



# Chapter 1: Introduction to the Forest Garden



## What is a Forest Garden

A Forest Garden is a multi-layered, integrated agricultural system that combines diverse plants and animals into one area to sustainably produce a variety of products and environmental services. It is an agricultural system designed to resemble a forest ecosystem, which is one of the most productive systems on Earth. Forest Gardens maximize use of both horizontal and vertical space, and can be tailored to nearly all agroecological zones. Forest Garden designs incorporate a wide variety of edible plants along with those that provide both timber and non-timber forest products in combinations that maximize beneficial interactions and minimize negative effects on each other and the system as a whole.

Forest Gardening is a practice that incorporates technologies and concepts from both agroforestry and permaculture. Though designs differ dramatically depending on the location and production goals, Forest Gardens incorporate a wide variety of perennial plants that will continue to grow year after year requiring minimal maintenance. Properly managed, it produces fruits and vegetables of higher quality and nutritive value than those produced through monocultures. The innate diversity of Forest Gardens protects crops from devastating pests and disease outbreaks. They also act as a buffer against deforestation by providing an alternative source for goods and services that people would otherwise collect from natural forests. When fully established, a Forest Garden is also temporally optimized to provide a harvest nearly every day of the year.

Food production for consumption and sale is the commonly the primary objective of Forest Gardens, but other products may include, **fuelwood, fiber, fodder, fertilizer, dyes, ornamental/artisan goods and medicinal plants.**

### *Other Names:*

Multi-strata cropping, vertical garden, food forest, stacked polyculture

## Major Characteristics of the Forest Garden

- It allows people to sustainably meet their needs and produce a marketable surplus, by making maximum use of the land
- It incorporates the symbiotic relationships among plants, animals and microbes
- It avoids the risk of economic dependence on one, or a very few crops
- It provides a continual supply of food and other crops
- It harnesses natural biological fertilizers and pest controls

## Key Concepts

These key concepts will provide the basis for understanding the more detailed characteristics that follow this section.

### *Forest Garden*

- Maximize spatial dimensions of the area planted, evenly distributing plants and efficiently using horizontal and vertical space.
- Maximize utilization of space by ensuring systems, technologies, and species are selected and designed to serve multiple functions wherever possible.
- Take into consideration temporal planning, through staggered planting and harvesting of selected species to provide products to consume and sell consistently throughout the year.
- Are designed following the natural patterns of the plants and site throughout the year, taking into account important factors such as: soils and climatic conditions, production timing of selected plants, and including the movement of wind, water, and sunlight across the site.
- Utilize a large variety of plants that often serve multiple purposes, with each plant type forming a specific layer of the Forest Garden.
- Utilize natural fertilizers and pest control through the conscientious design of plant species' relative locations and attributes. Nutrient management takes place through understanding plant interactions with the soil and other plants. Composting is used whenever possible.

### *Benefits of the Forest Garden*

- Forest Gardens are an important source of diverse and nutritious foods, especially for poor, rural families, and thus are important contributors to the food security and livelihoods of farming communities.
- Forest Gardens provide a safety net for households when food is scarce. These gardens are not only important sources of food, fodder, fuel, medicines, spices, herbs, flowers, construction materials and income, but they are also important

for the *in situ* conservation of a wide range of unique genetic resources for food and agriculture.

- As Forest Gardens incorporate lots of perennials with deep root systems, they are far less vulnerable to destruction from environmental shocks and stresses such as droughts, floods, landslides, etc. than are similar sites planted with annual crops. This makes Forest Garden families less vulnerable and more resilient.
- Mixing of different compatible species is commonly practiced to maximize spatial (intensive use of ground and vertical space) and temporal (staggered planting and harvesting) dimensions of the Forest Gardens.
- The plant diversity in Forest Gardens is characterized predominantly by multi-purpose plants in various vegetation layers, allowing for good utilization of necessary elements like water, nutrients, and sunlight.
- The plant diversity in Forest Gardens serves to enrich the local biological diversity. These systems also do not depend on expensive or fossil fuel-based inputs such as chemical fertilizers, fuel-powered machinery, or pesticides.
- The diversified food products provide a substantial portion of nutritive and energy requirements of the local diet. Moreover, the species diversity and varying production cycles of the different components ensure continuous production throughout the year from the Forest Garden.
- Forest Gardens are considered a shady place to relax and socialize. They provide respite from the hot sun and provide a safe and a safe environment for children to play.

### *Forest Gardens Compared with Other Cropping Systems*

The following are some of the economic, social and/or cultural foundations of Forest Gardening in comparison with other cropping systems under similar situations:

- Lower input and labor requirements once matured – suitable for resource poor and small-holder farming situations.
- Better utilization of resources, greater efficiency of labor, even distribution of labour inputs and more efficient management.
- Diversified range of products from a given area, and increased value of outputs
- Increased self-sufficiency and reduced vulnerability to climatic, biological, or market impacts on particular crops or products.
- Higher income with increased stability, greater equity, and improved standards of living.
- Better use of under-utilized land, labor or capital, while creating capital stocks—increased resilience—to meet intermittent costs or unforeseen shocks or stresses.
- Enhanced food security and an ability to meet the food, fuel, fodder, and timber requirements of the family.

- Increased fulfilment of social and cultural needs through sharing or exchange of produce and recreational opportunities.
- Better preservation of indigenous knowledge.

### *Forest Gardens and Multipurpose Plants*

Most plants provide multiple benefits and, as such, we aim to take advantage of as many of those benefits as possible to maximize the productivity and sustainability of Forest Gardens. Wherever possible we select plants in a Forest Garden to take advantage of their multiple uses, providing useful food or forest products as well as environmental services. For example, an agroforestry tree may be included that reduces wind, controls erosion and fixes nitrogen into the soil. The same tree can also be coppiced for fuelwood and fodder, or the leaves and stems can be used as a mulch or mixed into the soil to increase fertility and moisture retention. Some examples of different roles that plants can serve are:

- **Edible and medicinal plants** (roots, shoots, leaves, fruit, seed, etc.)
- **Woody plants** (typically trees and shrubs that provide timber, poles, and fuelwood)
- **Companion plants** (plants that have an overall benefit to one another)
- **Insectary and nectary plants** (beneficial insects depend on these plants for food, shelter, reproduction etc.)
- **Aromatic Pest Confusers (also called 'Repellers')** (plants that confuse and repel pest insects with strong odors e.g. onions, garlic)
- **Wildlife plants** (birds and other animals rely on the food and habitat these plants provide)
- **Nitrogen fixing plants** (relationship between N fixing bacteria or fungi and plant roots creating free nitrogen to improve growth rates)
- **Dynamic accumulator plants** (mineral miners collect nutrients = free nutrients)
- **Bulbs and large rooted plants** (soil structure diversity, ability to absorb/mine minerals)
- **Ground cover plants** (protects the soil, conserves water, and creates healthy soil-level habitat)
- **Fertility and mulch plants** (free nutrients and green mulch for seasonal chop and drop practices)
- **Animal forage and fodder plants** (reduce outsourcing of food for animals and livestock such as cattle, goats, sheep, and chickens)

### **Structure of Forest Gardens**

Forest Gardens are strategically designed to cultivate plants that fill space both horizontally (across the ground) and vertically (from belowground to the top of trees' canopies). The combination of trees and other plants in a layered canopy

configuration is the most obvious characteristic of all Forest Gardens. The tight space within Forest Gardens results in intimate plant associations.

### *Use of Vertical Space*

In general terms, all Forest Gardens consist of an herbaceous layer near the ground, a tree layer at upper levels, and multiple intermediate layers. The lower layer can usually be partitioned into three, with the lowermost producing below-ground, root products, the next (less than 1 m height) dominated by different vegetable and medicinal plants, and the third (1-3 m height) composed of herbaceous semi-lignified food crops such as cassava, banana, papaya, and yam. The intermediate layer of 3-10 m in height is dominated by various fruiting and/or nitrogen-fixing shrubs, some of which would continue to grow taller. The upper tree layer can also be divided in two, consisting of emergent, fully grown timber and fruit trees occupying the uppermost layer, over 25 m height, while medium-sized fruit trees of 10-20 m occupy the space just below that. This layered structure is never static; the pool of replacement species results in a productive structure which is always dynamic while the overall structure and function of the system are maintained. An example of a vertical arrangement is presented in Figure 1.

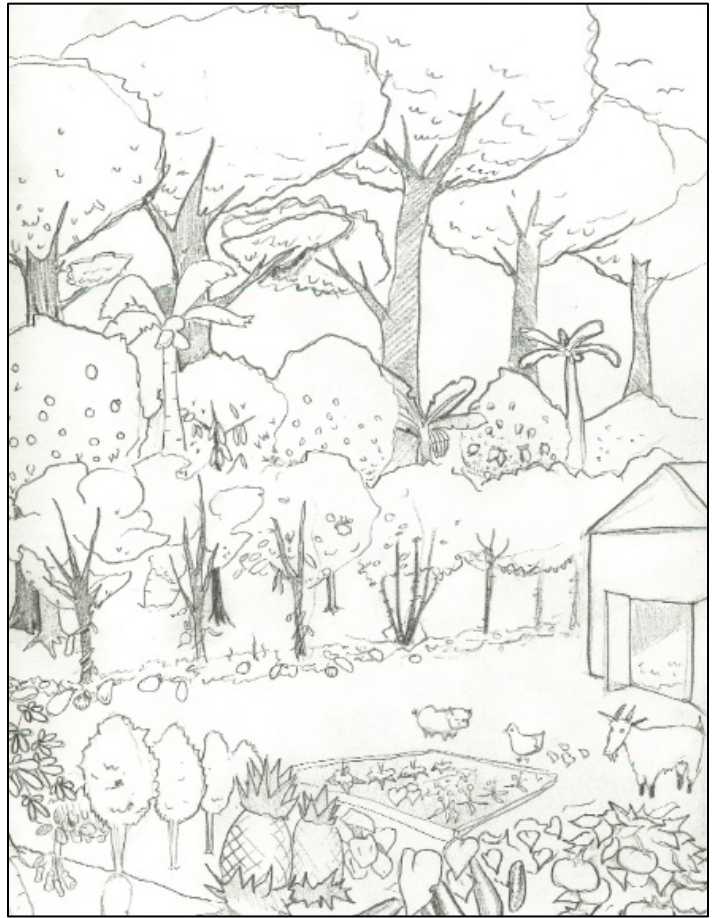


**Figure 1.** An example of vertical (side view) arrangement of complex Forest Gardens in the tropics.

## *Forest Garden Layers*

**Forest gardens make efficient use of vertical space**, both above ground and below ground. This means that when deciding where to place specific plants, the root structure and soil characteristics are taken into consideration along with the branching structure and height of the plants. Looking more closely, Forest Gardens can be divided into seven distinct layers (also called strata or zones), though not every layer necessarily needs to be present. Each layer typically provides specific functions, products, or environmental services. See Photo 1 below.

1. **Canopy plants** – which can be fruit or nut trees, timber species, or pioneer species that grow quickly and produce shade;
2. **Subcanopy plants** – lower plants utilizing shade of the canopy plants, including coffee plants or small fruiting plants such as papaya and banana;
3. **Shrub plants** – large bushes or tall annual crops;
4. **Herbaceous plants** – often edible and medicinal plants;
5. **Vining or climbing plants** – plants that climb their way up subcanopy and canopy plants;
6. **Groundcover plants** – shade and fertilize the soil, conserving moisture, adding nitrogen and organic matter, and preventing soil erosion.
7. **Underground or rooted plants** – become nutrient pumps for the surrounding soil enhancing its fertility, and also often include root vegetables such as potatoes, carrots, tubers, onions, etc.



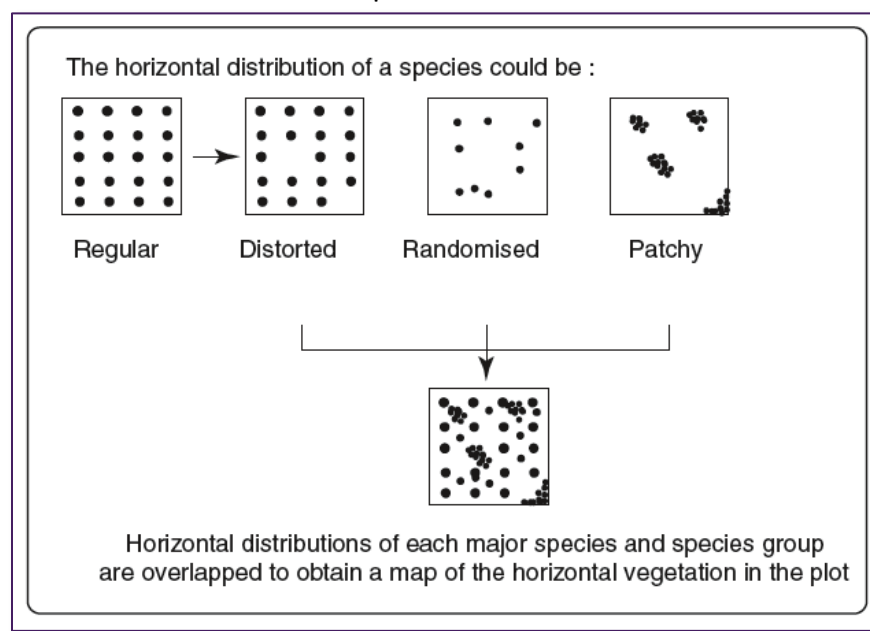




**Photo 1.** Forest garden layers at Kusamala Institute of Agriculture and Ecology in Lilongwe, Malawi with marigold, legumes, yams, roselle, tephrosia, papaya, mango, and more.

## Use of Horizontal Space

Horizontally, looking down from above, Forest Gardens usually follow regular, distorted, randomized or patchy distribution of plants inside the plots; in many cases plant distribution in Forest Gardens is a combination of these patterns. Families could adopt any of those patterns according to their objectives and resources. See Figure 2 and Photo 2 below for examples.



**Figure 2.** Horizontal (top view) arrangement of Forest Gardens in the tropics (Lamanda et al 2006)



*Photo 2. Areal photograph of Kusamala Institute of Agriculture and Ecology in Lilongwe, Malawi using a combination of patterns.*

Forest Gardens make efficient use of space through the intensive cultivation of various types of plants around each other in ways that utilize symbiotic relationships between species of plants as well as animals. The biophysical characteristics or requirements of plants need to be taken into consideration when planning (i.e. light and water requirements, soil preferences, nutrient demands, and interactions with other plants). The first training event in TREES' Forest Garden Approach teaches participants to create maps of their sites to begin designing their Forest Gardens with these considerations in mind.

- **Vegetation patterning** – Plants pattern themselves naturally in a forest in ways that can help regulate insect populations. Forest Garden design looks to mimic these patterns to produce natural insect populations that are beneficial to plant growth.
- **Plant diversity** – Having a large diversity of plant species included in the design will help with creating small plant communities of species that grow well together and maximize the use of space in their growth patterns both structurally, but also in regards to what time of year they need to use the most nutrients to produce fruits, nuts, leaves or roots.



- **Soil horizons** – An understanding of the soil horizons and how they change over the area being used for the Forest Garden is essential. Soil samples should be taken from various locations to better plan where plants will be placed.
- **Guilds** – Creating guilds is an important practice in Forest Gardening. A guild is an association of plants that have common characteristics or habits that grow well together. It is similar to companion planting. Certain plants secrete liquids from their roots into the soil, help certain bacteria to form in the soil that provide beneficial results to the plants growing near them, or attract pest predators or repel pests that affect nearby plants.

## Forest Garden with green walls and fruit and fuel trees





## Forest Gardens with fertilizer trees, fruit trees, and field crops





**Forest Garden with cashew trees and cassava**



**Forest Garden with raised beds, earthworks, fruit trees, and vegetables**

