

### Introduction

The importance of water for human and animal existence needs no discussion and on the African continent the state of water availability is in a rapid decline due to a variety of factors.

Some of these are due to the activities of man – these include population increases of both people and their animals which causes overgrazing in arid and semi arid lands which in turn leads to rapid run-off of rainfall with little infiltration thus compounding the problem of grazing.

### Desilting Dams

Dams and pans were mostly constructed with a large storage capacity but this has been greatly reduced over time due to silt deposited with each rains so that this capacity has been greatly reduced sometimes to zero.

As they dry up prematurely the pastoralists are obliged to move to other sources of water which can result in conflicts with other groups who are also suffering from the same shortage.

Changes in global weather patterns have generally made the situation more difficult. There are many cases where expected rains failed not once but severally thus forcing groups to leave large areas as they became completely uninhabitable.

Yet, by contrast, in 1978 the El Nino phenomenon caused large amounts of rainfall in arid areas. This had advantages in that it resulted in profuse grazing and filled all the dams and pans but it also destroyed some of them due to the large volumes which overcame the spillways.

This downfall raised the relative humidity of the air which is normally very low and this in turn produced diseases leading to losses especially young stock.

Thus the general situation is one of deterioration with suffering to both humans and animals and this article indicates how some improvements can be obtained.

### Energy sources for increasing dam capacity

There are different techniques to remove silt from dams and these depend on the type and source of energy used.

**Engine Powered Equipment:** A wide range of mechanical equipment is available on the world market and this equipment can dig or clean dams at a very high rate compared with other means.

While these may be used initially, under donor supported programmes, to create the structure

they are too costly to be used for maintenance purposes by privately owned machines unless considerable work exists within a limited area. In arid and semi-arid areas distances between dams may be far and the costs of just moving the machines to the sites will be high so private owners are reluctant to participate.

**Human Energy:** This is the most commonly used form of energy. Communities provide the energy to remove the silt often twice per year prior to the anticipated rains. They do this by loosening the silt with hand tools such as a forked hoe or cutlass then filling wheelbarrows or laying it on sacks which are manually moved/carried out of the dam and dumped often on the walls.

This is a very laborious means of desilting but it has little capital input and requires good organisation of the community so that the maximum amount of silt is removed from the structure.

**Animal Energy:** In arid areas pastoralists depend entirely on their animals for their livelihood and these may be cattle, shoats, donkeys and camels. In semi-arid areas where the rainfall allows some cropping to take place cattle, shoats and donkeys are found.

In few of these areas is the potential energy of animals used. Exceptions are in semi-arid areas where oxen are used to cultivate more extensive areas than can be cultivated by hand and also to pull carts. Donkeys are used to pull carts or, where no tracks exist, to back pack loads.

Camels are used by some communities to move their households and some back packing but their great pulling power is seldom used often because of the high regard of their status they are considered to hold by the community.

Thus oxen are already being used for draught purposes in semi-arid areas and by making available suitable equipment they could be used for dam cleaning.

In arid areas cattle are often ill fed, too thin and light to be used for draught purposes and there is cultural resistance from the owners to use them. Donkeys, however, thrive in these areas and are used by women for water carrying so they are potentially suitable animals as a source of energy – but they are clearly less powerful than oxen so suitable equipment has to be designed for them.

### Equipment for Silt Removal with Animal Power

Two tools are used in a series of operations similar to silt removal by hand. A cycle of operations consists of:

- Loosening hard soil compacted by the feet of animals.
- Loading the soil into a container.
- Dragging the container and load to an unloading area.

- Returning with the empty container to the start point for another cycle

This article describes how the soil loosening operation is performed separately from that of loading and transport by using two tools, each designed specifically for the operation it is to perform thus reducing the energy and making a more efficient operation.

### Soil Loosener

This is a scientifically designed tool to loosen soil with the minimum of energy input and in the case of the donkey and camel a novel harnessing arrangement allows a short and light tool to be used which can easily be handled by women and young adults.

This is designed to suit an animals(s) pulling capacity and it penetrates about 100 mm depth and loosens the soil over a width of about 350 mm.

### Use of Soil Loosener

The handles normally do not need assistance to penetrate nor to control the depth, their main use being to drag the tool when turning with donkeys or camels. In most soils except dry heavy clays it will loosen in one pass but sometimes a second pass at right angles is needed. It will handle surface trash but if the amount of surface weeds or shrubs is excessive will have to be first cut with a machete.

Care should be taken when turning that the sharp ends of the tool do not contact the animals and cause injury.

### Soil Scoop

This is made in two sizes a small version for two donkeys and a larger one for two oxen or a single camel.

The scoop has handles to control the depth of the cutting blade, to control the load when transporting and to tip the load at its destination.

The cutting blade is hardened steel to resist the abrasive wear in sandy soils and hard rubbing plates are welded under the scoop to reduce the rate of wear.

### Use of Scoop

Potential users reading this article will understand that the adage 'Practice makes Perfect' so even though a description of its use is given here it only describes what the aim to accomplish is.

### Rules for using the scoop:

- Use the handles to load a thin layer into the scoop over a distance of 20-40 m. Depending on the soil and its condition it will load automatically but may need the occasional rapid 'down flick' with the handles to throw the soil to the back of the scoop.
- It is important to keep the surface as level as possible as any undulations or furrows can

cause a sudden increase in pulling force when the blade of the scoop enters. This sudden increase in force is transmitted to the animals through the harness and causes them discomfort and may cause them to stop.

- If this happens -Do not try to make them start until you have reduced the force by lifted the blade by pressing down on the handles.
- Do not overload the scoop – remember loose sand is very dense and heavy and if the transport route is steep then limit the load.
- Observe the condition of the animals when pulling –if they move slower than usual then they are probably overloaded.
- Spend time making the transport route as smooth and with gentle grades to reduce the energy needed.
- When the tipping site is reached raise the handle in a controlled manner to deposit a layer of soil over a distance rather than a heap which will interfere with the next load.
- As with all animals work them early in the morning and late evening with rest, water and food between.

### Comments on the Use of Specific Animals

**Oxen:** These are yoked as a pair but a wider yoke, normally for weeding, is used to keep the loosening tool away from contact with the animals. The long pole beam attaches the tool to the animal in place of the normal chain while the two handles are for control of the depth of working and to pick up the tool when turning.

This tool is light and can be handled by women and young persons while a man guides the animals unless they are well trained.

**Donkeys:** Normally two donkeys are used and unless they have been used to pull a cart they will require training to work together which is beyond the scope of this article.

Note that the harness must be a good fit on the breast of the animal. Now donkeys add or lose weight according to the grazing available so the harness must be adjusted to suit the current size.

The harness falls steeply from the back of the animal to attach to the tool via the swingle tree. This system of harnessing has been proved to require less energy from the animals and allow a lighter and cheaper tool to be pulled.

**Camels:** These be trained to accept the harness and to pull loads but experience has shown them to be intelligent and to learn quickly after their temperament has quietened down an occurrence at each new harnessing during the initial stages. The harness has been designed so

that it does not cross the neck or throat thus eliminating the risk of affecting its breathing.

In work camels are very powerful and can continue for long periods without apparent strain thus do much work.

General Comment on Animals: As the two tools are used alternately it is better if two pairs of animals are available so that one pair rests while the other works.

### Making a Silt Trap

The use of a silt trap can reduce the amount of silt entering the dam or pan, depending on its configuration. It consists of a depression in the ground at the entry to the dam. The water fills the depression before entering the dam and some of the larger particles of soil will be deposited into it while the water continues to the dam (See diagram).

Normally the trap will be above the water level so that as it dries out the sand/silt can easily be emptied before the anticipated arrival of the rains.

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