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.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 their 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 for Increasing Dam Capacity

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

Mechanical Energy

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 but is costly except for very large dams.

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.
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 by Animals

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 (Photograph 1 )

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. It 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.

Soil Scoop (Photograph 2)

This is made in two sizes a small version for two donkeys and a larger one for two oxen or a single camel (Photograph 3).

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.

Animals

The equipment is made for donkeys, oxen and camels but some communities have resistance against using oxen or camels.

Each animal must have a correctly made and fitted yoke or harness and this must be checked each time it is fitted as animals increase in size in the rainy season and the harness is adjusted to take this into account.

The animals must be trained to walk together and pull loads if they have not been used to working with carts.

Desilting

If the soil is clay it must be dry before it can be loosened for moving but if sandy it can be moved when wet but as it is so dense the scoop should not be filled or the load will be too great for the animal.

Careful timing and organisation is needed to move the most soil in the time available and this is best carried out as a community effort where a series of animals are available so that each pair can work then rest while another pair continues.

This means those with looseners work over an area then the scoops remove that soil while the others rest.

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