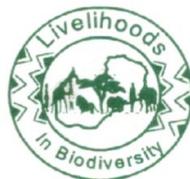




North Luangwa Wildlife Conservation & Community Development Programme



**Striking a Balance (SAB):
Maintaining Seasonal Wetlands
& their Livelihood Contributions in central Southern Africa**

TECHNICAL REPORT 2

Sustainable Cultivation of “Acid” *Dambos*

by
Jonas Sampa, Agriculture Coordinator, NLWCCDP



**The SAB Project is implemented in Malawi and Zambia by
Wetland Action, Self Help Africa, FAIR, MALEZA and NLWCCDP
in collaboration with the University of Huddersfield**

Mpika

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1. Introduction

1.1 The report

This technical report focuses on the development by communities of new ways of using acid, or sour, *dambos* for agricultural purposes in response to problems of food insecurity and poverty in Mpika District of Northern Zambia. This is an important development for a number of reasons:

- first, it is an example of farmer experimentation and innovation, which is to be encouraged given the need for rural communities to be self-reliant and develop sustainable practices based on local resources;
- second, it is a way of addressing food shortages by diversifying cropping and increasing food security, thereby improving household nutrition, as well as resilience in the face of climate change; and
- third, this method of *dambo* cultivation allows farmers year-round use of these areas which not only addresses domestic food needs but also provides opportunities for generating cash to raise incomes and diversify livelihoods.

As well as explaining the techniques developed, this report addresses critical questions about the possible long-term environmental impacts of the use of this *dambo* farming method. Findings to date point to the need for upslope woodland/forest conservation to be undertaken in order to maintain the supplies of water needed for this form of *dambo* cultivation. Other environmental management measures are also suggested in order to achieve sustainable *dambo* cultivation and improved livelihoods.

The report concludes with some case studies of lives transformed through this method of cultivation in the formerly little used acid / sour *dambos*. These are just three of the many cases of dramatically transformed livelihoods of poor households, showing how the future for families can be improved.

Careful experimentation with the methods outlined in this report is encouraged and exchange of information with the author and publishers of this report are encouraged by those who use it so that long-term sustainable use of these acid *dambos* can be achieved.

1.2 Striking a Balance (SAB) Project

This report is the second in a series of several technical reports produced by the Striking a Balance (SAB) project which is seeking to develop extension material to support sustainable management of seasonal wetlands in central southern Africa. The SAB Project was a 30-month project (July 2006-December 2008) to explore how to manage seasonal wetlands in Zambia and Malawi in a sustainable way. The project was initiated under the management of Wetland Action in partnership with Harvest Help (now Self Help Africa) and Find your Feet and funded by the Dutch government through Wetlands International. In Zambia, the North Luangwa Wildlife Conservation and Community Development Programme (NLWCCDP) has been the local partner NGO responsible for the implementation of SAB project activities in Mpika District. The SAB project has also involved a field project in Malawi, (see Technical Report 1), policy support, advocacy and information sharing in both countries and with COMESA and SADC. (For further details see www.wetlandaction.org)

2. History of *dambo* use and development

Dambos are grassland areas which are seasonally flooded or have very high water tables which prevent the growth of trees. They are found in many parts of Southern Africa and have long been used for a range of activities which contribute to the livelihoods of the communities living near to them. Typically the benefits from *dambos* include domestic water supply, grass for thatching, wild plant collection for relish and medicinal use, dry season grazing (where there are livestock) and small-scale dry season supplementary cultivation, as well as some planting of perennial crops such as bananas. *Dambos* vary across Southern Africa in terms of water and soil characteristics so care should be taken to note the specific conditions reported in this document, particularly the “acid” nature of the soils in Mpika’s wetlands and other part of northern Zambia, which have led to the term “sour” *dambos*.

In Mpika District, recent interest in *dambos* for cultivation was stimulated in 1990/1991 when drought and fertilizer shortages caused upland harvests to fail. Old men and women resorted to their traditional method of using *dambos* and seasonally swampy areas, called *Ibundu*. This involves burning the grasses and surface roots and cultivating in the friable and ash-rich soils which are so created. Using the residual moisture farmers traditionally planted early maturing crop varieties, a pumpkin called *utunkomankoma*, maize called *kanjele* and squashes. These crops produce a harvest at the end of the dry season and into the rains (October to February), and so help people survive during the hunger period after a drought and before the next upland harvest.

A second drought occurred in the 1992/1993 rainy season. Fertilizer for upland fields was still a problem in the country at that time and this further restricted the harvests which were obtained. More people started farming in *dambos* on sites where they practised burning. In some cases farmers found that they could cultivate these gardens for two years before the land had to be fallowed and the natural vegetation regenerated.

The traditional land preparation used at that time involved uprooting the grass in pieces, or turfs, with quite thick “slices” taken, each having a reasonable amount of soil and the grass root system. However, burning of this proved very variable, with light and incomplete burning where the turfs were not fully dried and still moist when burning began. This led to low amounts of ash (potash) from the burning and led to poor yields. However, areas which received a good burn, due to the thorough drying of the turfs, had high concentrations of potash and gave good yields.

This experience led farmers to think about how to ensure that their turfs were always dry so that they would burn properly and from this a new method of soil preparation was developed. This involves cutting thin turfs, drying them first on the ground (grass side down) and then in open and well ventilated ridges, burning these ridges and re-ridging after burning. Overall this improves nutrient availability and moisture retention. As is explained in detail below, this has led to a method which can sustain 3 to 4 crops harvests in succession over 2 years without chemical fertilizers and without major water application, if a moist site in a *dambo* is selected. This method uses residual moisture in the soil below the ridge and uses the hygroscopic (water attracting) nature of the ash to draw water up from the non-disturbed *dambo* soil into the lower parts of the burnt ridges.



Training on integrated pest management to support the increased cropping

This method means that communities progress from poverty and hunger by continuously replenishing their food stocks and selling surpluses, especially in the wet season when prices are high. So far this method is being practised in Kabundi, Mushishe, Kaluba, Mwansabamba and Chikakala villages of Chiefs Mukungule, Chikwanda and Mpepo.

3. New approach to *dambo* cultivation

3.1 Background

Generally the *dambos* of Northern Province are sour, meaning they are acidic and their nutrients cannot be utilized since they are “locked up”. The other limiting factor is the high water table, which can make some areas water-logged for a good part of the year. A further problem is the heavy clay soils which have poor aeration which slows down the root growth of plants. These conditions mean that to farm in these *dambos* some manipulation of the soil and water conditions has to be made to create favorable conditions for plant growth.

Once this is done a wide range of crops can be grown including maize, onions, squash, tomatoes and Irish potatoes as possible first crops – often in some combination, followed by maize, rice, squashes, vegetables, beans and sweet potatoes as second and third crops. Sugarcane was used by some farmers as the last crop in the rotation but it is strongly discouraged now as it draws large amounts of water from the *dambos* and can dry out those areas.

3.2 Site Selection

Sites for cultivation should have the following characteristics:

- located in *dambos* with clay soils, subject to only seasonal water-logging or very shallow flooding,
- covered with short grass – which indicates moist conditions caused by the groundwater seepage which comes from the uplands,

- very gentle slope on the site – to avoid erosion risks,
- not close to a stream, preferably 20m to 40m away, to prevent silt going into the stream, and not close to the edge of the *dambo*, at least 30m away from the upland boundary,
- not at the head of the *dambo*, nor in the centre.



Typical *dambo* terrain which farmers are selecting for cultivation with turfs being cut

3.3 Land Preparation

The major labour need is for land preparation. This activity is undertaken in the dry season and usually starts just after the rains in April and can continue up to October. This gives enough time for this *dambo* land preparation, including other tasks with rain-fed cropping in the uplands. This *dambo* land preparation involves a set of activities to be undertaken in sequential order but their timing can be adjusted to suit farmers other commitments.

- Strip off the turf as a **thin** layer with only a little of the soil and root system. (Slicing thinly enables the grass, soil and roots to dry quickly, enabling the turfs to burn thoroughly).



Stripping turfs from a *dambo* to prepare a garden

- The turfs are dried by the sun, being placed upside down to enhance drying of the root system.
- The whole site is covered with the upturned turfs which protects the soil below from drying out due to the direct sunlight. This minimizes the loss of water.
- The turfs dry in two to six weeks depending on the moisture they contain and the intensity of the sunlight.

3.4 Ridge Making

Once the turfs have dried they should be made into ridges ready for burning.

- One ridge will be made from the turfs covering an area of 1.5m wide.
- The turfs are heaped into a ridge 0.5m wide, leaving 0.5m of bare ground on both sides of the ridge.
- Ridges should be aligned slightly across and slightly down the slope to help drain excess water which can cause water logging if not controlled. Ridges should not be aligned directly down the slope to avoid gulley formation.
- Because ridges are used for cultivation during the rainy season their height should be 30cm to 40cm so that water-logging does not occur.



Mounding the dried turfs into ridges for burning

3.5 Burning the Ridged Turfs

Burning of the heaped turfs is better done on a hot, sunny day. It takes 24hrs at most to complete. The burning provides a number of benefits:

- controls weeds, as it destroys their seeds and roots,
- sterilizes the soil, killing fungus spores, bacteria and nematodes,
- makes the clay soil friable which improves aeration and eases root penetration, and
- creates potash (from burnt grass and roots) which reduces the acidity levels in the sour soils and so releases nutrients and makes them readily available to the plants.



Setting a ridge of turfs alight

3.6 Burying the Potash – Earthing Up

The burnt ash should be buried by the addition of soil from the sides of the ridges or the surrounding ground. If the latter is used, this should be done while the ridge is still hot so that this soil is also sterilized. Burying covers the potash preventing its removal by wind.



A burnt ridge which needs to be earthed up to bury the potash

3.7 Ground Water Source

The potash draws up residual moisture from the undisturbed ground below the ridge. This is due to its apparent hygroscopic (water attracting) nature. This enables the centre of the ridge to become wet within only a week after the burning. Once this is achieved seeds can be sown. Depending on the wetness of the *dambo*, and the availability of the groundwater, no extra

water may be needed up to harvest time, while in other cases some irrigation is needed, but only at intervals of two to four weeks.



Making a planting station in an earthen-up ridge

3.8 Sowing / Planting

Seed holes or planting stations should be made about 10cm deep, in the centre of the ridge of sterilized and now friable clay soil. This should be done in such a way that some potash is present in the planting hole, to encourage ground water to rise to the rooting zone.



Hygroscopic action of ash at the planting station drawing moisture up to the middle of the ridge

Figure 1 below provides a summary of these various steps in the new method of *dambo* cultivation which farmers and the NLWCCDP have developed.

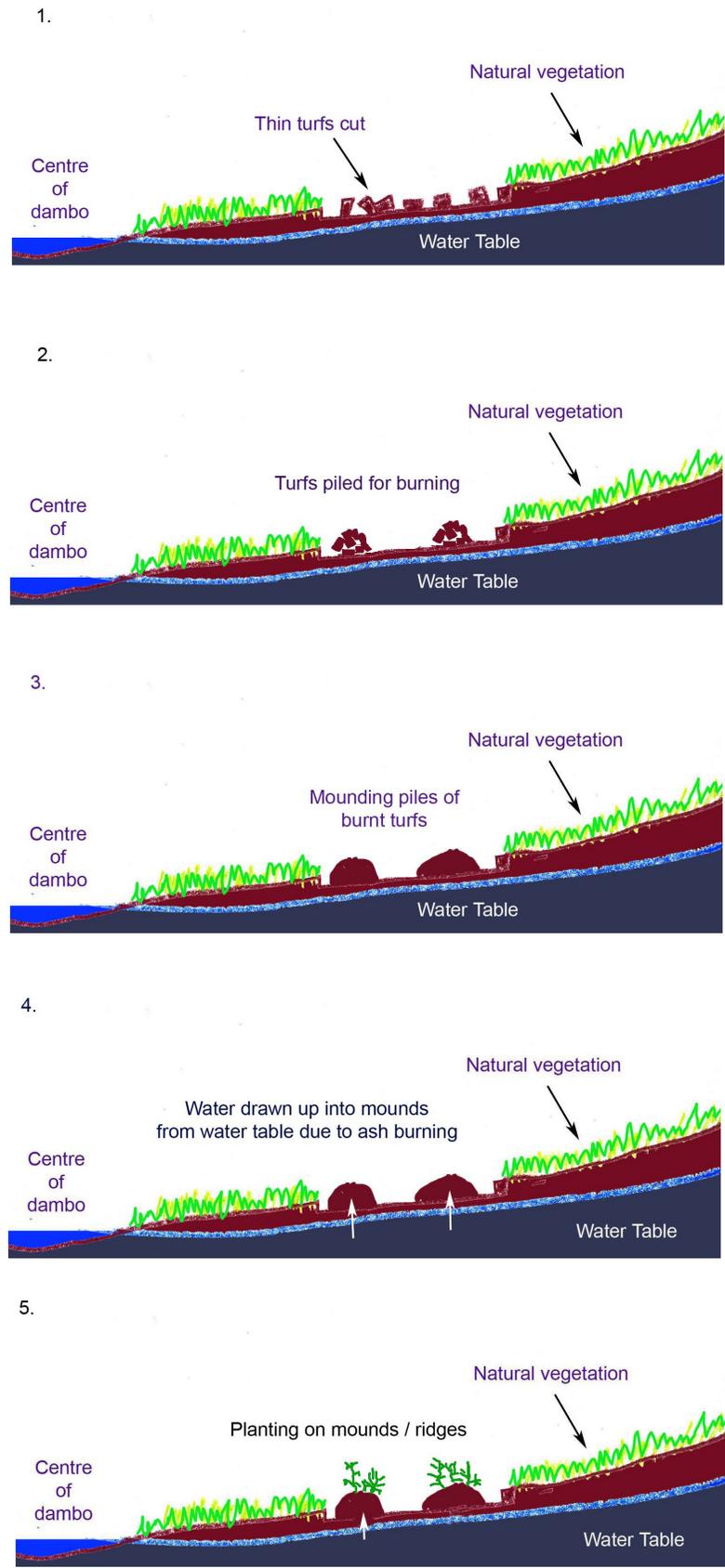


Figure 1: Steps in the recently developed *dambo* cultivation method

3.9 Plant Choices and Timing

The choice of the first crop will depend on the farmer's needs, these usually being either for cash income or domestic food consumption (food security). Planting can start as early as April for the first crop, followed by a second crop in July, with another crop in October which will be picked up by rains for full ripening. However, in most cases planting starts in the middle or late dry season, from July to September, with the first harvest from October to March, and the second harvest in June. The table below gives some examples of the cropping calendar followed to meet different needs.

Table 1: Dambo Cropping Calendar for Food Security and Cash Needs

Months	Food Security Crops	Cash Income & Food Crops
July/Sept – Oct / March	Maize	Tomato, Onion & Squash
March - June		Cabbage
July – Sept/Oct	Beans	Beans
Oct - Feb	Maize	Maize

These different cropping patterns can either give a regular replenishment of foodstuffs at the household level all year round or enable the household to sell produce during the lean months / hungry season of the year from November to March when prices are highest. This enables the farmer to purchase inputs, such as fertilizer, for upland farming for the next rainy season with the “off-season” *dambo* crops that fetch good prices.



“Chibwabwa” a delicacy vegetable is ready in November and squashes by December.

4. Environmental management to sustain *dambo* functioning

Experience has shown that this method of farming is most successful on sites where a very short grass-like plant is found (*Bulbostylis buchmanii*) which appears to be a sedge. This vegetation indicates a plentiful supply of water flowing through the soil from the upland areas. Extensive participatory assessments in several sites have shown that this good supply of water is found when the adjoining uplands, close to the *dambo*, are well wooded or forested and it is thought that this natural vegetation facilitates water infiltration. Where there are many *chitemene* gardens in the adjoining uplands there is less groundwater coming into the *dambo* and such areas in the *dambo* have tall “elephant” grass showing drier soil conditions.

In order to keep the water flowing through the soil and to ensure the sustainability of *dambo* farming, communities are encouraged to establish a pattern of land use which can help achieve a well functioning landscape. To achieve this, communities are now developing Village Natural Resource Management Committees (VNRMC). These raise awareness of the environmental issues related to *dambo* cultivation and have developed bylaws which they are enforcing, once these are approved by the village headmen and local chief. The bylaws which they typically apply are listed below, while the results in terms of land use are shown in Figure 2 below.

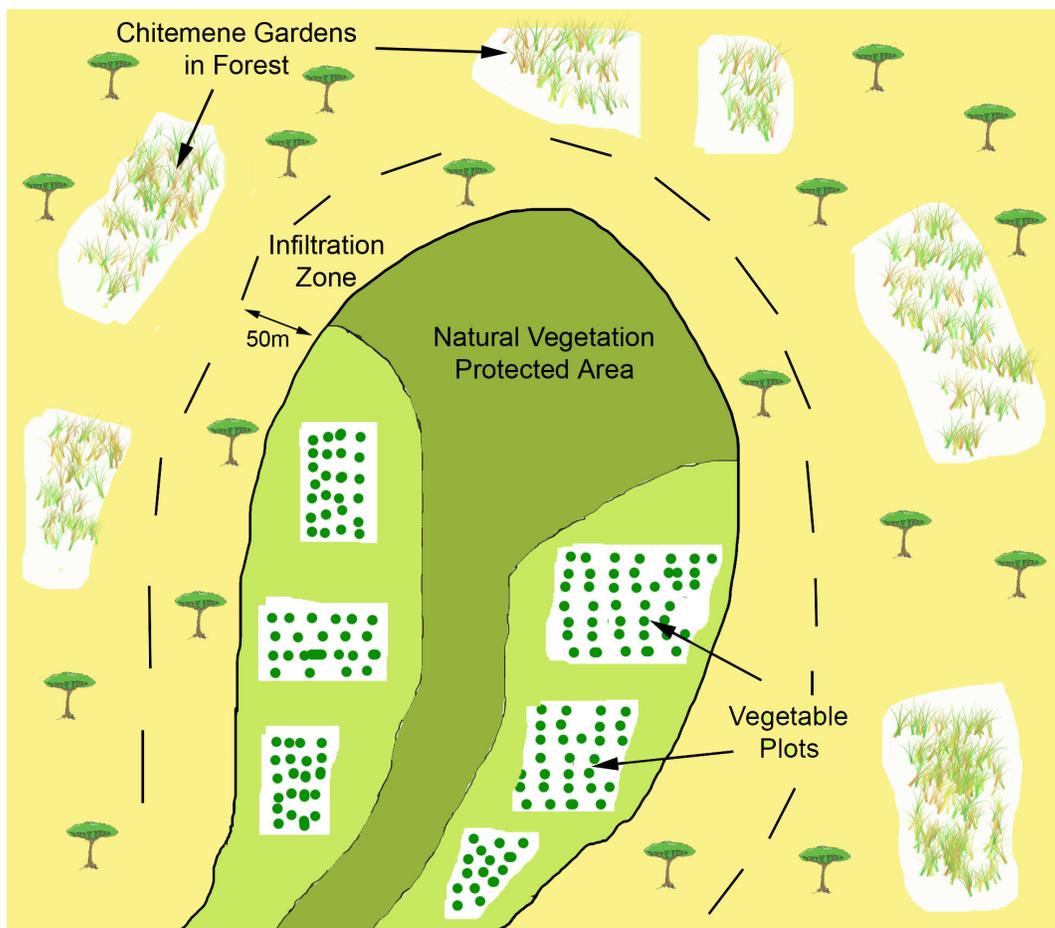


Figure 2: Land use layout to achieve a functional landscape to sustain wetland functioning for livelihood benefits and environmental services in Mpika

Specific bylaws, which are now being enforced, include the following.

- Protection of woodland and forest upslope from *dambos*, or rehabilitation of these areas where degraded - measures include restrictions on tree cutting and late burning, with the use of early burning encouraged to reduce fire damage.
- Protection of streams and seasonal water courses by keeping cultivation more than 20 metres away.
- Prevention of cultivation in the centre of *dambos* and at the head of *dambos* where streams originate and overland flow can occur.
- Prevention of cultivation near the edge of the dambo, both in the upslope area and in the *dambo*.
- Limiting the size of cultivation plots and controlling location so that large areas of farming do not develop, and areas of natural vegetation dominate to stabilize the environmental conditions.

One further environmental lesson is that by cutting thin turfs, much of the roots system of the sedge remains in the soil and this appears to facilitate regeneration once cultivation in the area is abandoned.

Fallowing for four to six years should follow after two years of cultivation. This allows the vegetation and soil characteristics to return to near natural conditions, although the initial fertility of such sites after cultivation ceases remains somewhat higher than in other parts of the *dambo* it appears.

5. Impact of *dambo* farming for livelihood development

The following three cases are examples of how *dambo* farming can transform people's lives. They show that one route out of poverty in Mpika District is through sustainable *dambo* cultivation. This is an opportunity which these successful farmers want to ensure is also available for their children and so they are active members of their Village Natural Resource Management Committees, and follow the catchment rehabilitation and wetland conservation bylaws.

5.1 Case One

Cecilia was left to bring up four children by herself when her husband left her. She started working as a farm labourer for other farmers, but found that she could hardly support herself and the children from such irregular income. She felt that she had to farm herself and was aware that there was plenty of land available in the *dambo* near her village. With help from NLWCCDP she learned that with the new method of cultivation this previously unusable land could become productive. In her first year of cultivation in the *dambo* she managed to develop only a very small area, but the crops were good and the prices high. As a result she met her household needs and could also send her children to school again. In her second year, she managed to prepare one lima, 50 x 50 m, and from the pumpkins, squash and tomatoes she sold to traders from the nearby district headquarters she managed to make over US\$200, a small fortune by local standards.

Since then she has not looked back. She invested some of her *dambo* profits in chicken rearing, and is now on her seventh set of broilers, which every three to four months yield her a profit of some K1.5m (US\$ 300). Her wetland farming is still on-going, but less intensive now she has diversified into this other enterprise. However, she says that she will never give up *dambo* cultivation as it provides her family with food during the hungry period and income to meet household needs. As a successful and respected member of her community, Cecilia has been elected the Secretary for the Community School, something she can manage to do now her household is food secure. Hence *dambo* cultivation has also helped her contribute to her community.



**Cecilia grading her farm produce.
She is paying the two farm assistants for helping
harvest the produce. Previously she was a farm labourer herself.**

5.2 Case Two

In Chief Mukungule's area a village was established in the 1950s by a group of Bisa people who are traditionally hunter gatherers. They had chosen the site as a new permanent home, nearer to the services in the district headquarters and planned to follow a more settled way of life. However, many people found farming difficult and continued to migrate for work either locally or further away. Michael was one of those who worked away, but eventually returned to farm in the early 1980s. However, farming was not very easy or successful and the village, where he is now headman, gained the nickname "famine village" – "Chipowe", because they were regularly short of food. Poaching of game was one of the ways households survived, as well as gaining piece work or daily labouring at Mpika, the District Headquarters.

Following contact with NLWCCDP in 2005 Michael started farming in the dambo on a small patch of the short grass which was pointed out to him by the project staff. As the village headman he wanted to set an example to his colleagues and followed the guidance with care. The results were spectacular. Within one season he managed to earn more than \$300 and had bought a bike which helps in transporting produce to market. His family now has three meals a day, and he can afford to send his children to school.



Purchase of assets, such as bicycles, by first-time *dambo* farmers

5.3 Case Three

Joseph was one of 50 or so young men who saw little future in their village of Chikakala. They could not grow enough food on their farms and so would regularly migrate to the district headquarters (Mpika town) in the rainy season when food at home became short. They would make charcoal before they left and carry some bags with them to sell in order to buy food to send home. At Mpika they would look for daily labouring work, or else they would make more charcoal in the nearby woodland or crush stones to sell for building or for making drives. As such they were contributing to environmental degradation. Joseph reports that some of the group ended up in jail for robbery, while others have become ill and some have died having contracted HIV/AIDS. Meanwhile, his wife was left alone on the farm to try to manage this and ensure a good rain-fed harvest from the upland fields.

In 2001, Joseph learned about *dambo* farming from the local Extension Agent and decided this might be a better way of making a living. It would also mean he could stay with his family during the rainy season and help ensure the upland fields produced well. While this has been achieved, the main success is in the wetland where the crops are so plentiful that traders, from as far away as Mpika town (50 kms) and even the Copperbelt (+400kms), come to buy. Joseph is now a respected member of his community, and is acting as a Community Development Worker with the NLWCCDP showing other farmers how to use the *dambos* in a sustainable way. He is active in the VNRMC protecting the adjoining upland areas with early burning and preventing *chitemene* fields in that area. He is also the Chairman of the School's PTA, quite a change from a poor migrant labourer spending half his time in Mpika town looking for piece work.

6. Reflections on *dambo* farming – sustainable and developmental

The experience with *dambo* farming has been quite dramatic for many people and this type of farming is becoming popular in many parts of Mpika District, with the increasing “off-season” produce drawing traders from the urban areas nearby and further away. However, there remain concerns about whether this is an entirely desirable development because of the fears that land degradation could undermine the long-term positive prospects. The view of NLWCCDP is that provided communities understand the dynamics of wetland hydrology, understanding where the water comes from and how it can be lost, and provided they can control, plan and limit the

number of plots and their locations in a *dambo*, the positive results can be sustained. (A similar conclusion is reached by the ecological assessment – see Technical Report 5).

A summary of the pros and cons of *dambo* farming are as follows:

6.1 Advantages

The main advantages of *dambo* farming are as follows:

- makes land fertile and productive in areas which were previously impossible to use for productive farming;
- makes productive use of the dry season when labour is available;
- produces crops in the dry season;
- produces crops for sale in the early rainy season crops when the prices are high and food insecurity occurs;
- uses residual moisture so households can plant early before the onset of the rains and spread their workload;
- allows food stocks to be replenished at regular intervals throughout the year, or else generates cash to meet household needs;
- environmental impacts are minimal as there is no need to use chemical fertilizer or pesticides and fungicides, as these soils are naturally fertile once burned and are sterilized;
- *dambos* regenerate in four to six years once the land is left fallow, which is much quicker than in the uplands where the *chitemene* system needs 20-30 years for regeneration;
- the technology is appropriate for small-scale farmers as a solution to the poverty and hunger they face;
- an assured water supply for the crops is possible if suitable land is selected, as a result no irrigation is needed;
- social development is enhanced in the village through the development of VNRMCs to manage the upland and wetland in a sustainable way; and
- this cultivation method reduces the absence of men from their communities.

6.2 Disadvantages / Dangers

The following dangers, which are all addressed by the advice to farmers as detailed in this report, can be faced in *dambo* cultivation:

- water levels may go down in the cultivated site and adjoining areas if large areas are cleared, (although clearance in the adjoining uplands is thought to be a bigger influence on water table);
- erosion may occur if ridges are aligned precisely downslope;
- streams may be blocked due to silt if *dambo* fields are close to them; and
- streams may dry out if extensive cultivation is undertaken in the head of the *dambo*, near the stream source.

6.3 Solutions to the Dangers

This report provides advice about how to address the dangers, but specific points to stress are:

- build understanding in the communities on how wetlands function, especially their water sources;
- develop community-wide discussions on how to manage the *dambos* and build up a consensus based on the above understanding; and

- establish VNRMCs and enforce their bylaws, especially protecting the woodland around *dambos* as well as the centre and head of the *dambo*, and ensuring the correct layout and density of plots.

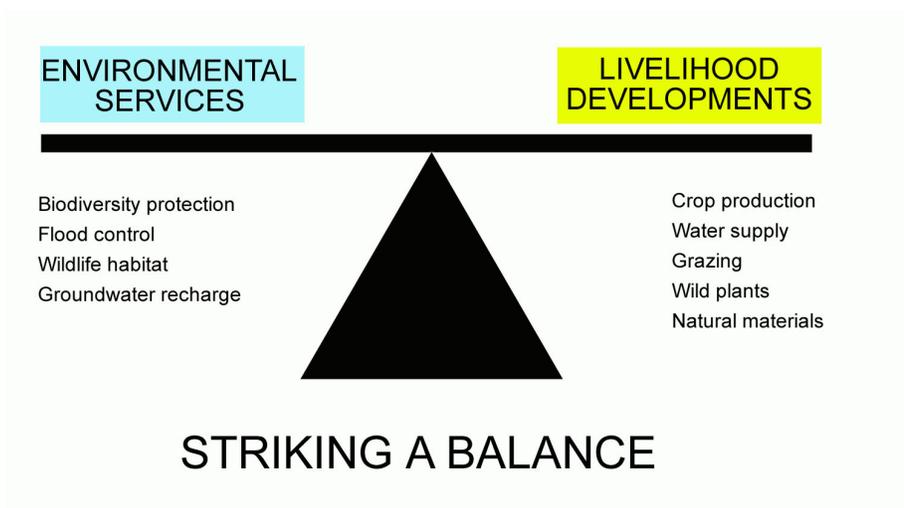
7. Ways ahead

The cultivation of *dambos* in Northern Province of Zambia is going to increase spontaneously as farmers realise the benefits which can be obtained from these areas. The challenge now is to manage this through training and capacity building to improve the skills of farmers to undertake these practices in ways which minimize negative environmental impacts and ensure long term sustainable use. This requires the building up of community institutions as local guardians of that knowledge and also as organizations which can manage the use of land both within the *dambos* and in the surrounding upland catchments. If this is done, the future prospects are encouraging for poverty reduction through sustainable *dambo* cultivation and sound wetland and catchment management, thereby creating a functional and productive landscape.

SAB Project.

The SAB Project is one of four demonstration projects in Africa and Asia which are exploring how wetlands can contribute to poverty reduction. It is part of a global initiative on Wetlands and Poverty Reduction developed by Wetlands International and funded by the Netherlands Ministry of Foreign Affairs. The SAB Project is implemented in Malawi by MALEZA. The project was designed by MALEZA, Fair and Wetland Action. Wetland Action has overall responsibility for the project to Wetlands International. The SAB Project includes six field sites in Zambia and Malawi, policy support, advocacy and dissemination activities.

The overall aim of the SAB project is to reduce poverty among wetland-dependent communities in central Southern Africa, by supporting sustainable wetland management through a functional landscape and multiple use approach, including the development of community institutions to ensure sustainable use. The project seeks to achieve this aim through technical field trials and policy dialogue.



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For Further Details Contact:

Jonas Sampa,

Agricultural Coordinator,

NLWCCDP,

P.O.Box 450063,

Mpika,

Zambia.

Tel: 00 260 4 370623

Email: jonasampa@yahoo.com