



TREE PLANTING

**A PRACTICAL GUIDE FOR KENYAN
SCHOOLS AND COMMUNITY GROUPS**



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INTRODUCTION

THIS BOOKLET SHOWCASES BEST PRACTICE IN URBAN TREE PLANTING AND IS INTENDED FOR PUBLIC USE. IT HAS BEEN DEVELOPED IN PARTNERSHIP BY TREES FOR KENYA AND TREES FOR CITIES.



Figures 1 & 2 - Deforestation has detrimental effects on global ecosystems, e.g. our water catchment areas. Where possible, this should be reversed through reforestation.

Each year, many more trees are felled globally than are planted. This has led to serious problems which include deforestation, desertification, massive soil erosion, soil degradation, siltation, lack of fresh air, loss of habitat, change in weather patterns and climate change. In addition, this has resulted in a scarcity of firewood, timber and building materials. Trees are vital for our survival and they are integral to many parts of our lives. They are particularly important in urban environments, where environmental issues such as heating, air pollution and biodiversity loss are exacerbated.

1. WHY ARE TREES IMPORTANT?



FOR PEOPLE

Trees provide us with:

- Income
- Medicine
- Building materials
- Paper
- Fibers
- Charcoal
- Firewood
- Fences
- Animal fodder
- Cultural resources
- Shade
- Physical health
- Mental health

FOR THE PLANET

Trees help the planet because they:

- Support wildlife habitats
- Prevent soil erosion
- Support agroforestry
- Produce fruit
- Create windbreaks
- Conserve soil water
- Produce flowers
- Produce oxygen
- Filter pollutants
- Reduce flooding
- Cool the air
- Absorb carbon



Figure 3 - Trees provide us with fruit and can support healthy diets.

THE IMPORTANCE OF PLANTING TREES

Whilst trees grow naturally, we need to plant trees and manage them so that we can restore our landscapes. Afforestation and tree management is particularly important in towns and cities, where natural regeneration can be a challenge due to rapid development, interference from humans, difficulty in land acquisition etc. Each and every person needs to conserve our environment at a local level.

Tree nurseries are places where schools, communities or individuals can prepare soil, germinate seedlings, manage the seedlings and afterwards transplant them. A tree nursery has an educative and training role to play in the community. A nursery can also be a source of considerable income to the owner(s), particularly through seedling sales.

2 . CHOOSING WHICH TREES TO GROW

INDIGENOUS OR EXOTIC?

The choice of either indigenous or exotic species depends on the intended use of the trees and also other considerations such as local biodiversity targets or climatic effects such as pests, diseases or urban heating. Indigenous trees take many years to mature compared to exotic trees which take less time to mature.

Indigenous trees have greater biodiversity impacts on the local ecosystems and are usually the most commonly chosen by communities because of the many benefits accrued from them. However, it may be necessary to plant non-native species on certain occasion, for example as part of a mixed species planting plan, ensuring greater resilience to future environmental threats.

THE FOLLOWING CRITERIA MUST BE MET BY BOTH INDIGENOUS AND EXOTIC SPECIES:

- Adapts to local climate and rainfall conditions in its natural distribution
- Easily obtained seeds
- Establishes well
- Resistant to pests and diseases
- Supports biodiversity
- Able to produce useful and locally needed products
- Species which do not cause problems for local agriculture or animals



Figure 4 - Grevillea Robusta is a common exotic species.

SEEDS

The following should be considered when growing trees from seeds:

COLLECTION

Collection of tree seeds in the immediate locality saves the time and expense of travelling to other areas. When collecting seeds locally, it's recommended to seek advice from qualified seeds collectors. This will help in determining when to harvest ripened seeds from healthy trees in the local provenance.

This way seeds are collected nearby to where they will be sown. The seeds from pods and ripened fruits must be removed and dried in the sun. However, in most cases, mature seed pods are already dry, brown in colour and about to open during the harvesting period.

Some seeds can be collected from the ground, while others will need the help of an agile climber, pole or pruning hook to collect them. Some fruits or pods can be dislodged by shaking the tree or beating the branches with a stick. Special care must be put into place to avoid damage of the tree itself and ensure development of buds for the next season.

You can also get seeds by visiting local forestry departments and seeds merchants regulated by the government, for example Kenya Forestry Seeds Centre in Nairobi, Kenya.



Figures 5 & 6 - Tree seeds stored in polythene bags.

STORAGE

Before storing seeds, it's advisable that they must be well dried to avoid rotting. The storage can be in bags and tins labelled with species, date and the location of collection. It is best not to store seeds for more than few months and some should not be dried and stored at all. For example, citrus, avocado and mango seeds are best planted wet immediately after the fruit has been eaten.

PRE-TREATMENT

The percentage of seeds which will germinate and how long this take varies between species. Some species, like neem, germinate vigorously and at a high rate if fresh, while others require some kind of pre-treatment to enable a good percentage to sprout. For example, the seeds with a hard coat, like *Leucaena leucocephala* and *Calliandra calothyrsus* benefit from putting them to soak in hot water one night before sowing.

Other methods of pre-treatment include cracking, like macadamia nuts and *Podocarpus* species, which need freezing and nicking with a knife. Advice on seed pre-treatments can be obtained from forestry officers with such knowledge.

3 . ESTABLISHING A NURSERY

CHOOSING A SITE

The first step is to plan, taking into consideration the various aspects of starting and running a nursery such as size, location and the availability of water and labour.

THE SITE FOR THE NURSERY SHOULD MEET THE FOLLOWING CRITERIA:

- Close to water; a permanent well, pond or river if possible
- On the ground or terrace
- Withstand the manure, compost or ash available
- Free of animals
- In the shade (otherwise provide)
- Secure

MATERIALS NEEDED:

- Forks
- Hoes
- Shovels
- Pangas
- Wheelbarrows
- Buckets



Figure 7 - Nursery equipment

CONTAINERS IN WHICH TO GROW THE TREES

You can grow trees in :

- Recycled milk packets
- Tins
- Polythene tubes

All bags, cartons or tins should have a few holes in the bottom made with a nail to allow excess water to drain out in case of heavy rain or overwatering. If containers are unavailable, seed boxes or Swaziland beds can be used (see chapter 4).



Figure 8 - Seedlings growing in polythene tubes.

SOIL

A well-drained (slightly sandy) fertile soil is the best for use in seed beds and containers. If it is not available, it can be mixed using:

- 4 parts fine top soil
- 2 parts sand soil
- 1 part old manure



PREPARING THE NURSERY

To prepare the nursery:

1. Mark out the plot and clear it of weeds.
2. Level the ground leaving some trees for shade if possible.
3. Dig shallow beds, 1 meter wide and about 15 cm deep.
4. Leave a path about 1.5 meter wide between each bed.
5. Preferably, make the beds in a west to east direction to allow all the seedlings the same amount of sunlight.
6. Fill the beds with soil, level and make a rim around the edges to hold water.
7. For a raised seedbed, use offcut planks of wood, stones or banana stems as a border to ensure good aeration, drainage and prevent soil erosion in heavy rains. Filling the base of the bed with stones aids drainage.
8. If the area is exposed, build a simple but secure shade over the beds.
9. Make similar sized, shaded areas to keep your container grown seedlings.
10. Fence the nursery if necessary to enhance security.
11. Dig a trench around the site to control rainwater.



4 . RAISING SEEDLINGS

WHEN TO SOW

The best way to ensure survival is to plant seedlings out soon after the start of the rains. The exact time of sowing depends on the species being grown and the time it needs to reach a size suitable for planting out.

DIFFERENT WAYS OF RAISING SEEDLINGS

METHOD 1

FOR SMALLER SEEDS - USING SEEDBEDS

For seeds that will be moved soon after they have germinated, scatter out the seeds closely over the seedbed. For some species, such as *Eucalyptus saligna*, branches bearing ripening seedpods can be placed over the seedbed to encourage the seeds to germinate. Small seeds should be covered with a thin layer of fine soil, while bigger seeds should be covered with a layer of soil twice the width of the seed.

For seeds that will stay in the seedbed for a long time, sow in straight lines, 15cm apart. This method is mainly used with citrus and other fruits grown without containers.

Compact the soil to prevent runoff when the bed is watered. As soon as the bed is sown, it should be watered well and covered with grass or leaves (mulch) to conserve moisture. The mulch should be removed later when the seeds have germinated.

You can construct a small seed box with a wooden bottom which will hold 49 trees in a 7 by 7 pattern. They can also be pricked out into a Swaziland bed.

TRANSFERRING OUT FROM THE SEEDBEDS

Small seedlings that have germinated in the seedbed can be pricked out and transferred to containers or seed boxes. Bags, tins and milk packets can all be used.

Prick out when the seedlings are very small, with just a few leaves. First, water the seedlings and the containers or boxes that you will put them in. Push a stick or panga under the seedlings to loosen the soil around the roots and lift them up gently by their leaves.

Plant the seedlings one by one in the holes you have prepared in the containers/boxes. The holes must be deep enough to prevent the roots of the seedlings from bending upwards. Plant the seedlings at the same level as it was in the seedbed. Press the soil firmly around the seedling. The containers/boxes should be shaded and watered well.

SWAZILAND BED

To make a Swaziland bed, paint some 4x1 timber with old engine oil to prevent termites. Use a few small nails to join the boxes together. Offcuts from the timber yard or fresh, split sisal poles can also be used. Make holes in lines, 5cm between lines and 50cm between the holes.



Figure 9 - Swaziland beds

METHOD 2

FOR LARGER SEEDS - USING CONTAINERS

Mix the soil in your container, create a depression, and then fill this with water. Leave overnight for the soil to soak up the water and become fully moist (not muddy). Fill the containers to the top with the moist soil to a level 1cm below the top of the container. Dry, then dip them in a bucket of water and allow to drain for 20 minutes before planting.

Place the containers in neat groups of 100, separated by walkways. Plant 2 to 3 seeds in each container, by making separated holes with your finger or a stick in depth. Drop the seeds into each hole and cover them with soil. In case all three seeds germinate, all but one should be transplanted later.



Figures 10, 11 & 12 - Seeds planted into containers at a nursery.

5 . MANAGING THE NURSERY

WATERING

Seedbeds and containers must be watered once per day, and twice a day in drier areas. Watering is carried out in the morning before 10am and/or in the evening after 4pm. The amount of water should be moderate. Avoid strong jets that damage the seedlings and cause erosion. A watering can is the best, but an old tin can with holes made in the bottom can also be used.



Figure 13 - Watering is an integral part of raising seedlings.

THINNING

This is the removal of the extra seedlings if more than one seed germinates in a container, to reduce the competition for nutrients and water. With care, the seedlings you remove can be pricked out into empty containers.

Seedlings in the seedbed left for a longer time without being pricked out should also be thinned so that each seedling has 5cm of space to reduce the competition between seedlings for light, water, and soil nutrients.

WEEDING

Ensure all parts of the nursery are well weeded every week to avoid competition with seedlings and reduce the attraction of pests to the nursery. Eliminate couch grass at an early stage of growth before it starts to spread.

ROOT PRUNING

This is the cutting of the roots to make them spread with many smaller roots in the soil. This is important when open-ended containers or Swaziland beds are used, to avoid roots growing too deep into the nursery and making it difficult to plant out in the field.

Seedlings in Swaziland beds are pruned using a sharp knife and a strong thin wire. Two people pass the wire under the boxes. Use a sharp knife to cut the soil into cubes around each seedling to prevent the roots from becoming entangled. Prune the roots using both the wire and the knife once a month, starting about 6 weeks after pricking out.

PESTS AND DISEASE CONTROL

Seedlings may suffer from a fungal disease known as damping off. This can be prevented by keeping the seedlings well drained and generally avoiding over shaded, misty conditions. If damping off occurs, wash the sand used in seedbeds and packets to remove some of the alkalinity that causes the fungus to thrive.

Check that there is not too much manure in the soil (no more than 20% of the mixture used) and ensure that the seedlings are not too densely planted. A suitable fungicide can also be used, in the correct rate and taking the necessary precautions.

Another possible problem is cutworms. Dig them out of the soil and kill them or sprinkle ash around the seedbeds and plants too, as a deterrent. To avoid termites, paint all timber and rinse milk packets in old engine oil. Ash can also be used as a deterrent.



Figure 14 - Lantana Camara with leaf rust



HARDENING OFF

For the last 4 to 6 weeks in a nursery before planting out, (or when the seedlings reach a height of 5-10cm), the shade should be gradually removed to allow the plant to grow bushy and robust. Also, gradually reduce the amount of water that you give the seedlings. This hardens off the plant, readying it for planting out.

KEEPING RECORDS

The germination and survival rate of the seedlings can be recorded on simple forms. A record of labour, inputs and sales is needed to determine the cost of production and the viability of the scheme. Seed sources and a nursery calendar also help in record keeping.

6 . PLANTING

WHERE TO PLANT

Agroforestry can be practiced when the type of tree does not harm crops or the soil. Trees that harm crops and the soil are planted in a woodlot, a piece of land where only trees are planted e.g. steep hillsides, rocky areas, field corners etc. Whatever the location, do not plant trees too close to buildings and installations such as electricity/telephone lines or water pipes, where they may cause problems later.

Always aim to plant trees during the second week of the rainy season, when the soil is fully wet. The best time to plant is in the evening or when it is cloudy.

PREPARING THE SEEDLINGS

Water seedlings in boxes and Swaziland beds well. Carefully remove the wood from the sides and cut the blocks away, each with a single tree, then carefully transport them to the planting site. For easier transportation, do not water seedlings again until you reach the planting site.



Figure 15 - Great care is necessary to transport seedling from the nursery to the planting site.



Figure 16 & 17 - Tree planting is a great way to teach children about the importance of the environment.

PLANTING

Ensure the soil around the seedlings is moist. If using containers, carefully remove the container. With bags/tubes/milk packets, cut the sides. Place the seedlings in the hole and fill the hole with top soil.

AFTERCARE

Firm the soil carefully around the root, making sure the seedlings sit in the ground at the same level they were in the container or seed box. Make a small basin around the seedling to catch water. Finally, mulching can be done to conserve moisture.

Protect your seedlings from animals by using sticks and thorns. If the rains fail, water the seedlings to keep them alive. Weak trees can be supported by tying a strong stick alongside them. Also, weed the seedlings regularly.

7 . ESTABLISHING TREES WITHOUT A NURSERY

DIRECT PLANTING

With some trees, it is possible to sow seeds or plant cuttings directly in the place where you want the trees to grow. Trees planted directly are best planted at the start of the rains. Dig the soil well, leaving a furrow or hole to collect rainwater around the seed.

The seedlings must be weeded well and protected from animals. If many seeds grow, they need thinning to give them enough space to grow.

TRANSPLANTING WILD SEEDLINGS

Often under large trees, seeds which have fallen and started growing (wildings) are found. With care, these seedlings can be moved or planted before their roots go down too deep. Wet the soil around the seedling first and let the water soak in. Dig deep under the seedling so that you do not damage the roots. If a seedling has enough room to grow, don't transplant it.



Figure 18 & 19 - Only transplant wild seedlings which wouldn't have enough room to grow in their original habitat.

8 . NITROGEN FIXING TREES

START-UP GUIDE

NITROGEN FIXING TREES

Nitrogen fixing trees (NFTs) have the ability to take nitrogen from the air and pass it on to other plants through the recycling of organic matter. This is done through a symbiotic relationship with certain soil bacteria. Using NFTs lowers cash outputs and increases self-sufficiency by greatly reducing the need to purchase synthetic nitrogen fertilizers.

NFTs also provide:

- Animal fodder
- Bee forage for honey production
- Living fences
- Wind shelter
- Human food



Figure 20 - Calliandra calothyrsus, a nitrogen fixing tree which provides forage for bees.

HOW DO NFTS GET THEIR NITROGEN?

Air consists of approximately 80% nitrogen gas (N₂), representing about 8000 lbs. of nitrogen above every acre of land (or 6400 kg above every hectare). However, N₂ is a stable gas, normally unavailable to plants.

Nitrogen fixation is a process by which certain soil bacteria on the roots of nitrogen fixing plants “fix” or gather nitrogen from the air and allow their NFTs hosts to incorporate it into their leaves and tissues.

Leguminous plants such as beans, cloves and peanuts are great nitrogen fixers. Other examples of NFTs include, Acacia, Mimosa, Alder, Red bud and Golden Chain Tree, among others.

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CONCLUSION

Every life form on earth, one way or another, depends on trees. They keep the ecological balance in the earth's ecosystems. Carbon dioxide is used up and oxygen is released into the air during the process of photosynthesis in trees. This rids the environment of unwanted carbon dioxide, making it cleaner.

Extreme weather has been witnessed across the globe in changing patterns, from heavier rains to hotter and longer heat-waves. This has been contributed to greatly by human induced climate change. The all-time warmest years have been recorded by NASA scientists within the past 20 years.

Climate change should be talked about, preached about, written about and sung about, either until we have managed to reverse the situation, or we have seen how far the extremes can get. The effort of planting trees is one of the few promising routes we can take to try and undo the damage we have long been doing. In summary, trees are a treasure that must be protected.

