add variety to the diet of the people.

Dambos also provide meterial for building purposes. Most of the rural houses are still grass thatched. Some of the grasses that grow in the dambo are used for this purpose. The most long lasting thatched roofs are those having the Ulweo grass which grows in the dambo.

From the preceding discussion on utilization of the dambo, it is evident that dambos play important roles in the livelihood of the people along them. However, when one looks at the expense of the dambos in the country and the portions that are utilized, it is evident that there still exists great potential for dambo utilization, as long as the principles and practices of conservation are adhered to.

Environmental sustainability of wetlands under agricultural use

Wetlands are components of a dynamic landscape, their function and characteristics controlled by upslope and in situ soil and hydrological processes. Land use changes can have an important effect on the hydrological processes of evapotranspiration, infiltration and on wetland storage capacity, all of which are important to the wetland's potential as an agricultural resource, as well as its ability to contribute to streamflow (Ingram 1991).

Human activities can have a considerable impact on the nature of the plant cover through clearing or modifying the natural vegetation, and on the properties of the soil through cultivation and grazing. Although not always

deleterious, these practices can result in reduced infiltration. Reduced infiltration will result in more surface runoff and a greater and more rapid loss of water from the dambo catchment. With increased runoff, throghflow is proportionately less and the recharge of ground water storage falls with the result that baseflow yields also fall and dessication can result.

The type, extent and seasonality of vegetation affects evapotanspiration and it is generally expected that rates from cropped and grazed land are less than from wooded land. Land use changes, in that they involve modification of vegetation will have an impact on the hydrological status of the catchment.

The reduction or removal of wetland vegetation with cultivation and grazing can affect wetland storage capacity. Hindson (1961), as quoted by Ingram 1991) commented that observations of dambos losing their sponge effect when grass is removed suggest that dambo vegetation is an important factor in the maintenance of dry season flow. In Western Zambia, Brammer and Clayton (1973) attributed loss of water storage capacity to peat shrinkage resulting from dambo drainage.

The consequences of upland forest clearance for dambos will be an increased movement of water through the system. This may initiate gullying through a larger surface runoff component. In the Luano basins, Zambia, removal of 95% of natural tree cover and settlement by subsistence farmers resulted in an increase in total annual flow of more than 50% (Muneka and Mwassile 1986).

The crop type and the seasonal patterns of cultivation are important with respect to extent and timing of cover, which influence the infiltration rate. Where crop canopy is sparse there is less interception and rainsplash occurs on the soil surface. Crop type, stage of growth and density of planting all affect the extent of cover. Timing of cover is also important as late planting means soil is exposed to most intensive storms at the beginning of the rainy season.

The crop type, its density, yield and management also determine how much plant litter is added to the soil to increase organic matter content (and so improve water storage capacity) and to protect the surface.

Upland cultivation usually replaces natural vegetation, the effects are inseparable from the consequences of woodland and clearance; the overall effect generally being reduced infiltration and increased runoff and erosion. In Eastern Zambia, it is suggested that sheet erosion, accentuated by

poor farming practice, is responsible for the occurance of soils with deep organic rich topsoil below cultivated fields (Dalal-Calyton 1987).

Good cultivation husbandry with ploughing across slope and many physical barriers which act to increase surface roughness (compared to grazing) can all reduce erosion hazard. In Zambia, Acres et al (1986) also report that dry season garden fences in dambos (eg. Eastern Province) act as effective barriers to erosion. Similarly, rice cultivation techniques enhance the advantage of wetland immunity to erosion, with bunds contructed for paddy rice designed to intercept runoff.

In Zambia very little if any information has been generated to understand the effect of wetland cultivation on water resources. From research undertaken in Zimbabwe, however, it was considered that cultivation on dambos without irrigation is unlikely to alter significantly the evaporative water use compared to intensive grasing (DRU 1987). During the dry season the water stored in the aquifer above the dambo is separated from the streamflow and lower dambo by a relatively impermeable barrier. The lower areas of the dambo which might contribute to streamflow consequently dry out early in the dry season. Cultivation in these lower areas of the dambo could result in early ceassation of streamflow. An analysis of the effects on upland aquifer storage and recharge, and streamflow of bringing a heavily grazed dambo under irrigation were considered in Zimbabwe. Given this analysis and discussion, Lambert et al (1990) consider that only when extensive cultivation of dambos takes place with highly mechanised pumping from wells is there likely to be a serious depletion in ground water resources. They recommend continuing with micro-scale irrigation which can be environmentally sustainable and suggest a three fold increase in present levels of cultivation with environmental safeguards.

Drainage can be necessary especially for early planting. Drainage is also a method of reducing the effect of iron toxicity in the upland dambos of northerly wetter areas of Zambia as observed by Kokwe (1991). It is recommended that channels should be built in a way that minimises the risks of erosion. For example, covering of the channel bottom with a layer of grass in the rainy season could check the erosional effects. Rattray et al (1953) notes that the wetland moisture regime should not be altered too much by drainange. They conclude that drainage need not be deleterious and where it is carefully controlled and permits efficient use of wetland on a sustained basis, then it is acceptable.

Gils (1988) in his environmental profile of Western province notes that traditional drainage by "canals" (ditches is the more appropriate word) as has been applied since the end of last century in the floodplain results in rapid and irreversible shrinkage and irregular subsidience of the surface thus impeding further drainage and leading to oxidation and wind erosion of the organic top soil. Banks of ditches in peat are very unstable and have become the starting point of land degradation.

Wetland degradation is not restricted to erosion and dessication; less tangible changes in soil physical and chemical properties can result when wetlands are cultivated (Ingram 1991). Having worked on the upland dambos of Luapula province, I observed that garden cultivation can result in chemical and physical soil changes. Once drainage is established ferrous irons will be oxidised to ferric and the pH of the soil falls. A decline of organic matter content can result from oxidation following a change to an aerobic regime with cultivation and drainage. Such a decline in organic matter brings deteriotation of soil structure, fertility and water holding capacity as well as predisposing the soil to the risk of erosion.

Dry season grazing of cattle and other livestock is one of the most common usages of wetlands. The problems of overgrazing in dambos is widespreas in Zambia (Acres et al 1985)

The main problem associated with excessive grazing in dambo is degradation of the vegetation which affects wetland hydrology and encourages soil erosion. Removal of grass that covers and protects the soil and compaction of the surface by trampling, which reduces permeability and increases the amount of runoff all contribute to make heavy livestock use one of the major causes of soil erosion. Periodic burning of grazing land is a common practice; the effects depending on the time of burning. The nutrient budget of the dambo is affected by burning which can lead to a gradual decline in the productivity of the system through erosion and leaching of the ash and loss of nitrogen through volatization (Whitlow 1985). Occasional burning (early burning), however, renews the grass cover to improve grass quality and is recommended especially in sour dambos by Ferreira (1977). Grazing may not always result in degradation. Although the scarp dambo in the southern part of the Lusaka plateau are heavily used for grazing, no severe damage in the form of gully erosion was found and the water supply from springs ramined unaffected (Mackel 1985). Grazing can have favourable impacts, such as supply of dung or the hardening of ground and the consequent improvement in grass quality.

Fishing methods such as fish poisoning will cause indiscriminate killing of fish and other orgnisms found in this habitat. Similarly, the use of chemicals in wetland agriculture if unchecked could cause pollution to surface and ground water.

The environmental sustainability analysis shows the fragile nature of the dambos. It is clear that wetland degradation can result from disturbances to dambo soil and hydrological processes brought about by land use change, both on the upland and in the wetlands themselves. To be effective, conservation measures should not be confined to the wetland alone but should encompass the whole catchment. Recent research in Zimbabwe (DRU 1987) suggests that, in some areas wetlands are not as fragile as previously thought. Land use change therefore need not always have deleterious consequences and with appropriate data and management, wetland patches represent important agricultural and grazing resources.

4. Policy and Institutional Management Implications for Wise Use of Wetlands

Land Tenure

Under the traditional systems in Zambia land in the past and present was and still is administered by the traditional chiefs and or headmen in consultation with the elderly (advisors) in the community or village. Land is allocated to individuals or groups with the rights to use it but the individual or groups do not necessarily own the land as in the modern sector. This is mostly applicable to land (including wetland patches) that are used for crop production. Communal land does not stimulate investment in land development as no one feels responsible and there is no incentive to invest in its development

Wetlands however are multifunctional and have by large remained common property except for patches that are used for crop production. This fragmented ownership (in relation to the right to use) of patches for crop production and the remaining surrounding patches as common property has caused conflicts among users with different objectives and environmental degradation eventually arise. Community organisation becomes inevitable to ensure that appropriate land use practices are adhered to.

On the other hand there are fine examples of how traditional authorities managed to control the use of natural resources including wetlands. In Western Province of Zambia until its authority was transferred to the Central Government after Independence, the Lozi Royal Establishment operated a

comprehensive system of natural resource managment in the Zambezi wetlands and surrounding areas. Senior councillors (Indunas) were appointed for each natural resource sector. Rules about places, rates and seasons of exploitation were strictly enforced. Generally, in rural Zambia the authority of the traditional institutions to adjudicate over land issues is well recognised.

It is important at this point to note that customary law from the past perspective was not, relatively, so much under the current pressures of population growth, market forces and the northern hemisphere's influential information systems and institutions. However, despite all these influences the traditional authorities still have comparable (if not more) powers to regulate the turn of events in their localities as the Central Government does.

Therefore, considering the multifunctional role of wetlands and the diversity of the types of wetlands it is very difficult if ever possible to formulate a blanket recommendation of a land tenure system that would ensure environmental sustainability and socio-economic fulfillment.

This paper therefore, proposes the land tenure issue to turn its focus on how to develop area specific land use plans which are facilitated by statutory instruments and institutions in collaboration with the traditional authorities as user representatives. The main purpose being to select and put into practice those land users that will best meet the needs of the people while safeguarding resources for the future.

In the final analysis the implementation and control over use must remain with the people and their traditional authorities while external agents play facilitatory and advisory roles.

Natural Resources Legislation

Mwiinga (1993) points out the the absence of reference to wetlands in the various pieces of legistlation on environment in Zambia. However, it is also noted that the various pieces of legislation could be amended to adequately consider wetlands. Some of these legistlation include the following;

- The Land Acts, resticting the sale of land and declaring land as valueless except for improvements on land could be sold. Who is going to be stimulated to buy contour ridges, and properly constructed drainage channels when in the short run even the badly constructed drainage channels that cause land

degradation can suffice for a livelihood activity. This kind of legislation does not encourage investment in the environmental development of land in general and wetlands in particular.

- The Forest Act, recognises Locl Forests and National Forest where logging and firewood collection is licenced and controlled by the Forestry Department, and the open area, where commercial logging and charcoal burning is licenced. The purpose of the Local Forests and National Forests is the conservation and development of forests for securing timber and forest produce, while in the National Forests also protection against floods, erosion and maintaining river and baseflow is emphasised. As Gils (1988) states, it is important for erosion prevention to use the provision of the Forest Act to declare all trees within a certain distance from dambo and valley edges as protected trees.

- The Natural Resource Conservation Act enables the Minister to regulate stock numbers when deemed necessary. the Provincial and District Natural Resource committees set up to monitor and enact the necessary by-laws are not functioning at the moment. This act should specifically consider the monitoring of stocks on wetland grazing areas instead of its emphasis on upland or forest rangelands.

- The Fishery Regulations are only partially enacted and applied to open waters as far as unpermissible fishing methods are concerned. The traditional fishing methods employed in the wetlands need emphasis.

The prohibitive legislations currently in place though seemingly capable of protecting the environment if effectively enforced, lack adequate considieration for wetlands as mentioned earlier. The other weakness is their lack of enforcement due to resource constraints of the relevant Government Departments. A user friendly protection strategy suggested by this paper includes the provision of production oriented incentives for those utilizing the wetlands according to the prescribed environmental limits. The relevant departments have to come to terms of adequately involving the local communities in the enforcement of the laid down regulations. Again this could be more effective if income generated through levies on wetland products would be reinvested into tangible community development projects to benefit the community.

Furthermore, there is need for cross reference of the various pieces of legislation that are related to wetlands

as the examples (Acts) given in this paper to avoid contradictions. For example, the Forestry Act in the wetlands context refers to the upland catchment areas whose management or mismanagement has influence on the inflow of water into the wetlands catchment area. The Natural Resource Act would refer to the wetlands itself and the Water Act would refer to the streamflow. All the three Acts for example are from the ecologic and economic point of view functionally related. Therefore, the need to harmonize such legislation.

- **Economic Reforms**

  The Zambian Government is currently pursuing economic reform (popularly referred to as Structural Adjustment Programme) whose emphasis as it relates to agriculture is to remove <u>all</u> subsidies (incentives) on agricultural inputs, streamline the public service (through reduction of numbers of personnel), liberalise the marketing system for agricultural produce. The world Bank contends that these reforms should help enable poverty reduction through promotion of growth in small scale agriculture (through improvements in the efficiency of the marketing system) and lower prices to consumers in the medium term. They should also free public resources to invest in basic infrastructure. However, the bank acknowledges that the overnight transition to a new system has potentially increased the "short-term" vulnerability of two important groups of the poor-low income maize consumers and high cost (in terms of location, transport and inputs costs) small-scale producers who are the majority in the Zambian agricultural sector.

  As illustrated in this paper, wetlands are of vital economic importance to this vulnerable group of small scale producers. What then are the implications of the economic reforms on environmental stability of the wetlands?

  Since the removal of subsidies in maize inputs and the liberalisation of the maize marketing which is very uncertain and inefficient following the World Banks prescription in a business envronment as it exists in Zambia, most of the small scale farmers are turning to activities that will produce high value crops at minimum risk of failure. The wetlands offer this alternative. Increase in the exploitation of dambos is observed.

  Conservation measures on a resource such as wetlands require significant investment (eg. labour, appropriate

technology, etc.) but do not necessarily provide tangible returns in the short-term further increasing the short term vulnerability of the small scale producers. This has led to small scale resource users to concentrate more on exploitation of wetlands to alleviate this short term stress on their livelihoods with minimal concern for conservation.

As shown in this paper food security is one of the major influencing factor for the use of wetlands either through direct means by producing the food on the wetlands or indirectly through cash earned from sale of produce from wetlands. The removal of production subsidies increases the food insecurity through increased costs of production, transport, therefore it follows that instead the consumer prices will increase and the the efficiency of production will decrease (resulting in overexploitation of resources) and environmental degradation is likely to be on the increase.

The public and private sector reform programme has meant that people in the Urban areas are losing jobs and consequently the market for produce from wetlands is dwindling. The result is fewer and poorer markets which entails that the expected rise in income levels of the small scale producers will be hard to realise. With lowered income levels under such circumstances it is unrealistic to expect investment by the rural farmers in environmental protection of the wetland resource.

As is implicit in the wetland use analysis of this paper, the increasing human population and macro economic conditions necessitate change in production practices and consequently technological changes to protect the environment are necessary. To achieve this technological change the trained and skilled local manpower is necessary. The public reform programme which is a conditionality of the economic reforms programme does not allow for any further increase in public service job establishment list, including the much needed and inadequately available personnel to facilitate environmental protection measures in the relavant Government Departments.

The examples on wetland exploitation show that food insecutiry is not only a result of land degradation but more so a contributory cause.

This highlights the need to identify solutions which would make a rapid improvement to the food security and

income level situation of the small scale farmers, before long term conservation can be adopted. The following economic policy recommendations are suggested by this paper.

Farmers or communities who are able to demonstrate through practice production practices that ensure environmental sustainability should be encouraged through production incentives. It has to be recognised that worldwide environmental protection has a cost. This cost if it ultimately benefits the resource users who also implement the protection measures, the likelihood of enforcing the measures will be eased, the income levels of the farmers raised and the environment protected. Coupled with such short-term measures should be the awareness creation through demonstrations (extension) on the importance of protecting the environment and the use and reinforcement of the traditional authorities network to employ the inherited local managerial capability by emphsising strict application of communal rules to all users and the sanctions for breaking the fundamental rule of environmental management.

Infrastructure development and consequently market support is important in the promotion of sustainable wetland use. Deliberate policy must be put in place to develop the infrastructure and small scale agro-processing industries at community level in areas where wise use of wetlands is recognised and practiced. Agro processing can add value to the produce hence raising the income levels of producers. Furthermore, it can also be a way of increasing the shelf life and reduce in some cases the bulkness of the produce.

- **Public service institutions:- Research and Extension**

  (a) **Research**

  Policy on technology development for sustainable utilization of wetlands should consider the following research aspects:

  Although there is general recognition that wetlands are a resource of major environmental and economic significance, these wetlands are not always clearly defined and are not adquately mapped. Development policy must therefore, ensure that dambo inventory and characterization information is updated. The current data available on wetland characterization are very old. The Zambian example where this information

is still used from studies undertaken more than ten years ago (eg. Shultz, 1964) clearly shows the need for updated information. At the same time substantial knowledge and information is available which should be used as a basis for the update of the mapping and characterization of wetlands. A country review is therefore recommended, updated wetland inventory can be used to assess the current status of wetland resources and form a basis for subsequent monitoring of trends in wetland utilization and conservation. This can also allow for the development of appropriate management and conservation strategies.

The implementation of socio-economic research (diagnostic surveys) as a prerequisite to technical research on wetland utilization is recommended by this paper. The Zambian example of technical research with minimal socio-economic research clearly supports this recommendation. The need to know and understand the costs, benefits, opportunity costs and effective economic value of wetland is crucial to the development of appropriate technologies for sustainable utilization of wetlands and their adoption by the resource users. As a matter of policy any technical research proposed on wetland utilization and conservation must be supported by adequate socio-economic information clearly showing the circumstances within which the proposed technical research is to be conducted and its social, economic and cultural implications to the dependant resource users.

Most of the research reviewed in Zambia shows a clear isolation of wetland research from the catchment and streamflow implications. This paper advocates for future research on wetland utilization to consider the catchment (upland) areas and the streamflow to which dambos are functionally related.

Consequently, this paper recommends that proposed research work on wetland utilization should include adequate Envrionmental Impact Assessment parameters to be used as indicators of ecologic sustainability of the proposed measures. Specific examples can be cited from the Zambian case where technologies for crop production in dambos have been developed. The issue of pollution of the soil substrate and the water in the surrounding stream through the use of nitrate fertilizers were

not considered adequately. This oversight could lead to crucial disturbances in the ecosystem. While tangible short term benefits may accrue from the developed technologies, long term devastating environmental degradation of the ecosystem can easily upset the benefits in the long run and defeat the whole purpose of improving the livelihood of the resource users.

Coordination and collaboration of different research disciplines in wetland utilization is inadequate.. The dambo work on food production by the Adaptive Research Planning Team in Zambia for instance, could be collaborated with the past and present hydrological studies by other institutions such as the National Council for Scientific Research and the National Irrigation Research Team. Policy within the country must ensure that there is a "clearing house" for proposed research on wetland utilization. This should ensure that resources allocated for dambo research are not used on "re-inventing the wheel" but rather to build on existing information and avoid wastage through duplication of work.

Extension

The farmers' experiences in Zambia have clearly showed the skills and information gaps existing in the national extension system to deal with wetlands issues.

The need for agricultural policy to ensure that dambo management and conservation principles and practices form an integral part of extension worker training is inevitable.

This can be achieved at two levels. The first being at the initial college training of extension workers. The syllabus needs to address this important natural resource's implications in agriculutral development and environmental protection. The second being at field level where extension worker participation should start from the technology development process through to the technology dissemination stage.

Educating the resource users on the importance of wetlands within the ecosystem can most effectively be achieved through the broad coverage of personnel that extension services offer in the respective countries. Policy must, therefore,

ensure that the extension approach used incorporates the education of farmers not only in improved agricultural technologies but to include the broader aspects of agricultural diversification through sustainable utilization of complementary niches such as wetlands, the complementarity of niches (eg. dambos) within a faming system must be wisely used to break the chain of food insecurity. The Zambian example on use of dambos to offset seasonality in food availability through use of residual moisture in the dambos is a pointer to the important role that wise use of complementary niches can play in ensuring both food security and income generation. Emphasis should be placed on conservation in the process of increased food production and other related dambo uses.

- **Development aid projects and programmes in the wetlands**

Several maltilateral and bilateral aid agencies have and are still assisting in development programmes aimed at improving the livelihoods of the rural people through the utilization and conservation of wetland habitats in Zambia. In this section, I will simply outline some of the reason for failure to achieve the desired objectives of these agencies and suggest options for redressing these situations.

In the Zambian situation the programmes in this sector are currently growing and on-going.

Environmental protection in general is a long term undertaking. Development projects and programmes on the other hand are usually planned on an average of two to three years with the possibility of extension being based on economic and political imperatives. This sometimes leads to discontinuity with the end result of objectives not fulfilled and the raised expectations and hopes of the people left hanging. The Government with its perpetual budget deficits failing to contine the programme. Sustainability of the partial but important contribution is not realised. If plans where such that maintenance is required for the introduced strategies, this maintenance is not forthcoming and the strategies (could be structures of organisation, or physical structures eg. contour bands or ditches) become points of further environmental degradation.

It is, therefore, important and necessary in my view that there is need for long term committment from both

the aid agencies and Government and people to come to terms with long term committment. How this can be achieved is dependant on the technical design of the programme social appreciation and a political will to develop.

As mentioned earlier in the paper, the fragmented approach of the projects in terms of the discipline areas being addressed sometimes in the same locality leads to unnecessary "reinvention of the wheel", wasting resources through duplication instead of adding on complementary fields that would reinforce the ultimate objectives of food security and environmental protection. Instead it becomes an academic excercise.

It is incumbered upon the Government to be able to recognise such anomalies and redress the situation for the sake of tangible development of the resource and its people. A positive development after so many years in Zambia is a series of planning documents whose latest product is the National Environmental Action Plan.
It is envisaged that this plan will guide and result in environmental projects that are holistic and hopefully go a long way in bringing about meaningful development in the enveiromental sector in general and wetlands in particular.

Some aid projects do not adequately support local capacity building. Many a time excuses have been given of the unnecessity of higher qualifications (such as Phd level) to undertake the responsibilities after the "experts" leave. However, at the same moment, the same projects will hire international consultants as experts to plan, appraise etc., the programme, because of lack of qualified and experienced local experts. The Government has a moral obligation to retain local manpower trained through peoples tax money (local and foreign country's peoples tax money - aid. It should ensure this investment bears fruit through its contribution to knowledge and skills for the benefit of the countries through proper placement and conditions of service. Aid projects should also be sincere enough to recognise the human resource potentital and encourage it to grow through further training to ensure synergy in output when the cross pollination of local and international experts jointly perform functions of development. After all the local experts are better versed with the social, political and physical environment than some international experts.

Effective participation of the local people in

programme development process (ie.diagnosis, planning implementation and evaluation) has been lacking in most wetland programmes. To put it simply as Harrison (1987) notes, there is not a single one of our projects that does not involve some degree of participation by the beneficiaries. The finding should come as no surprise; almost every major survey of the ingredients of successful projects has pointed to the crucial importance of participation. Effective participation will ensure that project aims are based as far as possible on peoples felt needs, on their priorities, on dealing with what they perceive as important problems.

5. CONCLUSION

The paper has attempted to highlight insights related to small scale farmer wetland utilization and its consequences on the environment of this resource. Wetlands are important to rural peoples livelihood strategies in Zambia. They are some of the most productive natural ecosystems in Zambia. Despite the importance of wetland they still remain low on the development policy agenda. Preservation of this common property needs the identification of information and action needs that will adequately consider the complimentarity of food security and environmental sustainability. This paper's objective was primarily to attempt this identification and analyse it and offer suggestions for reinventing this common property taking into consideration as much of the complexity involved for this task. In my opinion, in Zambia we are still in the early stages of wetland development at institutional level (as external agents) Therefore, only if the foundations are secure can anything be built on them that has hope of lasting.

REFERENCES

1 Acres BD, Blair Rains A, King RB, Lawton R M, Mitchell A B and Rackman L J (1985). African dambos: their distribution characteritics and use. Zeitschrift fur Geomorphologie; supplement and 52, 63 - 86.

2 Adams, W M and Carter R C (1987). Small Scale Irrigation in Sub Saharan Africa. Progress in Physical Geography, II 1 - 27.

3 Brammer H and Clayton D B (1973). Detailed Soil Survey of Kataba Valley research substation, Western Province, Zambia. Soil Survey Report No. 8. Land Use Services Division. Ministry of Rural Development, Lusaka.

4 Dalal-Clayton, D B (1987). Reconnaissance soil survey of the Mtetezi river area, Eastern Province, Zambia, Soil Survey Unit, Research Branch, Dept of Agric, Zambia.

5 DRU (1987). By Bell M, Faulkner R, Hotahkiss P, Lambert R, Roberts N and Windram A. The use of dambos in rural development with special reference to Zimbabwe.

6 Ferreira, R. (1977). Dambos: their agricultural potential. Part 4 cattle grazings. Farming in Zambia II, 1 - 2.

7 Gils, H Van, (ed) (1988) Envrionmental Profile: Western Province. PPU, Mongu, Zambia.

8 Harrison (1987) - The Greening of Africa. Earthsian Studies Edition IIED - London

9 Huckabay J D (1986). A definition of dambos. Zambian Geographical Journal No. 36 1986. Zambia Geographical Association.

10 Imai, I. (1985). Fishing Life in the Bangweulu Swamps. A Socio-ecological study of the swamp fishermen in Zambia. African Monographs, Supplimentary issue 4:49-88. The Institute of African Studies, University of Zambia.

11 Ingram, J (1991). Wetlands in Drylands: The Agroecology of Savanna Systems in Africa. Part 2: soil and water processes IIED, London.

12 Kay, G (1964) Chief Kalaba's village. A preliminary survery of economic life in an Aushi Village, Northern Rhodesia. The Rhodes Livingstone Institute Paper No. 35. Manchester University Press.

13 Kokwe, M. (1991). Wetlands in Drylands: The Agroecology of Savanna Systems in Africa. Part 3e: The role of dambos in agricultural development in Zambia. IIED - London.

14 Lambert, R A, Hotchkiss P F, Roberts R, Faulkner R D, Bell M and Windram A. (1990). The use of wetlands (dambos) for micro-irrigation in Zimbabwe. Irrigation and Drainage Systems 4, 17-28.

15 Mackel, R M (1985). Dambo environments of the Central plateau region of Zambia. Zambia Geographical Journal. No. 35

16 Muneka and Mwassile, (1986). Some aspects of the hydrology of dambos in Zambia. Proceedings of National Workshop on dambos, Nanga, April 1986, Ministry of Agriculture and Water Development (Zambia) and FAO, 111-127

17 Mwinga, D (1993) Environmental Legislation in Zambia for sustainable Dambo Use. In proceedings of the Workshop on Sustainable Use of Dambos in Southern Africa ARPT - Zambia, IIED - London.

18 Ndiyoi, M, Heermskerk, W (1989). Status of Agronomy Research in Wetlands, ARPT - Western Province, Mongu, Zambia.

19 Rattray J M, Cormack R M M, and Staples R R 1953. The Vlei areas of S Rhodesia and their uses. Rhodesia Agricultural Journal 50, 465 - 483.

20 Scoone, I (1991). Wetlands in Drylands: The Agroecology of Savanna Systems in Africa. Part 1 - Overview - ecological, economic and Social issues. IIED London.

21 Shultz, J (1964). Land Uses in Zambia Part I. The basically traditional land use systems and their regions. Weltforum Verlag, Muncher Publishers.

22 Veboom, (1970). Range, type and estimated carrying capacity of the grasslands of Zambia. File report S.560/6.9 - Agriculture Zambia