

## FOREST GARDENS

*Health through Diversity*

*Martin Crawford*



**Forest gardens** are a type of land use common in many parts of the world, and fast becoming more popular in Britain, for growing a wide variety of edible and other crops in a sustainable and low-input system. They have a long history in the tropics and sub-tropics (where they are often called home gardens) with evidence for their use as long as 12,000 to 14,000 years ago in parts of Asia.

This diverse system involves mixing trees, shrub and ground-level plants in an integrated system which provides food and other crops, mimicking the structure of a forest but using plants of direct or indirect use to people. So as well as the obvious fruit and nut trees, there will usually also be many perennial vegetables, trees and shrubs for edible leaf crops, fibre plants used for tying, construction materials like bamboos, medicinal plants and dye plants. Plants of indirect use usually include nitrogen-fixing plants and mineral accumulators (deep rooted plants which efficiently raise nutrients into the topsoil layers) which help feed the whole system.

Although annual plants may be included in forest gardens, the majority of plants are perennial and the majority of the soil is not cultivated, which gives tremendous benefits, the most significant of which is that a healthy mat of beneficial fungi (called mycorrhizae) grows throughout the topsoil. These beneficial fungi have many important functions, none more so than linking up the whole system into one by forming symbiotic associations with almost all plant roots.

Mycorrhizae form symbiotic associations with most plant roots, giving the plants difficult-to-find nutrients in return for some sugars. They protect plant roots from pathogens. They move nutrients around from areas where they are abundant to where they are lacking. And perhaps most important of all, they are a vital part of the process of carbon sequestration, where carbon is locked into the soil in stable forms.

It is this interconnectedness of the system which gives it not only resilience but also health – most pests and diseases just cannot make much impact. They do not move easily from one species to a quite different one, nor can they easily find their way by smelling their way because of the myriad of aromatic plants which ‘block their senses’. Also there is increasing evidence that eating from a healthy system like this also aids human health. Perennial plants usually have more substantial root systems than annuals, can access more soil volume and thus in most cases contain more nutrients than annuals. The mycorrhizal fungi help increase nutrient levels too. A survey of 25 perennial vegetables found that they contained on average 200-300% of the amounts found in common annual vegetables of potassium, magnesium, iron, vitamin C and protein <sup>[1]</sup>.

It is unfortunate that the last couple of hundred years have been dominated by the development of annual-based agriculture and horticulture. It is a clear consequence of linear thinking as opposed to holistic thinking. Whilst annual plants can be very productive, it is the case that annual cultivation is detrimental to both the soil, and in terms of the carbon emissions. Every time soil is dug or ploughed, carbon is released into the air as humus oxidises. Annual cultivation never achieves a healthy mycorrhizal mat, so it can't sequester much carbon.

In the natural world, annual plants are relatively uncommon, usually only being found where there has been a disturbance of soil by animals, fallen trees, or weather extremes. On these sites annuals are the first plants to re-colonise, but they are quickly replaced by longer-lived perennial plants in a succession. So it is true to say

that an annual-based agriculture is profoundly unnatural. Forest gardens and agroforestry systems are a reflection of the real world.

The development of an annual-based agriculture has gone hand in hand with increased mechanisation and the domination of agriculture by fewer and fewer corporations controlling seeds and other factors. Forest gardens are inherently complex systems which are not suitable for mechanisation or large individual scale implementation. *Small is Beautiful* indeed.

In Britain the history of forest gardens is short, with Robert Hart starting his experiments some 40 years ago, and Martin Crawford some 20 years ago in Devon. In this country the same principles can be applied, though the spacing of trees needs to be wider than in the tropics to allow enough sun energy to filter down to crops below. Most forest gardens here contain fruit trees (apple, pear, plum etc.), nut trees (hazel, sweet chestnut), perennial vegetables (Alliums, purslane, Hostas, Solomon's Seal, Pokeroor, herbs etc.), tying materials (New Zealand flax), leaf crops (lime trees), nitrogen fixing trees and shrubs (Alders, Elaeagnus) and so on.

Diversity is key to the resilience, stability and health of forest gardens – diversity in structure and diversity of species. Most forest gardens in different parts of the world contain 150-250 species, sometimes more. This sounds a lot compared with the few dozen food plants that most people in the 'developed' world eat, but it isn't really. Some of our nearest relatives, orang-utans, regularly eat 300-400 different plant species. Diversity in diet is likely to be linked to health in many ways.

Most forest gardens achieve diversity through using a mixture of native and non-native plants. Just as most of the annual and tree crops grown in Britain are non-native (wheat, barley, potatoes, onions, garlic, sweet corn, squash, apples, pears, plums etc.) so many of the plants in forest gardens here are non native too. I don't regard this as a problem, for there is increasing evidence that diversity of structure (giving many niches) and of species is just as valuable for wildlife as nativeness. The likelihood of continued climate change is a further factor which makes reliance on natives only in both forest gardens and forests themselves a risky strategy. We desperately need resilience in the decades to come.

Forest garden and similar agroforestry systems offer a sustainable and low-carbon alternative for growing crops for people, which also protects the soil, stores carbon, and is excellent for wildlife. Oh yes, and forest gardens are very beautiful and being in them surely increases health too!

---

**Reference:**

1. Martin Crawford.(2005) Food value of annual and perennial vegetables Agroforestry News Volume 13 No 4.

**Martin Crawford** is a Director of the Agroforestry Research Trust, a British charity which conducts research into temperate [agroforestry](http://www.agroforestry.co.uk). Martin has spent over twenty years in organic agriculture and researching all aspects of plant cropping and uses, with a focus on tree, shrub and perennial crops. The Agroforestry Research Trust produces several publications and a quarterly journal, and sells plants and seeds from its forest gardens. Martin is the author of *Creating a Forest Garden* (published by Green Books). [www.agroforestry.co.uk](http://www.agroforestry.co.uk)