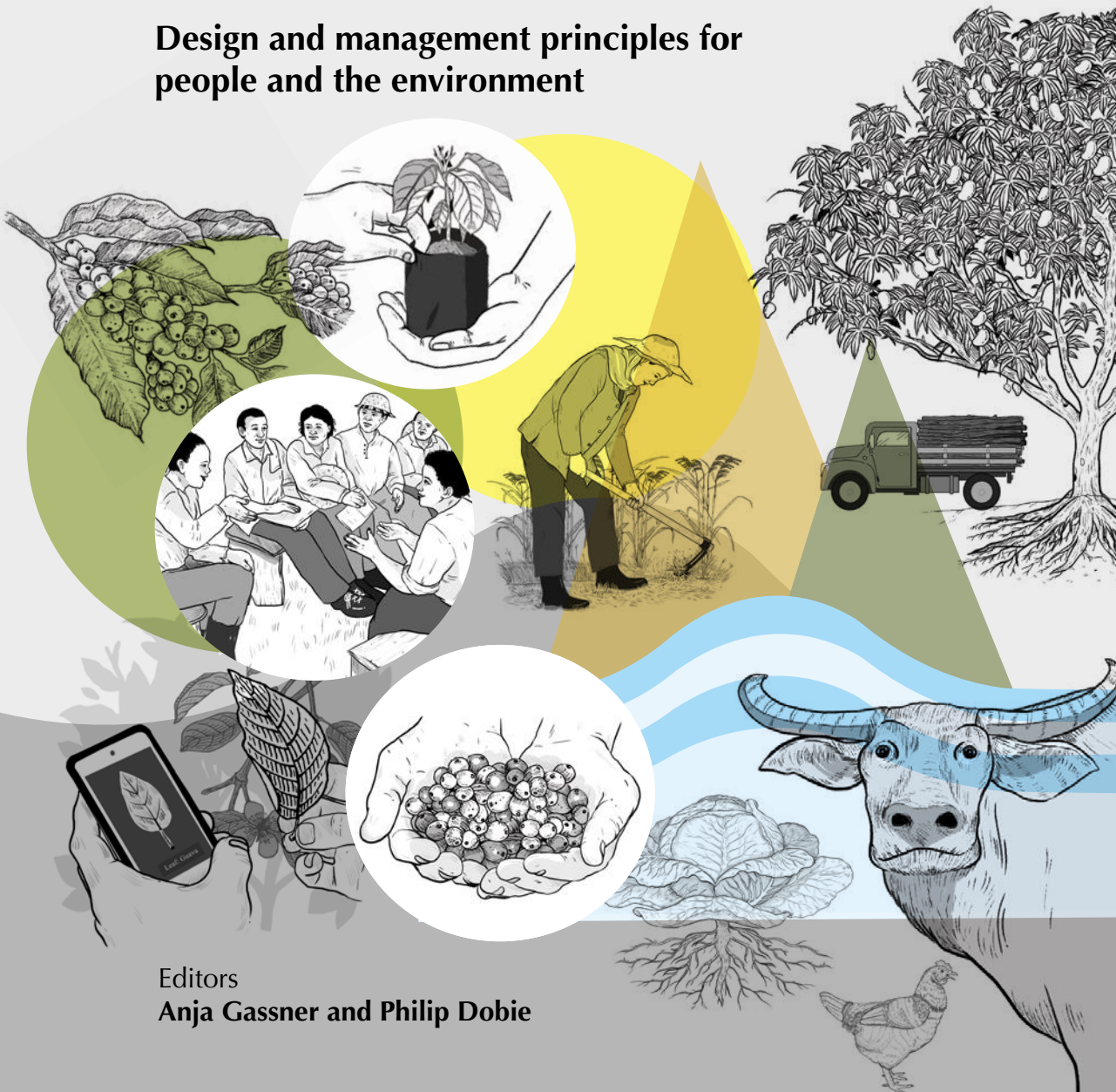




AGROFORESTRY: A PRIMER

Design and management principles for
people and the environment



Editors
Anja Gassner and Philip Dobie

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and the environment**

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ISBN 978-9-96-610861-6
<https://doi.org/10.5716/cifor-icraf/BK.25114>

Gassner A and Dobie P. eds. 2022. *Agroforestry: A primer*. Design and management principles for people and the environment. Bogor, Indonesia: Center for International Forestry Research (CIFOR) and Nairobi: World Agroforestry (ICRAF).

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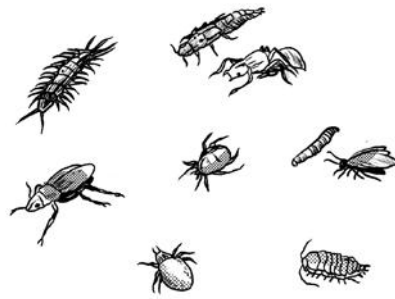
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MANAGEMENT OF TREES IN AGROFORESTRY SYSTEMS





Many tree establishment efforts focus entirely on the planting process, and fail to consider the years of time and effort needed to care for the planted trees and to manage their growth. It is true that the cultivation of trees usually requires less work than crop cultivation. **But trees planted on farms do require management, whatever the system, and this management can be very time consuming.** The design process must ensure that farmers are aware of the demands of management and that they consider these before deciding to establish an agroforestry system. Growing trees requires a long-term commitment, sufficient resources and sound knowledge about how trees interact with their environments, including other components of agroforestry systems. In this section, we provide an overview of how to manage trees in agroforestry systems.



Agroforestry systems differ, but broad management goals are similar

The expertise, knowledge and time needed to manage trees in agroforestry systems depend on the complexity of the system or practice. For example, farmers are likely to spend more time managing the trees in a multistrata system than those in a living fence. They will also need more knowledge and expertise for the multistrata system. In each case, however, management aims at achieving one or more of the following goals:

- ▶ System components have adequate supplies of nutrients and water.
- ▶ System components, particularly flagship species, are free of pests, diseases and other agents of damage, or are not critically affected by them.
- ▶ System components, particularly flagship species, have optimum light conditions.
- ▶ Productivity and profitability of the system are maximized.
- ▶ Trees grow to the right shape and size for their location and roles.
- ▶ Specific environmental goals, if any, are met.

Some tree management activities resemble those used to optimize growth, health and quality in orchards or forestry plantations. Other measures are also needed because of the special characteristics of agroforestry systems.



Thinning

Thinning is the removal of individual trees. It is done by felling the trees at ground level, usually with a chainsaw. The main aim of thinning is to manage competition, particularly between trees of the same species. It increases both the productivity and quality of the remaining trees.

In conventional timber plantations, which usually have trees of one species planted at 3.0 metre or 2.5 metre square spacing, thinning is a very important management practice. By gradually removing most of the trees that were initially planted, it concentrates production on a smaller number of large-diameter, well-formed and valuable final harvest trees. In forestry, thinning is a planned activity: foresters plant many more trees than will be needed in the end, because high initial density improves stem quality, helps to control weeds, and ensures that enough high-quality individuals can be selected for the final crop. Sometimes it is also possible to sell some of the thinned trees for poles, small-scale construction material, charcoal or firewood.

Some agroforestry systems, or parts of them, may resemble traditional timber plantations – for example, woodlots and simple successional systems such as **taungya**. In these cases, thinning practices will resemble those used in forestry. In other agroforestry systems, each tree is intended to be either a permanent component of the system, or – in systems with a successional component – to die naturally due to shade or because it has reached the end of its life cycle. In these cases, thinning is less common. Its intensity and timing will depend on each specific case.

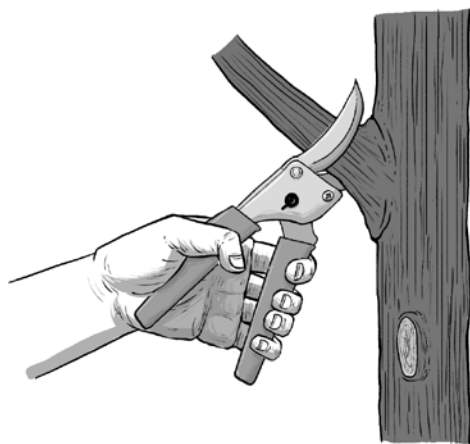




Crown management

Crown reduction is the removal of some or all of the above-ground parts of the tree – that is, its stem or branches. Four types of crown reduction are used in agroforestry: pruning, lopping, coppicing and pollarding. Crown management also includes the decision **not** to reduce the crown when more shade is needed.

Pruning



Pruning is the agroforester's main tool for managing competition. Selective removal of branches from one tree can prevent it from overshadowing and crowding out another. The removal of multiple branches from the crown may be referred to as 'crown thinning'. A pruned tree is less able to capture sunlight through its leaves, reducing the amount of energy it



captures, which leads to the dieback of some roots. Thus, pruning is also an important tool to control root competition.

Pruning to regulate shade also affects microclimate, including temperature and air circulation, which have important effects on pests and diseases. Shade favours some pests and diseases, whereas others are favoured by unshaded conditions, so crown management will depend on which pathogens are of concern.

Pruning is also used to enhance the productivity, or quality of production, of the tree itself – particularly in the case of timber trees, fruit trees, cacao and coffee. When a timber tree increases in girth, its side branches remain embedded in the wood; they are visible as knots in sawn timber. Pruning of dead and living side branches improves quality by preventing the formation of knots – an essential activity in the production of high-quality timber.

However, no more than one-third of the live crown should be removed in any given year. The belief that removing nearly all the branches of a tree will concentrate growth on the main stem is mistaken; rather, the tree's height and diameter growth will slow down, because it will **photosynthesize** less. Some timber species are self pruning, and should not be pruned artificially, except when live branches of flotilla trees are interfering with flagship trees. Pruning should also be used in all woody species to remove diseased branches.

For cacao, coffee and many fruit species, highly specific pruning techniques – which are beyond the scope of this booklet – have been developed to maximize productivity and quality.

Pruning, especially for high-value tree crops, is a skill that needs training and a good understanding of the physiology of a tree, as some species have highly specific requirements. It must be carried out with care, particularly on high-value trees. The best time to prune timber trees and young fruit trees is usually at the end of the dry season, because airborne fungal spores are likely to be less frequent, and because growth will soon start again and cover pruning wounds. In the case of mature (bearing) fruit trees, pruning is usually carried out after harvest.

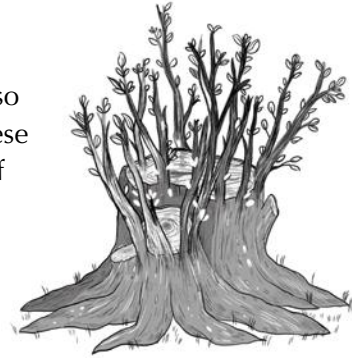
Lopping

Lopping is used when a ‘rough-and ready’ approach to crown reduction is acceptable – for example, in pruning live fences or in some forms of **alley cropping**. Lopping may sometimes be used instead of pruning when competition for light can be reduced by removing just part of a branch, particularly when the branch base is difficult to reach.



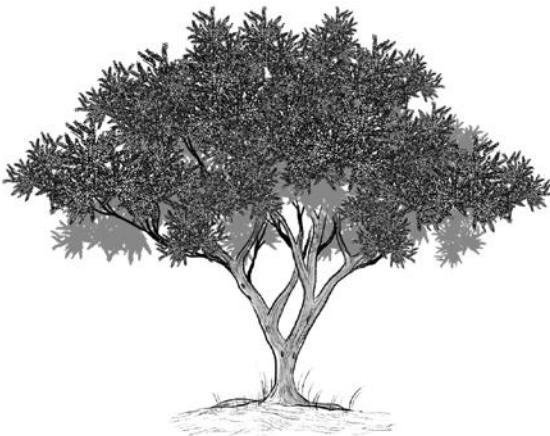
Coppicing

Many tree species produce new shoots from their stump or roots when cut, and coppicing takes advantage of this. The shoots, once woody and large enough, are harvested for poles, rods and fuelwood. The tree component in alley cropping is also usually managed by coppicing (or lopping). Coppicing can also be used to manage trees on soil conservation structures. In these cases, development of a large crown may affect the stability of the structure. Coppicing will lead to the death of some roots, but the stability-enhancing larger roots will remain.

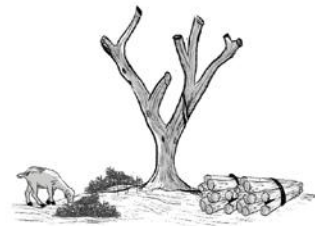


Pollarding

Historically, pollarding was used instead of coppicing in situations where browsing animals would otherwise have fed on coppice shoots. In agroforestry, it is important as a shade management technique, particularly in some simpler multistrata systems, such as coffee with erythrina pollards and laurel in Costa Rica.



a. acacia tree before pollarding



b. acacia tree after pollarding



Weeding

Weeding is the cutting or removal of herbaceous plants, grasses or climbers that grow near or on tree seedlings. Selective weeding targets plants that are visibly affecting the development of the seedling or the adult tree. Sometimes the negative effects of other plants are not very easily visible, but the growth rate of tree seedlings can be strongly impeded, for example by competition from grasses or other aggressive vegetation. A good standard weeding practice, especially when trees are to be established in pastures, is to 'clean weed' a circle around each seedling to a distance of 0.5 metres from the stem. To prevent erosion and drying, the bare soil should be protected by **mulching** with the uprooted plants and plant parts.





Fertilization

Fertilization is the addition of external sources of nutrients to replace those that have been lost to the system and that, as a result, are deficient. In agroforestry, the right spatial and temporal arrangement of trees, crops and livestock allows **organic matter** and nutrients to be circulated on the farm, so that the use of fertilizers can be reduced without losing yield. However, new agroforestry systems often need to be ‘kick-started’ with initial fertilization, and many will benefit from regular applications afterwards. In many countries, guidelines are available for fertilization of commercial agroforestry systems (for example, cacao and coffee) and fruit tree orchards.

Prunings may be used as mulch. However, woody material, particularly large branches, takes longer to decompose. To speed its decay, it should be placed in direct contact with the soil, and then covered with leaves and other non-woody parts. In some systems, plants such as bananas or plantains, Mexican sunflower and panic grass are deliberately planted to be later cut for mulch.



Some organic matter that accumulates in the fields, such as fresh animal manure or ripe fruit, can attract pests and diseases. These should be composted off-site and later added or returned to the system.

