



# 7



## Improving Tree Cover

### 47 • The Importance of Plant Cover

This chapter considers some of the ways in which the protection and cultivation of trees and plants can be used to improve local environmental conditions.

#### Why protect natural areas?

There are many reasons why we should protect the nature around us. One reason is that we don't have the right to destroy nature just because we have the power to do so. We humans are just one of the 10-15 million different species on Earth, and other organisms have the same right to exist as we do.

Why should we care if some or all these other species disappear forever?

One very obvious reason is that we humans need nature - in fact, we totally depend on



it. There are numerous historical examples of past civilizations that disappeared because they did not manage their natural resources well, such as The Mayans, the people of Easter Island, or the Viking settlers on Greenland.

The plants and trees are the basis for nearly all other forms of life, and it is therefore essential to preserve a healthy and diverse vegetation.

The greater the number of species living on earth, the more stable the global environment is. This means that natural systems are better able to survive the global environmental changes that occur regularly. And we need these natural systems in order to purify the earth's water and air. As natural environments are degraded, the water purification cycle is destroyed and topsoil that has been built up over centuries is eroded and washed out to sea. Climate change makes the maintenance and restoration of

a healthy environment even more urgent.

People also benefit directly from the existence of many species. Many of the profits gained from tourism are

intimately linked to nature and wildlife. Over one half of the prescription drugs from the USA have their origin in plant life yet only a fraction of existing plants have been researched for their medicinal properties. So there are many reasons to preserve the nature around us. Below are some examples.

**Gwembe District, Zambia** - How the degradation of nature results in difficulties for cultivators.

The Munyumbwe area of the Gwembe District was flooded for several weeks in 2003 due to heavy rains. Cars and trucks could not cross the river for two weeks. Such rains come about every ten years. But this year the problem was much worse because of the reduction of vegetation on the hillsides. People are now clearing new fields and cutting down for use as charcoal and firewood. When there are fewer trees, more water flows off the hills instead of entering the soil. Much of the fertile soil is carried with this rainwater and ends up in the river beds. Because the riverbeds are filled with the eroded material, there is less space for the water and the low-lying areas are easily flooded. This is precisely what happened in 2003. Not only were the crops destroyed by the water, but the floods also deposited a large layer of sand on the fields. The farmers thus have lost their fertile soil and have infertile sand instead.

We do not have statistics from the area but some people told us that the problem has become worse over the years. This is a good example of why it is important to protect the environment.

**Bana River System in Rajasthan, India**, experienced the same problem many years ago. However people started planting trees and creating systems to stop the water from running off. Twenty years later the water is running again in the streams and the valleys have become green again. It is possible to restore degraded natural areas and re-establish the balances, which are so important for all life.



*Deforested river bank-the result was loss of agricultural area due to erosion*



## 48 • Nature Preservation

### How to protect natural areas

The first step is to decide which area should be protected. The areas along the streams and rivers where water collects are critical. This is where much of the rainwater gets a chance to sink into the soil and becomes groundwater, which later supplies water to the streams throughout the dry season.

You must also decide what it means to protect the area. This will depend on the local conditions, and various degrees of protection can be agreed upon. If there is a lack of firewood in the area, one model might be to create a smaller area which is completely protected and a larger one outside of this where it is permitted to collect dead or fallen branches, and so on.

In other areas there are trees which grow many shoots from the roots - especially after fires. In such areas it can be beneficial to harvest the smaller shoots for firewood and let only one (the largest) develop into a tree. This applies to mopane trees and many of the trees in miombo and acacia forests. Similar decisions must be made regarding the grazing habits of goats and cattle, which will depend on the availability of food in the area. If possible, the best thing to do is to decide that there is to be no grazing allowed in the protected area. If this is not possible, then it may be possible to have a systematic type of grazing in the area. This means that animals can only graze when they are with someone who will make sure they graze in one area at a time. The animals can only return to the area when new grass has grown in.

Much tree destruction is due to frequent fires. New small trees burn before they

grow large enough to survive the fires. It is therefore very important to prevent the protected area from burning. This can be done by creating a fire belt (an area with little vegetation) around the protected area.

Early in the dry season when fires can still be controlled easily, a ring is burned around the area. It is best to carry out such controlled burning early in the morning or

late in the afternoon. The vegetation in the firebreak can also be kept low by allowing animals to graze there.

Other critical areas are wetlands or lakes. Normally it will not be possible to protect a whole lake since people need it for water supply or fishing. But it can be very beneficial to protect a part of the lake. People will find that if a part is protected, they will benefit as bigger fish are caught outside this area. Similarly, there are fields around many wetlands and lakes and along rivers. Communities will gain in the long term by restoring a zone of natural vegetation to border the water or wetland. This will avoid a loss of wetlands due to a lack of groundwater and reduce erosion along rivers.

Such discussions must take place at village meetings where all community members can contribute their views, and the community must be mobilized to select one or more areas to protect.

### Restoring degraded vegetation

The first step is to find out which area is most important to restore. This will in many cases be the areas around the riv-



*Destructive fires often spread when fields are prepared by burning*



ers, streams and lakes. In some places it is enough to protect the area against fire and grazing. The vegetation will grow back on its own because of seeds in the soil or new shoots coming from existing roots. In other places you will need to actively replant some of the trees which have been cut. Take this chance to learn about these trees by talking to the experienced elders in the area. They can tell you which trees used to be there and where to find them today.

**YOU ARE NOW ENTERING A PROTECTED AREA. PLEASE FOLLOW THESE RULES:**

**MILAWO YA BUSENA  
BUKWABILINDWE**

- 1. Kanyina kuumpa sokwe.**  
No burning of grass.
- 2. Kuyina kumvwima banyama, bayuni a kulida nzuki.**  
No hunting of bees, birds and animals.
- 3. Kunyina kusya miyanda a kukwama makwa kuzyisamu.**  
No cutting of roots for medicine.
- 4. Kunyina kugonka loozi**  
No cutting of fibres.
- 5. Kunyina kugonka masamu**  
No cutting of trees.

*Sign with rules in a protected area of Zambia*

When you have agreed which trees should be planted, you must look for seedlings of this kind of tree. Seedlings are the very young plants which are growing from the seeds and do not yet have a large root sys-

tem. Dig carefully around these seedlings and make sure that you dig much of the soil up as well. In this way it is often possible to move the seedlings to a new place. If all the soil falls from the roots they will often die. The best time to find these seedlings is halfway into the rainy season, and this will also be the best time to move them. You should plant the seedlings in the same kind of area as you found them.

If you can't find any seedlings of the tree you want, then maybe you can find the seeds and grow your own seedlings. The seeds must be collected during the dry season when they are ripe. This is when the fruit opens so that the seeds can fall out, or when birds and other animals are eating the fruit. It is usually best to let the seeds dry and then let them soak in warm water overnight. The next day you can plant them in small containers such as small plastic bags or plastic bottles cut in half. It is best if you can mix some old manure or compost in the soil some time before planting the seeds.

Often the areas close to flowing water are sloping, which means they are more prone to erosion. This is why it is so important to maintain a good cover of vegetation. When a large part of the plant cover has been damaged, it is necessary to stop the rainwater from running down the hills, because it removes nutrients and fertile topsoil. This can be done mechanically by making terraces with stones, soil and branches. It can also be made by planting grasses like the vetiver grass along the contour lines of the slope (lines at the same level). This will stop much of the water and cause it to sink into the soil.

You should choose a wet area where it is easy to establish a vetiver nursery. Here the grasses will multiply and produce new shoots for you to plant where it is necessary to stop soil erosion. (See section 23 for more information about vetiver.)



Some areas may be so destroyed that they need more help to be restored. This will be the case if the fertile topsoil has been washed totally away by the rain. Then you must start a nursery of plants that can help restore nutrients in the soil. These include the legume plants - plants which all have fruits that look like beans (pods). The pigeon pea is one of these plants. It can grow in poor soil and dry conditions. You can plant these in the degraded area and plant vetiver grass to control the erosion. After a few years, the soil will have improved and other trees will start to establish themselves in the area. You can also plant native trees which you know can grow under difficult conditions. You can help them get going by making a large planting hole - 50x50x50cm - and filling it up with compost and old manure.

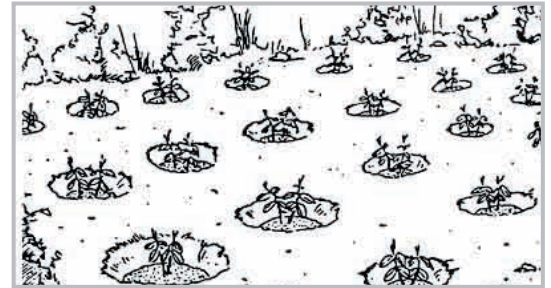
All villages should select an area to preserve or to restore. This is necessary to maintain and restore a healthy water cycle - for our benefit and for the benefit of all other living things.

### Restoring vegetation

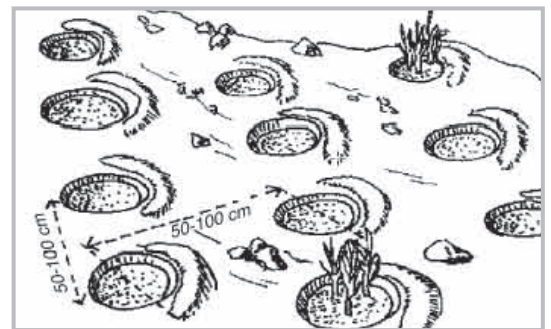
- Make holes in the ground and fill them up with soil and compost.
- Find seedlings of the trees during the rainy season.
- Transplant the seedlings and make sure you get plenty of soil along with the roots.
- Find seeds and grow your own seedlings.
- Plant them in the holes and cover the roots, but make sure you leave the surface lower than the ground level so that water is absorbed.

### Collecting water

You can make small semi-circular ridges of soil to collect rain water on the side pointing downhill of the planted trees. This can be used even on gently sloping areas. More water will penetrate the soil and the trees will grow better. This system works best if the area is not too steep. The ridge systems must be at least two metres apart from each other and the basin in which the trees are planted must be lower than the ground level in order to hold water. You can get even better results by planting vetiver grass on top of the ridges. This will save you maintenance work.



*Trees planted in holes to collect water*



*Semi-circular ridges of soil help to collect water in the holes where trees are planted*



## 49 • Production of Trees

### Introduction

New trees can be produced using the following methods:

1. in a tree nursery in polythene pots,
2. in a nursery using seedbeds,
3. by planting seeds where you want trees,
4. by planting wild seedlings found under mature trees in nature,
5. with plant cuttings.

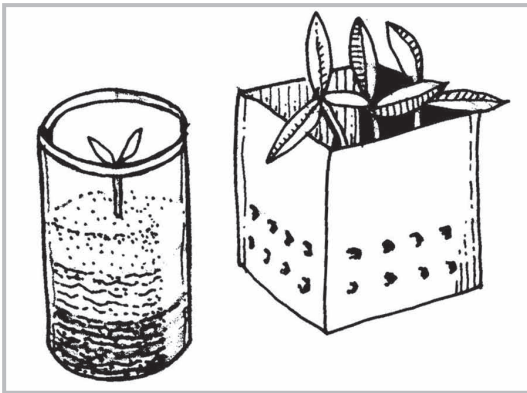
### Growing seedlings

#### Site selection

A nursery should be located near a water source, on flat land. It should also have a wind break, some shade trees, and not be waterlogged.

#### Fencing

The nursery must be fenced in order to protect the tree seedlings from animals and chickens. Use grass and poles, thorny bushes, or plant live trees to serve as a fence at the start of the rainy season.



Production of seedlings in cans (tins) or juice/milk cartons

#### Nursery beds

The beds should be one m wide and should be separated by walkways 60 cm wide. A bed 1 m x 5 m can accommodate from 500 to 1000 seedlings. So 10 m x 10 m will be sufficient for at least 10,000 seedlings.

#### Type of soil to use

The polythene pots or the seed beds can be filled with a good layer of topsoil. The best soil is found under big trees (acacias) or near dams/rivers. If the soil contains much clay (it can be easily formed into a ball when wet), you should mix the soil with sand. If the soil is not very fertile, then you should mix it with manure. Never mix more than one part of manure to ten parts of soil because the manure can burn the tree seedlings.

#### How to fill the pots

The bottom layer must be pressed hard, the middle layer should be slightly pressed and the top layer quite loose. The soil is pressed hard at the bottom in order for the soil not to fall out during transplantation. If you have no polythene pots you can use any available container, such as cans (tins) or milk cartons. Remember to make several small holes in the base so that excess water can run out.

#### Sowing the seeds

Seeds can be sown directly into pots or seedbeds. If you are using pots, it is best to sow at least three seeds per pot. Seeds sown in seed beds can later be transplanted to pots or even directly to the field (bare root planting). Cover the seeds with a layer of soil that is as twice as thick as the seed itself. This means that the bigger the seeds are, the more soil will be needed for covering.

#### Shading (protection from the sun)

The seed bed or pots should be covered with a thin layer of grass after sowing to protect against the sun and heavy rain storms. A thick layer of grass is bad for germination (the stage where seeds start growing into tiny plants). When the seedlings have germinated you should build



a shade at a height of 60 cm above the seedlings to protect them from the sun and strong rains.

### **Seed collection**

Many seeds can be collected locally from existing trees. It is best to collect seeds from good and healthy trees. Seeds from any ripe fruit can be washed and then sown fresh or dried in the shade.

### **Seed treatment**

It is important that the seeds are treated correctly before sowing, or they may take a long time to germinate or germinate poorly. There are basically two different treatments:

#### **Cold water treatment:**

Leave the seeds in cold water overnight before sowing. This applies to most fruit tree seeds and some other soft seeds.

#### **Hot water treatment:**

Heat some water close to boiling (the volume of the water must be twice the volume of the seeds). Put the seeds in the hot water and leave them to soak overnight.

### **Watering**

While the seeds are germinating and the seedlings are small, they must be watered daily. After this phase watering every other day is sufficient. Use a water can or sprinkler made from a plastic container with small holes in it. Do not over-water as this can cause fungal diseases. Keep the pots or seed beds free from weeds at all times.

### **Transplanting**

Seedlings can be transplanted from seed beds when they are 3-5 cm tall. Transplant them to pots or another seed bed for bare root planting, keeping a distance of 5 cm x 5 cm between each plant. Water the seedlings and water the pots. Lift the seedling and make sure that the root will not be dis-

turbed. Make a planting hole with a finger or a stick. Make sure the hole is bigger than the root. Press the soil firmly around the

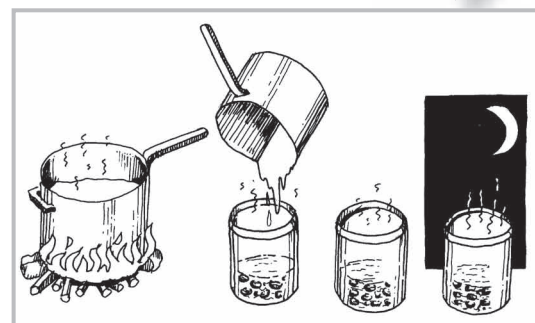
plant. Water again and give full shade to the seedlings for three days.

It is good to separate pots by size to make correct watering easier. Take away the empty pots where seeds did not germinate or where transplanted seedlings died. Re-sow or plant in these pots.

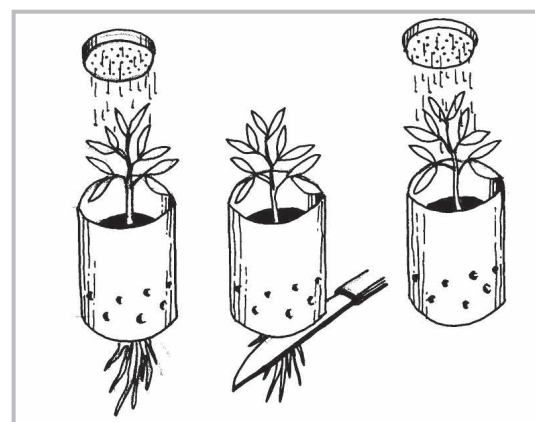
### **Root pruning**

Eliminate small roots protruding from the pots by simply lifting the pots and breaking the roots by turning the pot around or by cutting the roots with a knife. This will give the seedling a denser root system that can better survive being moved. Without pruning, the roots

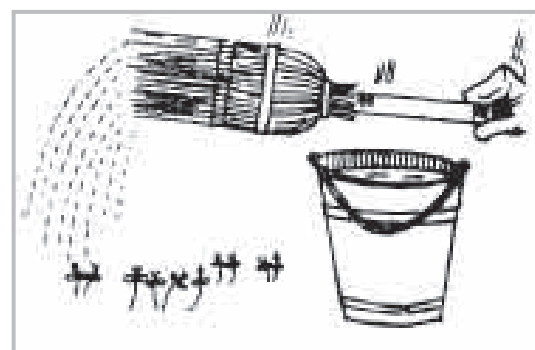
will grow under the pots. This can cause difficulties during transplanting, as roots may be damaged or break. Before and after root pruning, the seedlings must be well irrigated. Give full shade to the seedlings for 2-3 days.



*Hot water seed treatment*



*Pruning of seedling roots*



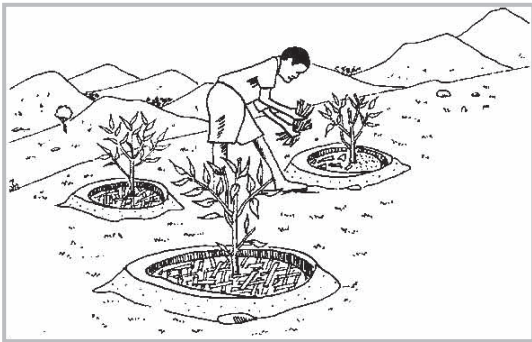
*Watering seedlings with a broom*



# 50 • Agroforestry Systems

## Environmental advantages of trees

Trees:

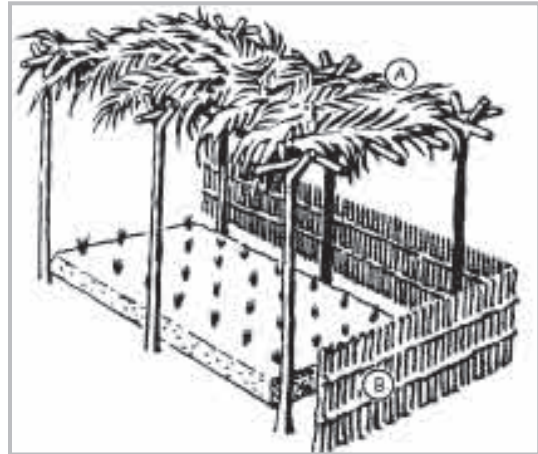


- improve the local climate (micro-climate), by forming a barrier against wind, regulating the temperature and increasing humidity levels,
- protect the soil against erosion caused by wind and water, while at the same time improving the absorption of water into the soil,

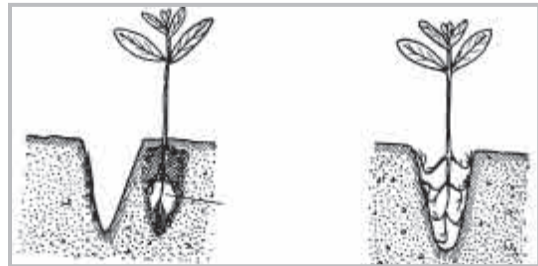
Mounds and covering to preserve the soil's humidity

- support nearby crops indirectly by influencing the micro-climate and the soil, and directly by supplying shade and shelter or protection, and by bringing up nutrients from deeper soil layers,
- diversify the landscape and enrich the environment - where would the birds make nests if there were no trees?

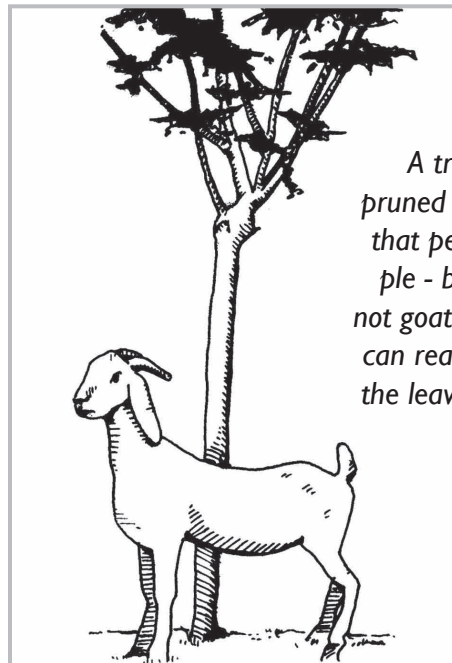
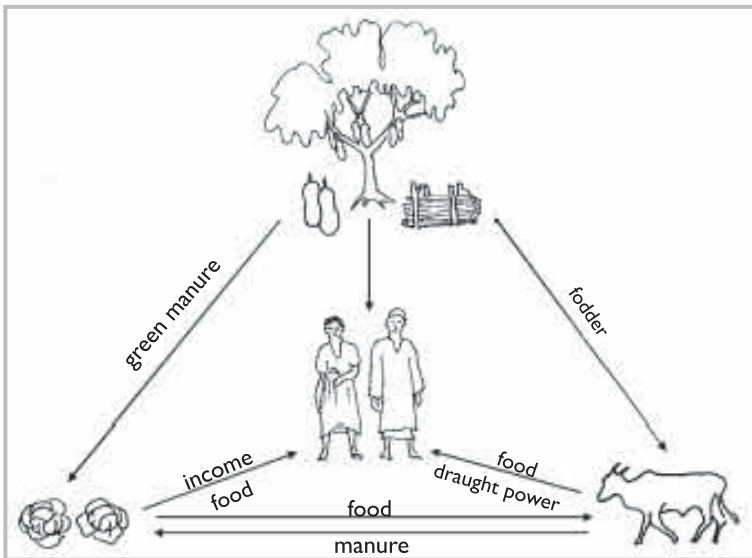
Advantages of trees



A well-covered nursery



Incorrect planting - with air pockets or bent roots



A tree pruned so that people - but not goats - can reach the leaves





Legumes - including trees, bushes and herbs - are capable of converting the air's nitrogen into nitrogen that the plants can use by means of bacteria that live in their roots. The trees have the great advantage of fixing nitrogen throughout the entire year. Many nutrients such as nitrogen are easily drained out of the topsoil and they often end up out of reach of the crop plants with smaller roots. Only plants with deep roots such as trees are capable of using these nutrients and are thus able to "pump" the nutrients back to the topsoil, when the leaves of the trees drop and decompose.

An agroforestry system is a farming system that integrates crop and livestock production with growing trees and shrubs. Read more about agroforestry systems in section 21-"Improved following".

### The Msangu - *Faidherbia albida*

Msangu (also known as *Acacia albida* and *Mussadze* in Central Mozambique), is used in some regions of Africa in an agroforestry system together with cultures of maize and many others. Msangu loses leaves at the start of the rainy season. It is therefore possible to plant crops beneath it since there is enough sunlight. Msangu is a legume tree that fixes nitrogen, with the result that the farmers get better harvests underneath the trees. The ability of msangu to improve soil fertility has long been known in Senegal, for example, and in many areas the trees are protected and may reach a density of 40 to 50 trees per hectare of agricultural fields.

Msangu also supplies plant fodder for domestic animals during the dry season. Msangu has many long roots and grows well where groundwater is not deeper than 30-40 metres.

Msangus can be grown from seedlings that grow naturally in the fields. The farmer

must then select and nurture the seedlings until the leaves are above the reach of livestock - about 1.5 m - after 2 rainy seasons.

The msangus can also easily be grown from seeds. The seeds should be soaked in warm water overnight.

Direct seeding of pre-germinated seeds has shown to be successful and cheap in Senegal. This requires careful weeding in the while the plants are young, to avoid competition for water.

It has been shown that millet yields under msangu are, on average, 2.5 times higher than when millet is

grown away from the trees, and the protein content of the millet increases by a factor of 3 or 4 when it is grown near the trees.

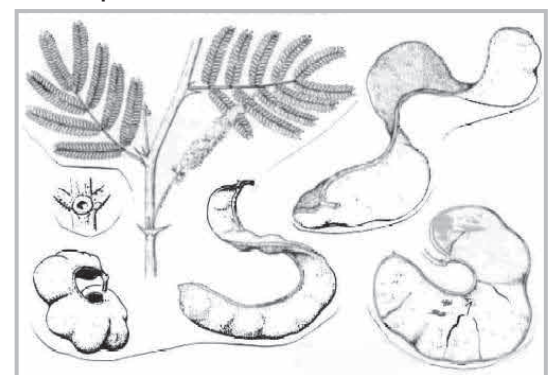
A similar system using the *Prosopis cineraria* tree in Rajasthan, India, produces the same good results.



Trees pruned so that branches and leaves can be used



Msangu trees left to grow in fields in Zambia



Msangu leaves and fruits



# 51 • Bamboo Cultivation

## Introduction

Bamboo is a plant that offers many economic advantages:

### 1. Rapid growth

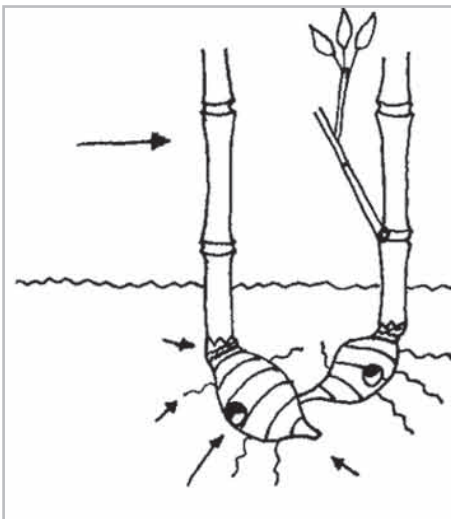


One billion people live in bamboo houses

Bamboo matures in three or four years, faster than the fastest growing tree. You can harvest shoots and sprouts. You can produce ten tons of bamboo per

hectare per year.

### 2. Ease of establishment, maintenance and collection



Bamboo does not demand complex techniques in order to become established after planting. Harvesting strengthens the bamboo and is done with manual instruments. Transport is relatively easy due to the lighter weight of bamboo in comparison to other woods.

Most African bamboos have bulbs

### 3. Adaptable uses

Bamboo has many uses. It can be used for firewood, paper, or as a construction material; its edible shoots can be eaten, etc.

### 4. Ecological importance

Bamboo is a material that can substitute for wood in many different ways and thus contribute to reducing deforestation. It can also be used to reduce soil erosion.

### 5. Cultural importance

About one billion people in the world live in bamboo houses. People use bamboo in many aspects of life, including music, ceremonies, food.

## Bamboo production

Bamboo is usually propagated through the growing of new plant shoots (vegetative propagation), not through seeds. Bamboo is a very resistant plant that can grow back after a bad year or season. The plants sprout again after fires.

The structure of bamboo includes an underground network of rhizomes ("roots"), the sprouts, and the shoots.

## Rhizome system

The bamboo has rhizomes, which are underground shoots. They grow and separate from the mother plant, so that the bamboo can spread to new territory. Each year, new shoots (sprouts) grow from the rhizomes to form the taller (above-ground) parts of the plant. After 3 years the rhizomes will not grow more sprouts.

The sprouts use the reserves from one part to grow and sprout again. The shoots from the centre of the group are the oldest and those at the outer circle are the youngest. The youngest are the most brilliant, most flexible, and are moist on the inside. The older bamboo will be dry and rotten.

The natural bamboos of Africa - the species *Oxytenanthera abyssinica* is the most common - have bulbs at the rhizomes.



Every year a new rhizome can be produced from the original. The growth of this type of bamboo is characterized by a group of bamboo shoots that are very dense.

## Shoots

The initial growth phase of the bamboo demonstrates the highest growth rates of any plant. Certain species can grow 40 cm within 24 hours!

In the dry season the shoots are drier, and are less likely to be attacked by pests.

## Flowering

Bamboo does not have an annual cycle of flowering. Actually, bamboo flowering is still a mystery to botanists.

This species of African bamboo flowers every 70 years, and all the plants die afterwards.

## Planting

In order to establish bamboo successfully, you need an open place close to a water source. This helps the bamboo spread more rapidly. Bamboo prevents the soil from becoming dry. When it is planted in sloping land or at the edge of a river, it helps to reduce erosion.

The best time to plant bamboo is in the beginning of the rainy season, when the new sprouts come up, so they will have time to save energy and nutrients.

## Techniques

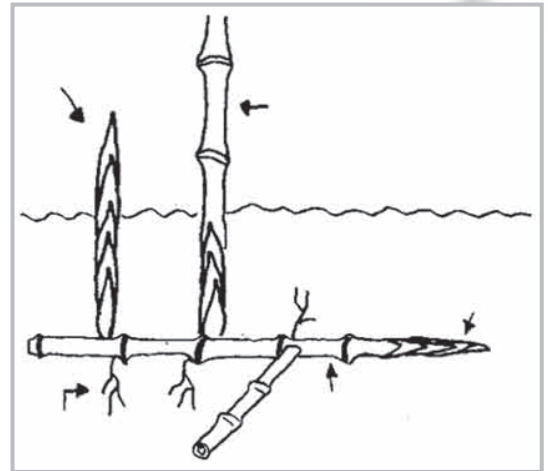
There are many ways to plant bamboo. Vegetative propagation can be done by using shoots, rhizomes or stems. For each of these three types, it is very important to ensure that the propagation parts have

intact buds that have not yet sprouted. They can be found in young bamboo parts up to one year of age.

### Separation of rhizome systems

You should choose rhi-

zomes that are a maximum of one year old. Cut the rhizomes at the neck where they are linked to the old rhizome and above the first knot of the young bud. Then plant it vertically with the bud above the soil or horizontally with the rhizome a few centimetres under the surface (3 - 5 cm) (see the drawings below).



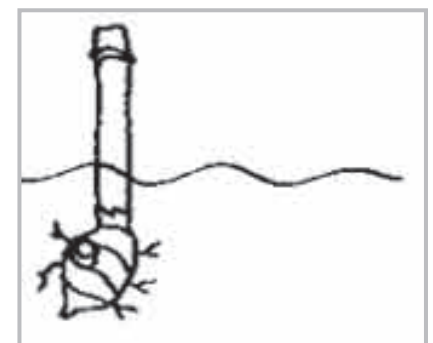
*The other type of bamboo - without bulbs*

### Separation of shoots

This technique involves using dormant seed buds (buds that haven't yet turned into sprouts) on the shoots to turn them into new rhizomes.

The shoot should be up to a year old. Leave the shoots that come out beside the buds at the joint of the shoot. On the drawings on next page you can see the two ways you can cut the shoot. Either cut just

around the joint, or cut a whole section of the shoot. If you use a whole bamboo section you can make a small hole and fill it partly with water. Plug the hole with cotton or cloth. Then bury it with the sprout on

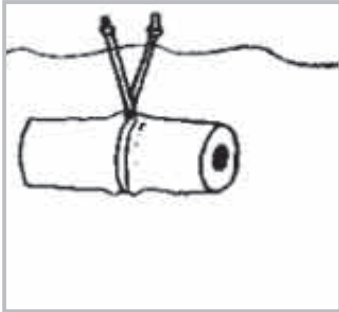


*Propagation with the rhizome in the soil*



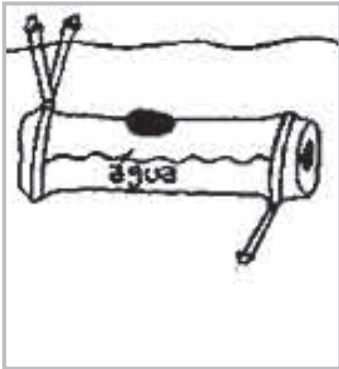
top. This method is more likely to work than the simpler methods.

### **Harvesting and pruning**



When pruning bamboo, one should leave the first section of the bamboo shoots. This is to avoid the rhizomes rotting when water is stored in the remaining shoot. After the first joint, cut as close to the soil as possible. It is important to make a clean, dry cut. This

reduces the chances of fungi and insects doing damage.



*Propagation with one (top) and two joints. See text.*

A group of bamboo includes individuals of varying ages. Those older than 7 years should be removed so that the energy of the group is directed towards the newer sprouts and shoots. Also, rotten and dry bamboo should be removed. You should never have to remove more than 80

% of a group of mature bamboo, since this puts the plant under stress. Always leave some mature bamboo spread throughout the group so they can provide nutrients to the younger plants.

The best time to harvest the bamboo material (for building, etc.) is in the dry season.

*Information and illustrations from the website: [www.bambubrasileiro.com](http://www.bambubrasileiro.com)*



*Bridge made of bamboo in Mozambique*