



22 • Soil Conservation

Introduction

A natural forest that is not disturbed by felling trees, ploughing of land, burning or killing of animals and insects, can be considered to be in balance. However, this natural balance does not apply to most land under cultivation, because most agricultural practices disturb the natural balances.

Too often this results in loss of soil through erosion and also reduces soil fertility. However, with good farming practices, much can be done to restore soil fertility. Soil conservation includes all the agricultural practices that are employed in maintaining or improving the soil. It is necessary to learn about some of the soil and crop management practices that lead to soil infertility, in order to avoid them.

Soil Structure

Topsoil

The first layer of soil is called topsoil. It is dark, because it contains humus. Humus consists of materials from dead plants and animals that are partly decayed.

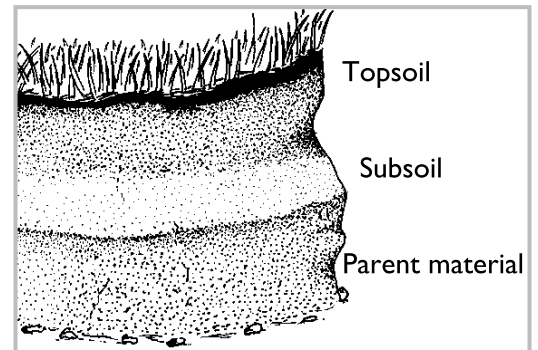
The more humus there is in the topsoil, the more fertile the soil is. This is because humus binds nutrients and water and it gives the soil a good structure so that air and water can penetrate.

Topsoil is therefore an important layer.

The crops that we grow have most of their roots in this layer. This is where they get the nutrients and water they need for growing. The topsoil layer is often 20-30 cm deep.

Subsoil

Subsoil may be very shallow or very deep. It is lighter in colour and does not contain as many nutrients as topsoil.



What is soil erosion?

Soil erosion occurs when soil is moved away by either wind or water. Every year thousands of tons of good topsoil is washed away from the fields. In Malawi it is estimated that on average 35 Tons of topsoil is washed away per hectare of farm land. This costs Malawi over 300 million US\$ in lost nutrients every year.

Soil erosion especially takes place where the soil is bare and it is worst on slopes and hillsides.

Wind erosion is mainly a problem in dry and flat areas with little vegetation.

A fertile soil forms a darker topsoil over the subsoil

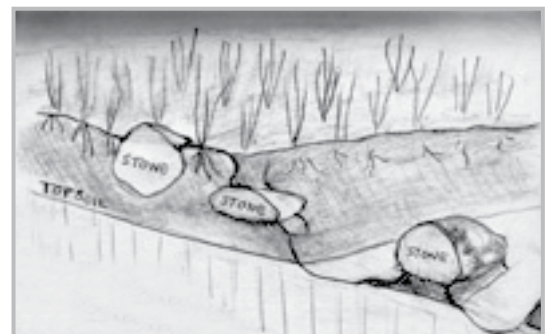
Types of soil erosion:

Rill erosion is often seen in fields. It looks like a network of very small streams that take away the fertile topsoil. Crops will not grow well in these conditions.

Gully erosion

If the rill erosion is not stopped this can develop into large gullies. They are easily seen and can quickly become several metres wide and deep. They look like big rivers in the landscape and make it impossible to use animals to till the field.

Sheet erosion removes the fertile topsoil. Small stones are left on top of the surface





Sheet erosion

This is more difficult to see; it means that a small layer of topsoil is lost all over the field. This often happens due to wind erosion. Sheet erosion can be identified by looking for stones that are raised above the remaining surface. This is because the topsoil has been washed away and the small stones remain.

Farming methods that cause soil erosion

1. Overgrazing

Overgrazing is a big problem in many parts of Africa. Too many animals, especially cattle and goats, graze on very small pieces of land, thus destroying the vegetation, which in turn causes soil erosion.

2. Lack of soil organic matter

Soil that contains humus (organic matter from dead plants and animal, which are partly decayed) is more resistant to erosion. Humus works as glue that binds soil particles together in clumps. These clumps do not easily wash or blow away. Soil with organic matter behaves like a sponge when absorbing water. Therefore, the soil is less exposed to erosion when it is given organic matter.

3. Tillage

Tillage increases the risk of soil erosion.

This is because tillage crushes the soil and thus produces large amounts of powdery material. After ploughing, the soil lays bare.

When the raindrops hit the bare loose soil, mud is formed, which easily washes away.

4. Mono cropping

Planting the same crop on the field year after year reduces soil fertility, because the same crop removes the same nutrients from the soil.

Mono cropping also builds up diseases in the soil, which reduces the yield.

5. Ploughing across contours

If ploughing is done across the contours (up-down) even on slightly sloping fields, it can lead to severe erosion.

6. Cultivating on steep slopes

Farming on steep slopes without constructing contour bounds or terraces will lead to severe erosion.

7. Lack of windbreaks around big fields

This will lead to wind erosion. Especially if the field is tilled and lies bare.

How to conserve soil and improve fertility

1. Make and use compost

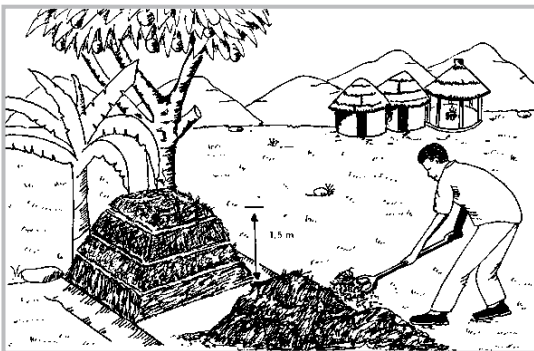
Compost is a source of organic matter for the soil.

It is best to place compost into the planting holes or mix it into the ground in order to avoid losing valuable nutrients. Mixing the compost into the soil will also improve the soil structure because it will increase the soil's ability to retain water and provide valuable nutrients.

2. Use animal manure on the field

Animal manure also provides nutrients that help to maintain soil fertility, but more nutrients are made available to the plants if it is first turned into compost.

Compost heaps are best suited for humid areas





3. Plant windbreaks

Plant windbreaks on the side of the field, where the wind blows from. This will prevent the topsoil from blowing away.

4. Use crop rotation

Crop rotation will make the soil more fertile. Crop rotation means that the farmer does not plant the same crop in the field every year.

An example of good crop rotation:

First year maize, second year cotton, third year groundnuts, fourth year maize. The crop rotation must include legume crops, because they will improve the soil fertility. Furthermore, crop rotation secures that organisms carrying diseases do not accumulate in the soil and this will help to keep the crops healthy.

5. Contour ploughing

This is ploughing along the contours. It is very important to prevent rain water from washing the soil away. It is only when the land is totally flat, that it is not necessary to use contour ploughing. In order to find the contours, the farmer can make and use an A - frame.

Making an A-frame

The A-frame consists of 3 straight sticks e.g. bamboo.

The two legs are cut to exactly the same length. The stick across is placed exactly on the same height from the ground on both legs.

The 3 sticks are nailed or tied together with fibre or string. A mark is made exactly in the middle of the stick across.

A string with a stone at the end is tied to the top of the frame. When the rope hangs over the mark on the horizontal stick, then the two feet are placed at the same level.

6. Contour bunds

In sloping areas the farmer ought to construct contour bunds. These can be made of soil or rocks. They can also be made by planting vetiver



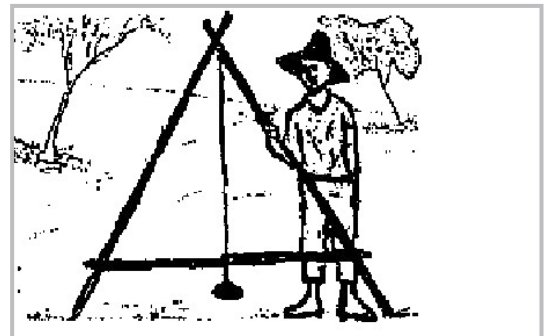
along the contour lines. Soil will then gradually accumulate in front of the vetiver hedge and form a natural terrace.

The contour lines can be measured with an A- frame.

A furrow and a bund to stop rainwater flowing downhill

7. Plant vetiver grass

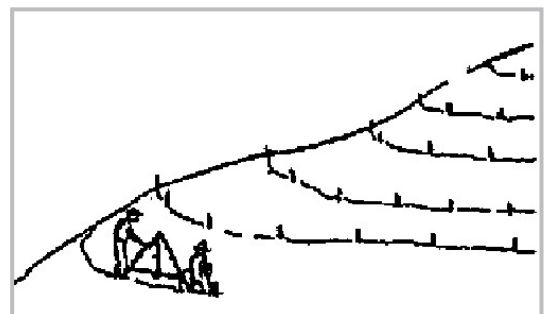
Plant vetiver hedges across gullies and around dams in order to protect against erosion.



8. Practice minimum tillage

Minimum tillage ensures that the soil is not broken down into very small particles that can easily be blown or washed away by rain.

Minimum tillage can be done using permanent planting holes dug with a hoe, ploughing or with ripping the lines for planting with draft animals or a tractor.



The A-frame

Marking the contours with an A-frame



9. Avoid burning

Never burn crop residues.

Chop them and spread them all over the field. This will protect the soil against the destructive action of the rain drops. It will at

the same time provide the soil with organic matter, which will improve the soil fertility. Avoid late burning of the bush, be-



Follow the contour lines to prevent the water from running off

cause it will leave the soil bare. Early burning or no burning must be practiced

10. Use improved fallowing

Degraded land can be rehabilitated by using the system of improved fallowing (see section 21). The roots of the legume tree will have broken hard plough pans and brought

up new nutrients which the normal crops cannot reach. The roots and leaves will also have improved the soil's fertility.

11. Leave Msangu trees in the field

The msangu tree grows in many parts of Southern Africa, and can with good result be left in the fields. The tree fertilizes the soil and it does not compete with the crops for light since it drops the leaves at the start of the rain season. Maize and sorghum grown under Msangu trees give very good yields. (see more in section 50).