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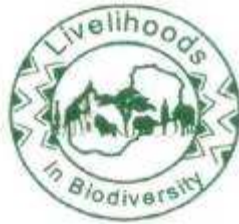


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*North Luangwa Wildlife Conservation & Community Development Programme*



# **SUSTAINABLE DAMBO CULTIVATION**

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**Harvest Help Sustainable Agricultural Forum Members  
visiting a new *dambo* garden at Mwansabamba**

**MPIKA**

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## 1. INTRODUCTION

This booklet is an extended and revised version of the “Dambo Cultivation” booklet prepared in June 2006. As before its focus is on the development by communities of new ways of using *dambos* for agricultural purposes in response to problems of food insecurity and poverty in Mpika District in 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 seasonal food shortages and diversifying cropping, thereby improving household nutrition, as well as food security.
- 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 income to raise incomes and diversify livelihoods.

This revised booklet addresses some of the questions raised in the original version about the possible long-term environmental impacts of the use of this 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 the process of achieving sustainable *dambo* cultivation and improved livelihoods.

The booklet concludes with some case studies of lives transformed through *dambo* cultivation. These are just three cases of how dramatically livelihoods of poor households can be transformed, and the future for families improved.

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

## 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 conditions so care should be taken to note the specific conditions reported in this project area.

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 methods 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 these farmers planted early maturing crop varieties, a pumpkin called *utunkomankoma*, maize called *kanjele* and squashes. These crops produced a harvest at the end of the dry season and into the rains (October to February), and so helped people survive during the hunger period after the 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.

At that time the traditional land preparation involved uprooting the grass in pieces, or turfs, with quite thick “slices” taken, with 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 grass had high concentrations of potash and gave good yields.



**Cecilia Pensulo receiving hands on training from Jonas Sampa of NLWCCDP on integrated pest management in her *dambo* garden**

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 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 riddinging

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.

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 high water levels, 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 the root growth of plants. These conditions mean that to farm in these *dambos* some manipulation has to be made to create favorable conditions for plant growth. Once this is done a wide range of crops can be grown including onions, pumpkins, 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 them out in those areas.



**Typical *dambo* terrain which farmers are selecting for cultivation**

### 3.2 Site Selection

Sites for cultivation should be chosen which have the following characteristics:

- in annually wet *dambos* with clay soils,
- near the edge of the *dambo*, and hence accessing the upland water which comes through groundwater flow,
- covered with short grass – which indicates these moist conditions,
- flat terrain or only very gentle slope on the site – to avoid erosion,
- not close to a stream, preferably 30m to 40m away, to reduce siltation into the stream course, and
- not at, or near, the source of a stream or in the main seasonal overland flow routes or channels of water.

### 3.3 Land Preparation

The major labour need is for land preparation. This involves a set of activities to be undertaken in sequential order but their timing can be adjusted to suit farmers other commitments.

- Start just after the rains in April and continue up to October - this gives enough time for land preparation, including other tasks with rain-fed cropping.
- Start stripping off the turf as a thin layer with only a little of the soil root system taken from the main soil body. (Slicing thinly enables the grass, soil and roots to dry quickly, enabling the turfs to burn thoroughly).
- The turfs are sun dried, with turfs 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 direct sun light and so minimizes evaporation and loss of water.
- The turfs dry in two to six weeks depending on the moisture they contain and the sunlight intensity.



Stripping turfs from a *dambo* to prepare a garden

### 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. But ridges should not be aligned directly down the slope to avoid gully formation.
- When ridges are to be used during the rainy season their height should be 30cm to 40cm so that waterlogging does not occur. Ridges should not be precisely along the contour as this blocks the water and the roots of the plants on the ridges can become waterlogged, creating unfavorable conditions for growth.



**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,
- loosens the soil to improve aeration and ease 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. Also, it is important to bury the potash before it starts to draw water from the ground, as this would accelerate moisture loss.



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

### 3.7 Ground Water Source

The concentrated potash draws up residual moisture up from the undisturbed ground below the ridge. This is due to its hygroscopic (water attracting) nature. This enables the centre of the ridge to become wet within only a week after the burning and then 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 ridge**

### **3.8 Sowing / Planting**

Seed holes or planting stations should be made deep enough (about 10cm), 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**

### **3.9 Plant Choices and Timing**

The choice of the first crop will depend on the farmer's needs, these usually being either cash income or domestic food security. Planting can start as early as April for the first crop, followed by a second crop in July to be followed by 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**

<b>Months</b>	<b>Food Security Crops</b>	<b>Cash Income &amp; Food Crops</b>
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. This enables the farmer to purchase inputs, such as fertilizer, for upland farming for the next rainy season, with off-season crops that fetch good prices.



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

#### **4. ENVIRONMENTAL MANAGEMENT TO SUSTAIN *DAMBO* FARMING**

Experience has shown that this method of farming is most successful where a very short grass or possibly sedge is found. This grass indicates plentiful groundwater. Assessments have shown that this good supply of water is found when the adjoining uplands are well wooded or forested and it is thought that this facilitates water infiltration. Where there are many gardens in the adjoining uplands there is less groundwater in the *dambo*, probably due to higher runoff and less infiltration. In such cases the adjoining *dambo* areas have tall elephant grass, and agriculture here is generally not successful.

Discussion of this association at the community level has led to communities deciding they need to protect the woodland in the areas immediately upslope of their *dambos*.

There is also a general awareness of the dangers of cultivating close to streams, with water pollution and gulleying likely results.

To apply this understanding, communities are now developing Village Natural Resource Management Committees. These raise awareness of the environmental issues related to *dambo* cultivation and have developed and are enforcing by-laws which will help sustain this important contributor to household well-being. Specific by-laws, which have been developed and are now being enforced, after being approved by the village headmen and local chief, include:

- Protection of woodland and forest upslope from *dambos*, or rehabilitation of these when degraded – specifically through restrictions on cutting and the use of early burning to reduce fire damage;
- Protection of streams and seasonal water courses by keeping cultivation more than 10-20 metres distant;
- Prevention of cultivation in the upper parts of *dambos* from where water originates; and
- Limiting of plot sizes and controlling location so that contiguous / adjoining areas of cultivation do not develop.

One further lesson is that by cutting thin turfs, much of the roots system of the grass remains and this facilitates regeneration once cultivation in the area is abandoned. Three years after abandoning a wetland plot it is hard to see where the cultivation had taken place, the original short grass being well established.

## **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 by-laws.

### **5.1 Case One**

Cecilia Pensulo 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 a particular method 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 so she managed to meet some of her household costs and could 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 ongoing, but less intensively 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 Pensulo 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 Bizile 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 they survived as well as gaining piece work or daily labouring at the Boma or District Headquarters.

Following contact with NLWCCDP in 2005 Michael, farming in the dambo on a small patch of the short grass, 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 provided 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 Salimu 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 (Boma) 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 for cash with which to buy food to send home. At the Boma 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 to make 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 rainfed 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 the Boma (50 kms) and even the Copperbelt 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 Boma.

## 6. REFLECTIONS ON *DAMBO* FARMING – SUSTAINABLE & 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, 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 result can be sustained.

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

### 6.1 Advantages

- Making fertile and productive land which was formerly difficult to use,
- Making use of the dry season of 6 to 8 months when labour is available,
- Producing dry season crops which are less vulnerable to fungal disease attack than in the rains,
- Selling crops in the early to mid rainy season crops when the prices are high,
- Using residual moisture means that households can plant early before the onset of the rains and spread their workload,
- Replenishing food stocks at regular intervals throughout the year, or generating cash instead to meet household needs,
- Environmental impacts are minimal as there is no need to use chemical fertilizer as these soils are naturally fertile once burned,
- *Dambos* regenerate in two to four years if the land is left fallow, which is quicker than in the uplands,
- The technology is appropriate for small-scale farmers as a solution to the poverty and hunger they suffer,
- An assured water supply for the crops is possible if suitable land is selected, and
- Social capital is enhanced in the village through the development of VNRMCs to manage the upland and wetland in a sustainable way.

### 6.2 Disadvantages / Dangers

- 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 the main influence,
- Waterlogging will increase if ridges are made along the contour in the *dambo*,
- Vegetation in the *dambo* is lost, but this is temporary and recovery is quick,
- Streams may be blocked due to siltation if *dambo* fields are close to them, and
- Streams may dry out if extensive cultivation is undertaken near the stream source.

### 6.3 Solutions to the Dangers

- Build understanding of wetland dynamics, especially the water sources,
- Develop community-wide discussions on how to manage the *dambos*, and
- Establish VNRMCs and enforce their by-laws

## 7. WAYS AHEAD

The cultivation of *dambos* in Northern Province is going to increase spontaneously as farmers realise the benefits which can be obtained and learn how their livelihoods can be enhanced. 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 have minimal environmental impact. 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 within the *dambos* and in their surrounding upland

catchments. The future prospects are encouraging for poverty reduction through sustainable *dambo* cultivation and sound land management to create a functional and productive landscape.

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