AGROFORESTRY – FARMING WITH TREES

Trees and forests are vital for soil protection and fertility and for the water supply of whole regions.

Kenya is especially vulnerable in this respect as literally the whole country is dependent on the water stored by forest areas in the highlands. These "water towers", which also feed the national hydro-power electricity plants, are under fast destruction. For too many years, they were just regarded as a source of land for cultivation, of timber, charcoal, and firewood.

Trees increase farm productivity also on a small scale. Besides producing fruits, fodder and other products, they act as moisture reservoirs, provide nutrients and protect from soil erosion and wind.

Forest situation in Kenya

From around 15 % land cover only few decades ago, the forest surface in Kenya has been reduced to less than 2% today, and pressure is still increasing. Population growth, poverty, missing governance and corruption have led to this situation, and the question whether Kenya will be able to do the necessary corrections remains open. While illegal forest clearing, charcoal burning and other activities go on, most people have noticed that drought seasons have become more acute and frequent, and that water points and rivers have become seasonal or have even dried up completely.

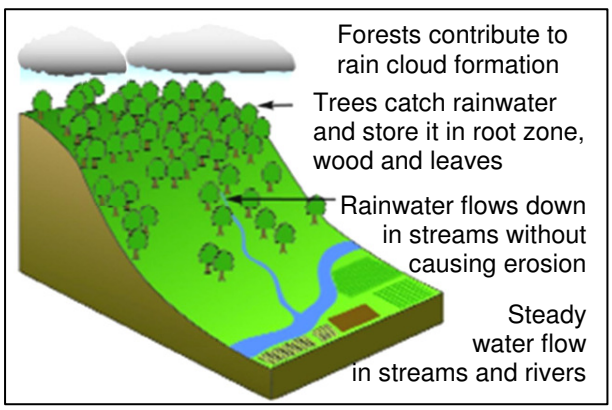
What happens if forest is cleared?

The Mau forest is an example of forest destruction that is known to most Kenyans. Millions of people are affected by the diminishing water levels of rivers and lakes that are dependent on Mau forest.

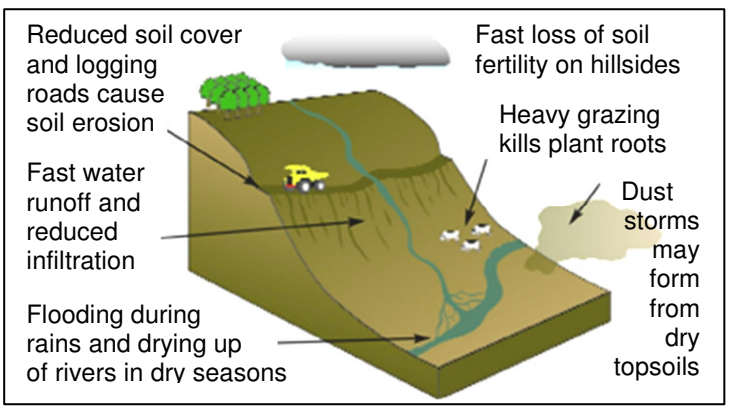
The pictures below illustrate the process. When trees become scarce, rainwater will hit the thinly covered ground directly. Because a dense forest canopy and deep plant roots are missing, water will not trickle down into the soil slowly and deeply, but run off from the surface quickly. Erosion sets in and will be especially forceful and fast on mountain tops and slopes. Soil fertility may be lost within few years. Most rainwater will flow downhill and into rivers causing flooding. This rainwater, together with the soil it takes with it, is lost for the region where it fell within few days. The next threat comes in the dry season: rivers will dry up earlier and for a longer period, because no water was stored in the hillside soils to feed the streams.

In addition, nobody knows what will happen as a result of the global climate change that is going on. You may feel that you can't be blamed for it. But you can do something: Planting trees and good tree and forest management are the most effective measures against both problems. Each tree counts! This leaflet wants to encourage and invite all farmers to utilize trees and forests with care and to make sure that they are replanted continuously.

Intact forest on hillside:



Forest that has been cleared:



Agroforestry for tropical countries

Agroforestry is found in all traditional farming systems. Trees and shrubs are used for marketable produce such as fruits, nuts, craft materials, fuel wood, timber, for animal fodder, poles, for mulching material etc. Trees conserve soil and water and improve soil fertility. They improve the microclimate, provide organic matter and protective shade, and act as wind breaks. On slopes, they stop run-off and soil erosion. Trees and other perennials are also important because they are able to use water and nutrient resources from deeper soil layers.

When farming was industrialized and mechanized during the last century, trees were rigorously removed from farmland to increase crop management efficiency. This has, especially in tropical countries, led to often severe soil fertility problems. It may even be a serious error and misconception for many parts of the African continent with its rich bush and forest land but fragile soils. Growing perennial shrubs and trees along with annual crops in cropland or on pastures was always a widely used system in Africa. Several institutes and organizations in Kenya are now focusing on agroforestry and methods that stop soil degradation and improve farm productivity in tropical regions.

Picture: A good example of intense cropping that includes trees and shrubs (Burundi)

Parklands: dispersed trees on farmland

Trees are often planted 8-10 or more meters apart to reduce competition. In drier regions, distances can be wider. Deep rooting, leguminous (nitrogen providing) trees are preferred. Besides *Leucaena leucocephala* which does not very well in drier areas, *Sesbania sesban*, *Crotalaria grahamiana*, *Tephrosia vogelii*, and *Gliricidia sepium* are valuable species, but also fruit or nut trees are good.

Examples

- Shade trees are especially beneficial in *Arabica* coffee plantations (top small picture). They provide mulch and prevent alternate bearing only every second year by reducing flowering and die-back from overbearing. This can double the lifespan of coffee trees.
- *Grevillea robusta* is a very good shade tree in tea (picture beneath).
- Dispersed trees in rangelands are very common in traditional livestock management systems. Valuable trees are preserved for livestock bowsing, shade or for other products (3rd small picture: acacias near Nakuru). The high protein content of leguminous species enables ruminants to benefit more from low quality forage during the dry season.

Living fences

Lines of densely planted shrubs and trees keep animals out of crops, protect plots from strong winds and demarcate field and farm boundaries. Sticks or dead branches can be twisted between them, or wire can be attached using them as living fence posts (bottom picture). Cuttings can be used to replenish the fence.

Examples

- *Gliricidia sepium* is often used for live fence posts. A few large (1.5-2.0 m) stakes can be planted into existing wire fences. They take root quickly and can be cut back after 6 to 10 months. Subsequent pruning and staking can be carried out every 6 to 8 months.
- *Tithonia hedges* can be cut back often. Young shoots used as mulch increase crop yields. As a protein rich fodder supplement it is especially liked by goats.

Different climates – different trees and forests

Natural tree and shrub vegetation reflects local rainfall patterns. In humid tropical regions with high rainfall, rainforests with high biomass production are predominant. In regions with seasonal rains, trees shed their leaves partly or totally during the dry season. Plant productivity decreases as the length of dry seasons increases. With decreasing rainfall, trees become scarcer and savannahs and rangelands with dispersed trees are prevalent. Planting in a "natural way" is recommended. Watch which trees are doing well in your region!

Fruit trees

Fruit trees are a valuable asset on most farms. Farmers know best which indigenous and exotic trees are most profitable and in demand in their region! Like all agricultural activities, fruit trees need attention and good management, especially during establishment which can take years (picture beneath: young mango tree). One of the most frequent reasons for planting failure is water scarcity. In low rainfall areas, the use of planting pits and water harvesting for supplemental irrigation may be necessary. Young trees must also be protected from livestock browsing and termite damage. For information on grafting, pruning and other management, you may to refer to specific literature or organizations.

Contour farming on slopes

Permanent vegetation that holds the soil together, prevents soil erosion and conserves water is crucial on slopes (see the 1st page of this leaflet). Contour farming as described in the TOF-leaflet No. 8 (Water management) involves strips of perennial vegetation along the borders of benches, on fanya juus and terraces. High fodder grasses, and all shrubs and trees are suitable. Their growth is checked by cutting and pruning them regularly.

Alley cropping

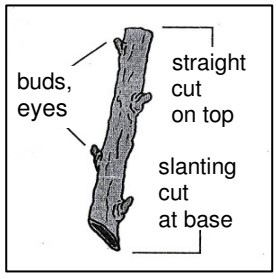
This system works best in humid climates; it improves crop yields. In dry areas, competition for water and nutrients between crops and the woody species is too high. Rows of leguminous species such as *Sesbania sesban* or *Crotalaria* are grown between annual crops. The trees are pruned regularly, and the prunings are used as fodder, as mulch to improve soil fertility and suppress weeds, for poles etc. The picture shows an example of *Leucaena* grown together with maize.

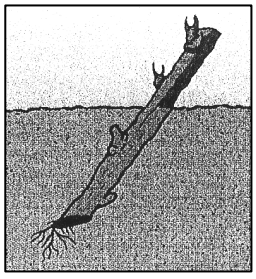
Nurseries

Buying seedlings can be expensive. Raising them yourself or in farmers' groups is cheaper and selling them can contribute to farm income as they are often in high demand. We recommend potted seedlings, as they are easier to control, move and sell. Seedlings need a lot of attention!

What seedlings need

- Well draining, fine soil high in organic matter. Mix compost into it and some sand if your site has loamy soil.
- Collect seeds from healthy trees and mature fruits.
- Clean the seeds and soak them in water before you seed them. Some have to be cracked open, or even soaked in an acid solution.
- A shading structure and regular watering (but avoid over watering).
- If you use stem cuttings, make them from young trees. Use a very sharp knife. Cuttings should have 4 to 6 buds and need to be planted immediately in the way indicated in the pictures beneath. They must be kept humid and well shaded until they begin to grow (4 to 6 weeks). Then the shade should be reduced gradually.
- Weed regularly and carefully (large picture). Cut off roots that grow out of the container at the base with a sharp knife.





Planting

- All plants establish best at the beginning of the rains.
- Chose a well drained site with good soil and prepare a nice planting hole where you want to plant a tree.
- In dry regions, chose a site where rainwater can collect, or prepare shallow basins.
- Mix some compost into the soil that you use to fill up the hole around the seedlings.
- Water immediately and protect the young tree from grazing animals by building a stable "cage" around it.
- Termites can be repelled by repeated application of Tephrosia leaf mulch, neem cake, or wood ash around the plants.
- During dry spells, you may have to watch and irrigate your trees – or your whole effort may be wasted!

Some useful literature and addresses

- Infonet Biovision: www.infonet-biovision.org provides information on trees and agroforestry in Kenya.
- Technical Handbook No.35: Useful trees and shrubs for Kenya. By P. Maundu and B. Tengnäs (2005). World Agroforestry Centre, ISBN 9966-896-70-8.
- A guide to tree planting in Kenya. KEFRI (Kenya Forestry Research Institute) 1990, Nairobi, Kenya. E-mail: director@kefri.org Tel. +254-0724-259781/2, +254-722-157414.
- KEFRI seed catalogue: http://www.kefri.org/seed_catalogue.pdf

TREES AND SHRUBS FOR LIVESTOCK

Woody species (trees and shrubs) provide shade and are an important fodder resource for both livestock and wildlife. This has long been recognized by livestock owners. In more humid regions, trees and shrubs provide high quality low-cost fodder that improves milk production of dairy animals and supports the growth of young animals. This can reduce dairy meal costs and improves meat production. In arid and semi arid zones, where the growth of herbaceous plants is limited, trees and shrubs provide the largest part of the protein and mineral supply during the driest months.

Picture: herdsman knocking seeds from tree

Use of fodder trees and shrubs

- Many fodder tree species are leguminous plants with leaves or fruits that are rich in protein and minerals. They are therefore an ideal feed supplement for grasses and crop residues.
- Their leaves can also be cut, dried and stored for feeding in the dry season.
- Acceptability as fodder can vary! Gliricidia, for example, is preferred by goats when foliage is older (mature leaves). Differences can also exist between varieties, individual trees or between different parts of trees. Animals also accept newly introduced feeds only slowly, as their digestive system must get used to them first.
- However, most legumes contain substances which can disturb digestion and interfere with animal health. As a rule of thumb, they should usually not be fed at higher rates than 30% of the daily diet.
- On grazing land, trees and shrubs are important for shade and shelter.
- Fast growing trees and shrubs (e.g. with thorns) can be planted to fence animals off. Plant them in two rows at a distance of only one foot from each other.

Trees and shrubs for plant and animal health

Some trees and shrubs can be helpful against certain plant and animal diseases and parasites. Preparations from Tephrosia and neem, for example, are both very good pesticides. Some trees contain compounds that can reduce livestock parasite burdens.

Many farmers are still aware of various traditional applications of tree products and still know how they can be used. One example is the use of papaya seeds for deworming.

But the most important effect of feeding tree fodder may be a general improvement of animal health.

Well-fed animals are more resistant and show better performance. Intestinal parasites, for example, are a common livestock problem. Especially young animals can be heavily affected. Feeding protein rich leguminous plants or other young leaves is a very effective way to help animals to cope with parasites better. Trypanosomosis is another livestock disease that is influenced positively by an improved feeding management.

Suitable fodder species

There is a wide range of useful trees and shrubs in the different agro-ecological zones of Kenya. It is simply impossible to described all of them here.

Please find more about important fodder trees (C*alliandra calothyrsus, Leucaena diversifolia, Sesbania sesban*) and their use in the TOF leaflets No.11 (Fodder production and concentrates) and 12 (Dry season fodder).

Gliricidia sepium, tree lucerne, *Croton, Ficus, Prosopis*, various *Acacias*, mulberry or *Tithonia* are other species that are usually known to local people in the regions where they are common.

For more specific information, it is advisable to consult the regional agricultural extension offices. The following addresses may also be helpful:

- This page describes fodder plants and their use (go to: Forages fact sheets): http://www.tropicalforages.info/index.htm.
- This page focuses on feeding small livestock: http://www.smallstock.info/info/feed/tree-fodder.htm.

Women and their young fodder trees

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K. Moir at al. 2007: Growing trees and gardens for life. Nairobi, Kenya. www.jacaranda-africa.com
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