What is Agroforestry ?

Trees with fields in between: plentiful, secure productivity

Agroforestry is a sysem where farm crops are mixed with trees to supply fodder, fuel, leaf litter, medicinal herbs, fruit, timber, etc.

Conventionally, farmers have only grown a single crop on one field. Also, there is a belief that crops cannot grow well in the shade of nearby trees, so trees will often be cleared from cropland. In the days when there was plenty of forest near to the village, there was no shortage of fuel, fodder, etc. But now, overcutting of fodder, firewood, timber, etc., and grazing live-stock, has destroyed the forests. So farm yields have become lower and lower. More landslides have been an extra problem. By planting agroforestry, farm needs for fodder, timber, fuel, etc. can be met as well as protecting the environment.

In this chapter, information is given on how to establish agroforestry, and how to manage it to increase farm yield.

Why do Agroforestry ?

Benefits from Agroforestry

- By planting agroforestry, yields of fodder, firewood, timber, fruit, herbs, etc. can be increased.

- Livestock needs are met more easily.
- The farm economy is stronger.
- Because daily needs of fodder, fuel, leaf litter, etc. are met from the land, the forest is used less, and so is conserved.
- Tree roots prevent soil from being washed away. Trees' leaves provide organic matter for soil organisms. This increases the fertility in the soil, and so trees have more nutrients to grow. Trees protect the soil, and the soil gives nutrients to the trees. This cycle works to protect soil life and natural fertility.

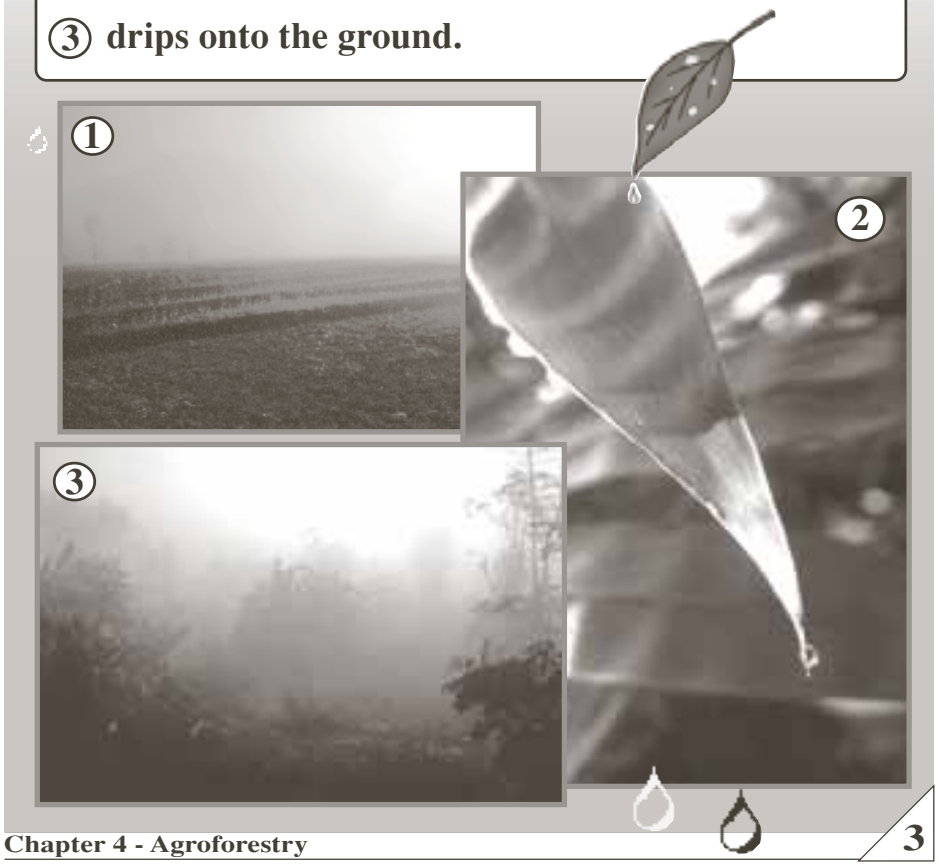
Agroforestry helps to make the homestead self reliant

- Trees protect the soil from the harmful effects of strong sun, wind and heavy rain, and conserve moisture in the soil.
- By producing daily needs of fodder, fuel, timber, etc. on the farm, less time is spent going to the forest.
- When agroforestry is on your own land then timber, fruit, herbal medicines, firewood, fodder, etc. don't need to be purchased. Livestock are also easier to raise for income, and overall the home economy is strengthened.

① With no trees, moisture in the air blows away.

② When trees are on the land, the moisture collects on the leaves, and

③ drips onto the ground.

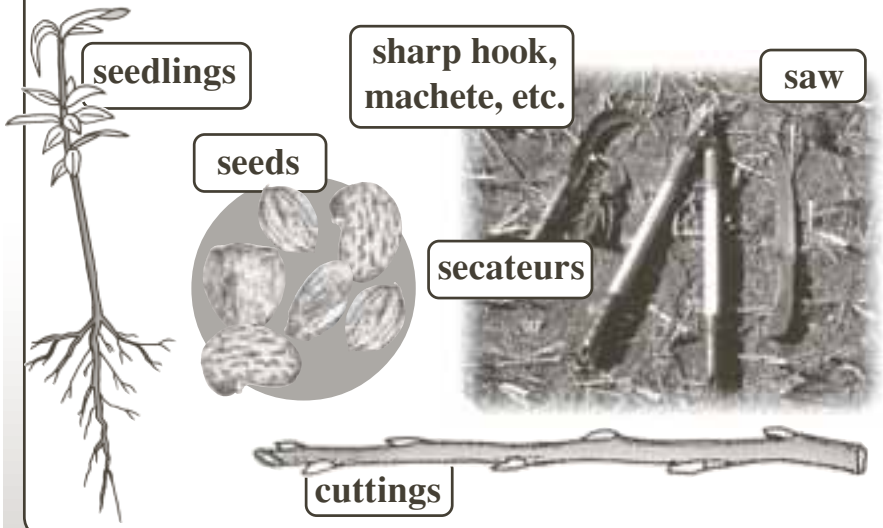


How to do Agroforestry ?

Where to grow Agroforestry ?

- on terrace risers and edges
- on the edges of fields and farm boundaries
- on the edges of paths
- according to the shape of the landscape

Materials Needed for Agroforestry



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What type of tree to plant in agroforestry ?

Multi-purpose trees which give many benefits such as fodder, timber, firewood, medicine, bee forage, fruit, etc.

Trees with small leaves that don't overshade the land, e.g. *Lucaena, Flemengia, Acacia.*

Trees which drop their leaves in winter, e.g. mulberry, *Melia.*

Trees which don't compete with ground crops.

Trees which can be pruned to a desired shape, e.g. mulberry, *Lucaena, Bauhinia,* peach, plum.

Trees which have deep roots that aren't damaged by ploughing, e.g most legumes, *Melia.*

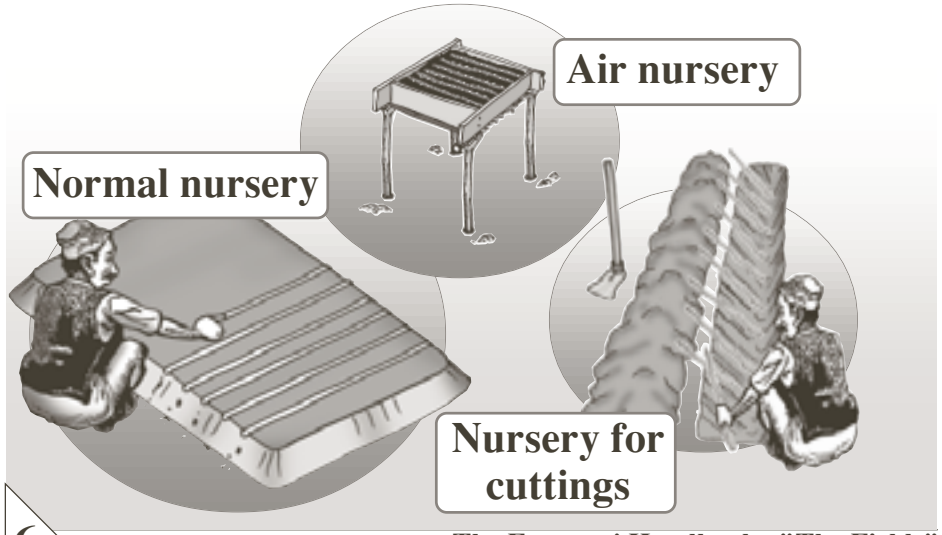
Plants which are good, nutritious fodder for livestock, e.g. napier grasss, most legumes, lemon grass, etc.

Nitrogen-fixing trees which increase nitrogen in the soil.

How are plants established in Agroforestry ?

- By planting **cuttings**, e.g. mulberry, napier grass, sugar cane, some *Ficus*;
- By raising **seedlings** in **nurseries**, eg. coffee, *Melia*, peach, etc. Trees with fast growing tap roots, such as *lucaena, bauhinia* (most legumes), tree cotton, papaya, walnut etc. are best raised in an **Air nursery.** For more information about this, see the chapter ***Air Nursery*.**
- By planting **root slips**, e.g. broom grass, cardamon, lemon grass, comfrey, vetiver grass, etc.;
- protecting seedlings naturally regenerated on the land;
- By **air layering**, e.g. orange, pomegranite, guava;
- By **direct sowing**, e.g. sunhemp, *Sesbania*.

It is easy to grow many of the useful, good quality and multi-purpose plants needed for agroforestry by yourselves, on your own farm. Once you've decided the types of plant needed, the seeds or cuttings need collecting at the right time. Then they can be raised in the appropriate nursery, at home.



Design of Agroforestry Systems

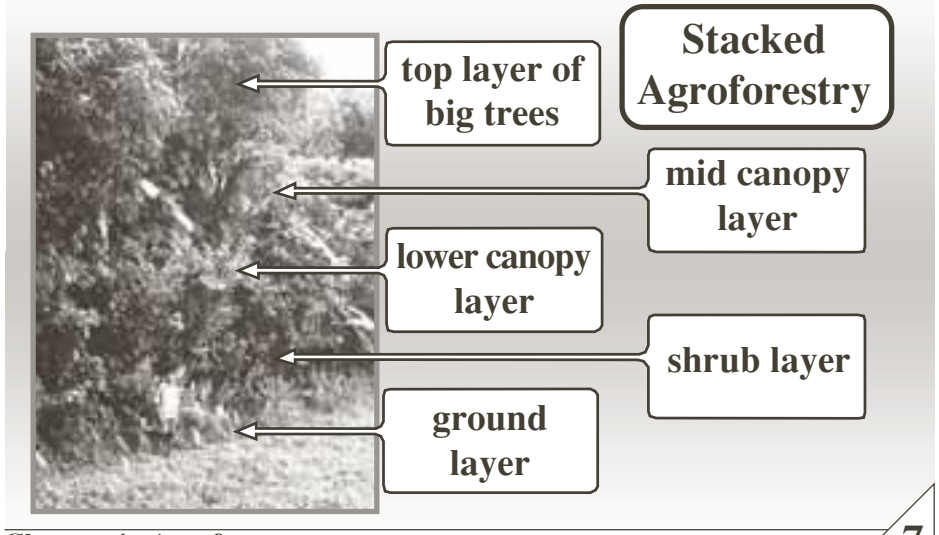
The following principles need to be applied when planning and establishing a farm or a community agroforestry system.

- **Diversity**

  Just as there are many types and sizes of tree and shrub mixed in a forest, so our agroforestry should also be made up of a wide range of species, to make them sustainably most productive.

- **Layers *(stacking)***

  In the forest, all plants are different. Some are small, some tall, some middle sized - this is called **stacking**. A stacked system means that more productive plants can fit into a smaller space without competing. For example, in the ground layer, pineapple and lemon grass can be grown. Above them, napier grass, sugar cane and coffee can grow. Above them, *Lucaena*, mullberry and tree cotton can grow. Even higher still, papaya, pear and peach can be grow. Highest of all, *Melia, Dalbergia*, Neem, and other timber trees can grow. They will also serve as a useful windbreak.

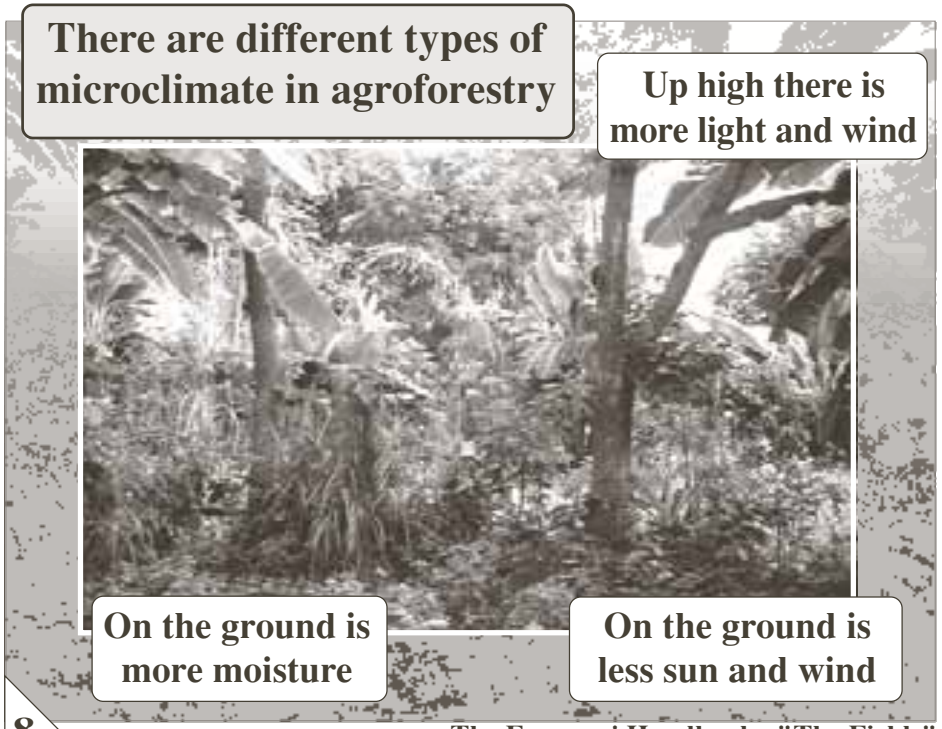


• Beneficial Relationships

It is important to consider the relationship between the species in different layers of agroforestry, and the field crops. Without a good relationship between the field crops and the tree systems, some crops may not grow well, such as in the shade. Then, companion plants can be used. For example, mustard and maize do not grow well close to tree crops. But taro, cardamon, ginger and tumeric do grow well, and they can tolerate both the trees and field crops. So by planting the companion crop in between, the best yields from all can be assured, without competition and drop in yield.

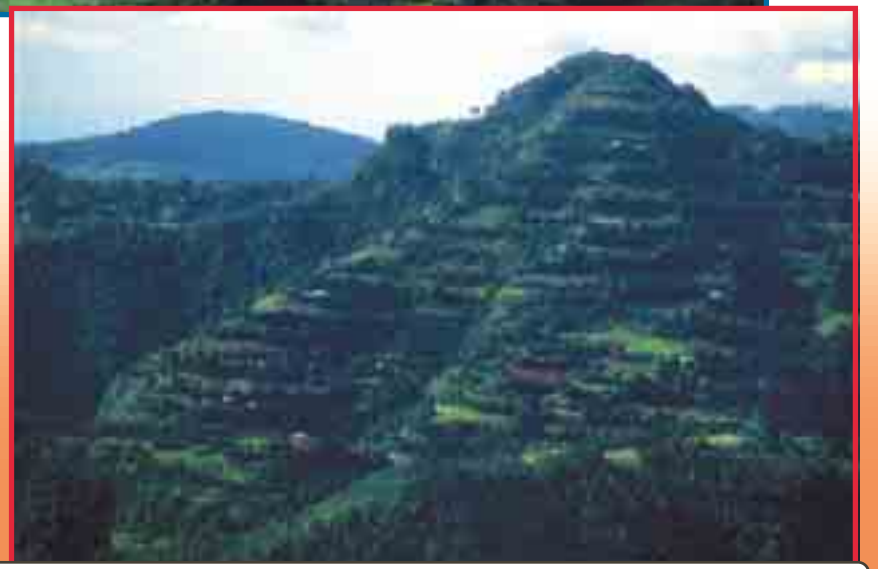
• Microclimate

The climate inside and around the agroforestry system is different to the surrounding climate. There are areas of different moisture, temperature, and light levels. These are called **microclimates.** Species need selecting according to their need.

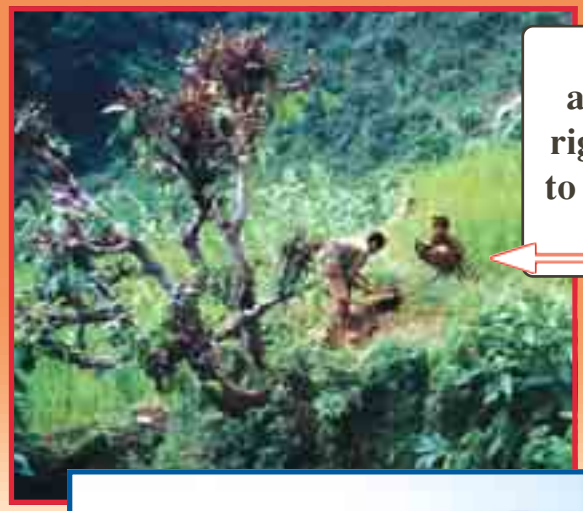


Let's See how to do Agroforestry

Areas with agroforestry and forest are productive, protected in a sustainable way.

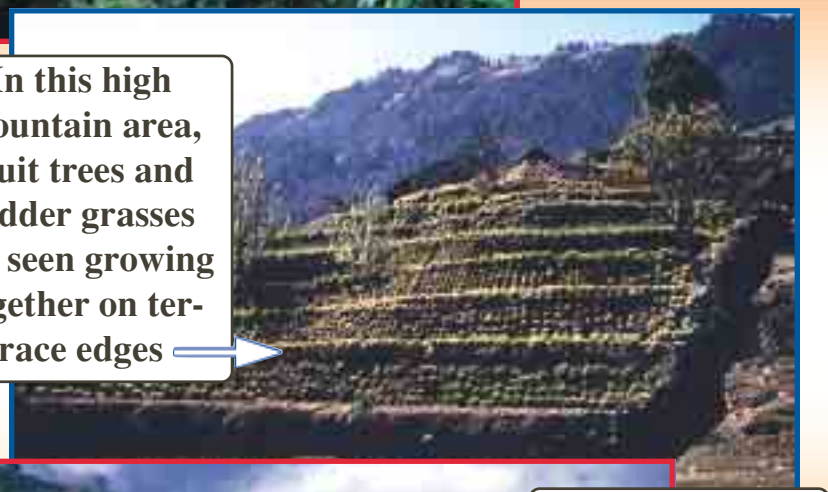


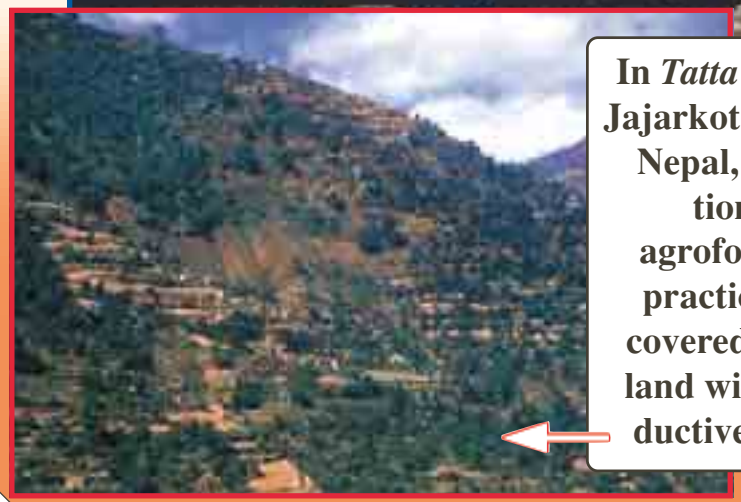
On steep slopes, farming with the plough is difficult. But with agroforestry on the terrace edges, the risk of erosion is less, and extra benefits of fodder, fuel, timber, etc. can be produced close to the village.



When starting agroforestry, the right species needs to be planted in the right place

In this high mountain area, fruit trees and fodder grasses are seen growing together on terrace edges





In *Tatta* village, Jajarkot district, Nepal, traditional agroforestry practice has covered farmland with productive trees.

By planting tumeric between trees and crops, competition is reduced.

By digging a ditch between lines of trees and crops, the tree roots are cut. This also stops the trees competing with the crops

The ditch is also used for irrigation and collecting leaf biomass

A 2 year old agroforestry, showing "stacking" of different species

People say that crops can't grow in the shade of trees, but here the wheat is growing well !

The same land a year later

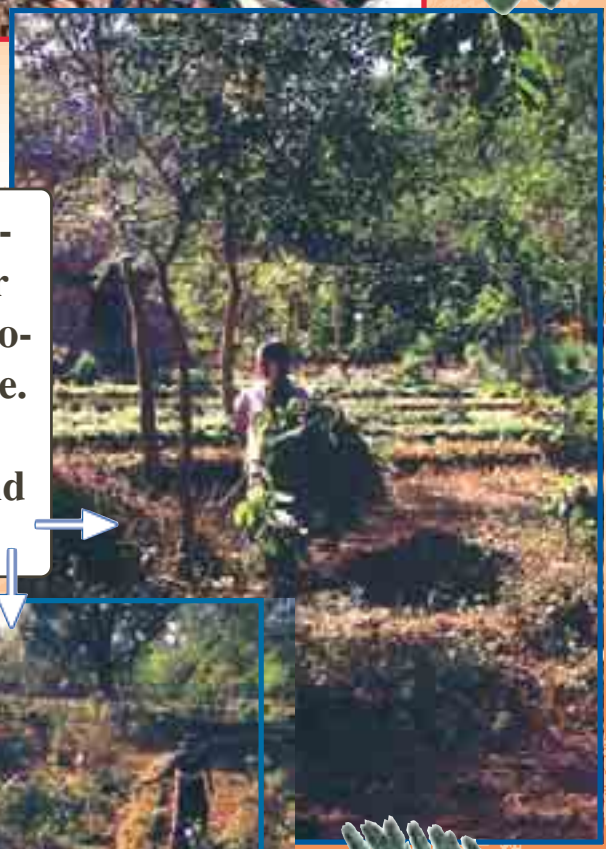
Competition between the trees and maize is seen here. The solution to this problem is given on pages 11 and 21.

This picture shows various types of small and large trees and shrubs planted together

The branches of *Dalbergia* are being pruned to produce good timber.

A third of the trees' top branches are left, and the remaining are pruned.

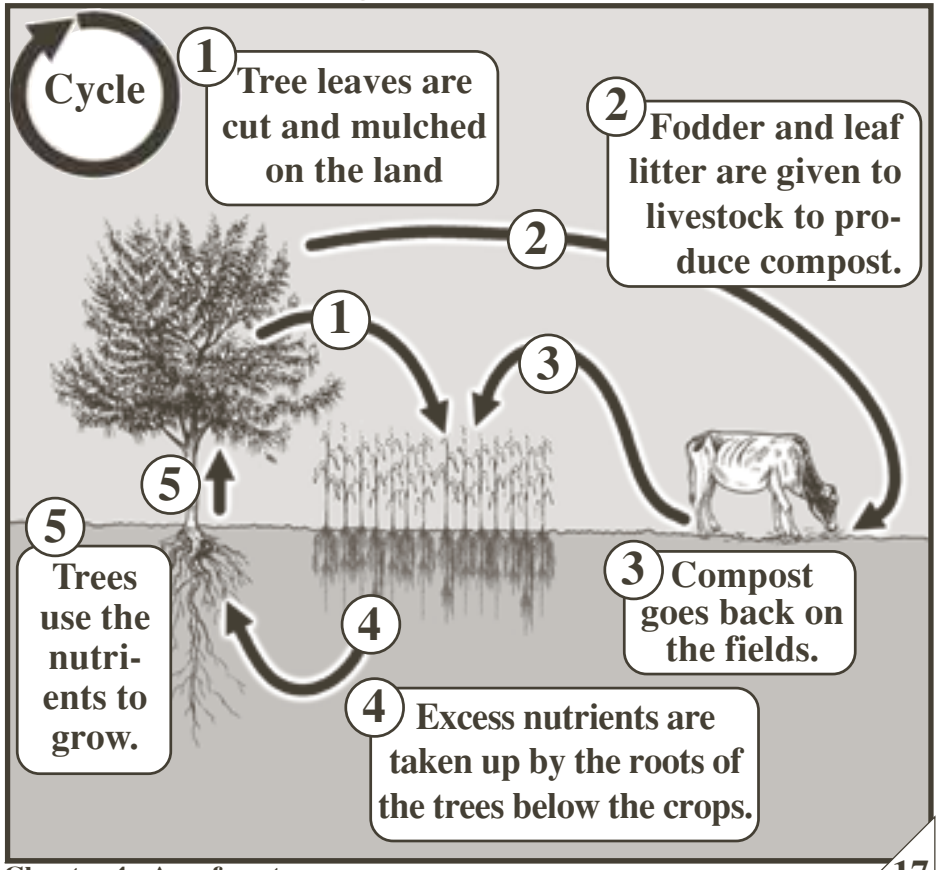
Lots of fire-wood can be produced on your own land by agroforestry



Plenty of fod-der and litter can also be pro-duced at home. This saves much time and labour.

- **Cycling**

The benefits of extra production and soil improvement from agroforestry are the result of cycling. This cycle needs to run continuously. Livestock are fed and bedded with fodder, straw, etc. from the agroforestry, and compost is returned to the fields. Leaf biomass can also be cut and mulched directly to the land. Work like this should be done regularly. If the cycle isn't completed, the trees will use all the moisture and fertility, and the soil will become depleted of nutrients for the crops. As a result, crop production can decrease, and farmers will lose out. So to manage agroforestry sustainably and productively, it is essential to run this cycle.



Maintenance

How to maintain Agroforestry

Management after establishing agroforestry

To manage agroforestry, the trees and shrubs should be cut from time to time. Any dead or useless branches and trunks should be cut and removed for use. So, management of agroforestry is mainly **harvesting** of products. Collection of fodder, leaf litter, firewood, etc. is beneficial to the trees, as well as to the annual crops. If this work isn't done in the right way, the agroforestry system will not help to increase production and benefit the land. So it is very important to manage agroforestry in the right way.

Agroforestry planted on terrace edges provides nearby fodder. The fodder can be fed to livestock or mulched directly on the land.

Timing of pruning in agroforestry

(a) Winter **(b) Summer**

Deciduous trees, which drop all their leaves at one time, are best pruned over winter. Evergreen trees are best pruned in the summer. Some of these can be pruned twice a year. In the winter, crops need more sun, and in the summer they need good air movement. So many trees and shrubs, especially those which cause more shade, should be pruned at these times so they provide production as well as to provide good conditions for the annual crops, based on their needs, and the needs of the tree crops.

Things to consider when pruning

- Use sharp tools;
- Don't split the bark;
- Try not to leave wounds on the sunny side of trees;
- Prune small branches and deformed trunks of timber trees;
- Prune fodder and biomass plants low down in the winter, and higher up in the summer.

Management for mulch and leaf litter

The leaves of *Adhatora, Melia*, castor, etc. make excellent mulch. Such trees and shrubs can be cut at least twice a year. Depending on the trees and crops around, they can be cut low down, or higher up. The plants should be able to sprout again after cutting.

Here *Lucaena* planted in agroforestry is cut and the leaves mulched directly on the land.

Fodder grass management

Fodder grasses planted or regenerated in the agroforestry should be cut to feed livestock, or mulched directly on the land. This should be done in a way which doesn't harm the crops.

Fodder tree management

Fodder trees should not be allowed to grow straight up. They are managed by cutting once or twice a year to produce maximum biomass. They should be cut according to the season to provide shade or sun, according to the needs of the field crops. They can be fed to livestock, or mulched directly on the land.

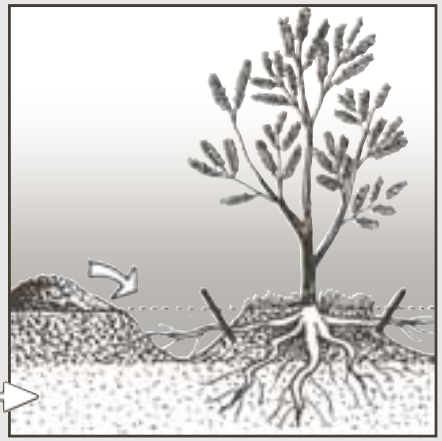
Management for firewood

Trees grown for fruit, timber, biomass or fodder will also provide firewood when they are pruned. Dead, diseased or damaged trees and branches should be regularly removed and can be used for firewood.

Timber management

Trees planted for timber should be allowed to grow up straight. The top one third of the tree should be left uncut, while the lower two thirds pruned of all side branches. The pruning should clean, otherwise disease can enter the wounds. When large branches are cut, plaster the wounds with fresh cow dung. Pruning can take place once or twice a year.

This diagram shows a method to control the growth of tree roots. By digging a trench along the line of trees, the roots are prevented from competing with crops. See also the picture on p.11.



Farmers' Experience

Mrs Belmaya Rana

From Nepal, Surkhet district, Gumi - 3, Ratadada village, and a member of "Hariyali" women's group Mrs Belmaya Rana has done agroforestry on her own land. Now let's hear about her experience.

Mrs Belmaya Rana

"At first we had hard times without the knowledge of agroforestry. We had to go far for fodder and firewood. This wasted a lot of time. I learned about agroforestry from the Homestead Programme (JPP) and designed my land. I've planted mulberry, *Lucaena, Bauhinia,* fruit trees, chillies and lots of other plants. In all, there are 56 species of useful trees and shrubs in my agroforestry system. The trees are all arranged in layers, all species are mixed up together. Before, 60kg of the mustard I grew was used to trade for chillies. Now I grow enough of both and have extra of both to trade. Now I have time to cut fodder as well as doing the housework. There's enough fodder on my own land for my 4 goats and 4 cows. I grow enough fruit for the family, and sell extra for cash. The trees don't affect the rice, but it did affect the mustard and maize, so I planted taro, ginger and tumeric against the trees in some parts, and dug trenches to cut the tree roots in others. "

Read On !

Subjects Related to Agroforestry

This chapter provides enough information for you to be able to grow your own agroforestry system at home. However, this information is also linked to other methods. For extra benefits let's read, learn and practice from other related chapters.

Nutrition chapter
Nutritious plants can also be grown in agroforestry

Improved Stove chapter
Agroforestry produces nearby fuel for the stove

Home Nursery chapter
Plants for agroforestry can be produced easily at home

Seed Saving chapter
How to produce various types of good quality seed at home

Fruit production chapters
Easy methods of producing, planting and managing fruit trees

Forest Management chapter
Forest is protected by using agroforestry to supply farm needs

Integrated Pest Management chapter
Grow plants in agroforestry which help in pest control

Mulching chapter
Produce plenty of biomass for mulching to conserve soil

Liquid Manure chapter
Grow plants to make liquid manure to control farm pests

Compost chapter
Nearby fodder and biomass makes making compost easier

Living Fence chapter
A living fence is agroforestry on the farm boundary

Kitchen Garden chapter
Agroforestry helps protect and supply the kitchen garden

Beekeeping chapter
Many plants for bee food can be grown in agroforestry

Livestock management chapter
Agroforestry crops make keeping livestock much easier