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Forest gardens are collections of diverse and useful plant species that are modeled on the structure of a young forest. As a horticultural pattern, forest gardening is found throughout the world, particularly around the tropical rainforest belt.¹ Temperate climate forest gardening is still practiced in parts of China, and there is much to suggest that the forest garden pattern may once have been found throughout the world's temperate forests, prior to the arrival of agriculture.² Practiced in diverse environments, by widely different cultures, the forest

¹ Forest Gardening is still practiced in Sri Lanka, India, Indonesia, the Philippines, China, Vietnam, Tanzania, Nigeria, central America, and the Amazon. (Hart; Crawford; Lawton; Workman)

² This claim, based upon a slightly broader definition of forest gardening than I have given in this article, includes practices that might better be called, as Dave Jacke has, "gardening the forest," or, as M. Kat Anderson has called them, "tending the wild." Examples of this more extensive approach to "forest gardening," include the Jomon, indigenous to the Japanese archipelago (Workman 2013), indigenous peoples of the eastern forest bioregion of North America (Jacke 2005a: 14), and the indigenous peoples of California (Anderson). In Europe, traditional coppice practices and the cultivation of hedgerows comprising many useful forest-edge species are certainly forms of "agroforestry," but may also suggest older practices of tending the wild.

garden pattern can vary greatly in detail. The common characteristics by which the general pattern can be recognized are:

- Vertical stacking of different species (forest architecture mimicry)
- High plant diversity (200 – 400 species per garden is common)
- Typically established on small parcels of land (1/4 – 3 acres)³
- The use of mostly perennial plant species
- Producing a diversity of yields to meet a wide range of human needs (geared more toward subsistence than an exchange economy)
- Low energy inputs, especially as concerns on-going maintenance
- Forest gardens are largely self-fertile and self-maintaining (ecosystem mimicry)

Unlike most horticulture and almost all agriculture, which is, by contrast, very two-dimensional, forest gardens are collections of plants arranged both vertically and horizontally. The vertical partitions of space are referred to as “layers,” and the utilization of these layers by the gardener is modeled on the vertical structure of young forests, or forest edges. While tropical gardens sometimes feature up to nine distinct layers, most forest gardens comprise seven layers:

³ Forest gardens are “over-yielding” systems, meaning that multiple harvests of different crops are possible from the same piece of land. The implication of this is that, while forest gardens cannot produce yields of a single crop comparable to agriculture, they can produce overall yields, from a given piece of land, far higher than that achieved with agricultural techniques. Thus, when geared toward subsistence, forest gardens need only take up relatively small areas of land.

Lawton, Geoff:
2008 Personal communication.

Workman, Dion:

2011 – ‘Natural Farming in the Philippines: Traditional farming systems and local efforts to save them.’ Unpublished manuscript, originally appearing on the now defunct natural farming website, *Terraquaculture*.

2013 – ‘Jomon Horticulture: “Incipient agriculture” or forest gardening?’ Lecture given May 5, 2013 at Shikigami forest garden, Japan.

pear ridiculously complicated, which it is not. Forest gardens, as close mimics of natural forests, are complicated beyond our understanding, and therefore, the gardener need not attempt to understand everything as the scientist seeks to, but rather, through observation and participation in the evolution of this ecosystem in miniature, can develop and depend upon the craft and intuition usually associated with the artist, or master gardener. There are a few fundamental ideas and techniques that need to be thoroughly grasped before planting a forest garden, but only a few. On the other hand, to become a master forest gardener will likely take a lifetime.

Finally, there is also Robert Hart's *Forest Gardening*, not a how-to manual so much as a poetic exploration of Hart's vision of the forest garden and how he came to it. As the focus of neo-forest gardeners has largely been on technique, it is good to remind ourselves that, at least as Hart saw it, the real fruits of the forest garden were self-sufficiency and autonomy.

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2005 *Tending the Wild: Native American knowledge and management of California's natural resources*. Berkeley: University of California Press.

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2010 *Creating a Forest Garden: Working with nature to grow edible crops*. Totnes: Green Books.

Hart, Robert:

1996 *Forest Gardening*. White River Junction, VT: Chelsea Green.

Jacke, Dave and Eric Toensmeier:

2005a *Edible Forest Gardens, Vol. One: Ecological vision and theory for temperate climate permaculture*. White River Junction, VT: Chelsea Green.

2005b *Edible Forest Gardens, Vol. Two: Ecological design and practice for temperate climate permaculture*. White River Junction, VT: Chelsea Green.

- the canopy, consisting of the largest trees in the garden
- a sub-canopy of smaller trees and large shrubs
- smaller shrubs
- herbaceous plants
- horizontally spreading plants covering the soil surface
- vining plants climbing through all of this
- and the "rhizosphere," the soil layer, from which roots and mushrooms may be harvested and upon which all the other layers depend.

Here in the northeast, a forest garden canopy might comprise walnut, chestnut, hickory, or sugar maple; with a sub-canopy of persimmon, plum, pawpaw, saskatoon, or hazelnut; making their way into the sub-canopy are the vines: grapes, hops, hardy kiwi, groundnut; underneath these in the shrub layer, raspberries, currants, and blueberries; then nutritious and medicinal herbaceous plants and perennial vegetables such as jerusalem artichoke, nettle, milkweed, lovage, or echinacea; and finally, protecting the soil surface, a carpet of strawberries, lingonberries, oregano or mint.

The utilization of vertical space within the forest garden allows for a large number of plant species to be grown in relatively small areas. The number of species found in traditional tropical forest gardens can be truly astonishing: 200 or more plant species, of direct and indirect use to humans — not to mention, birds, insects, and small mammals — is typical on a ¼ acre of forest garden. But even in temperate climates, the species diversity can be very impressive, and 200 — 300 species over an acre or two is not uncommon. The diversity of species in forest gardens makes them very resilient to pest and disease

infestations, as these usually only effect a small number of related species at any given time — if a few things fail, there are many more to make up the loss.

In contrast to annual-centric horticulture and agriculture where, every year, seeds are planted and after some months, food can be harvested, the forest garden, with its large diversity of perennial species, makes harvest throughout the year — or, here in the north, throughout the spring, summer, and fall — possible (though even here we begin harvesting tree sap in late winter). The gardener intentionally selects species to provide harvests for as many months of the year as is ecologically possible, and thus, avoids the need to grow any one species in large enough quantities that it may be stored as a primary staple food for the entire year.⁴ Harvesting from many species at different times of the year makes the forest gardener's way a particularly robust and resilient way of growing, food.

Forest gardens provide much more than just food, though. As already mentioned, a characteristic of forest gardens around the world is that they are geared more toward subsistence than an exchange economy. That is not to say that cash crops are never grown in forest gardens, but the gardens are typically planted with such a range of species as to allow the gardener to meet most, if not all, of her needs from her forest garden. There are plants for food, yes, but also plants for medicine, for fuel, for fiber, for dye, for building, woodworking and basketry materials, and also plants whose place may be primarily in providing ecosystem functions, such as nitrogen fixation, or attract-

⁴ While in the tropics it may not be necessary to store food for any length of time, in temperate climates, particularly the further north or south you go, it is. Thus, temperate climate forest gardeners do generally grow crops suitable for long term storage — nuts, in particular, but also fruits, seeds and tubers — however, they can do this by spreading the quantities needed, or desired, across as large a number of species as possible. This approach creates resiliency against crop failure in the forest garden.

technique of production: an ecologically regenerative/benign, low-labor, solar-powered, self-maintaining, resilient production system that is directed toward household and community self-sufficiency. While there may be some problems with the way forest gardening has been incorporated into permaculture practice, such as a focus almost solely on the production of food, rather than the full range of things needed for a subsistence life, it should nevertheless be acknowledged that many of the techniques used in temperate climate forest gardening by neo-forest gardeners, particularly those of design and site preparation prior to the establishment of a garden, are the fruit of decades of research, experimentation, teaching, and networking by permaculture practitioners.

Hart's pioneering work has inspired not only some spectacular gardens but also some very good texts on forest garden theory and practice. The most notable of these are Marlin Crawford's *Creating a Forest Garden*, and the two-volume set, *Edible Forest Gardens*, by Dave Jacke and Eric Toensmeier. The former is, in my opinion, the better introductory text as it clearly lays out the basics of temperate climate forest garden theory, design, and implementation, and it is authored by the person who has created what is, by popular consensus amongst forest gardeners, the finest example of a temperate climate forest garden in the western hemisphere. But once hooked and eager to take up the art of forest gardening, the Jacke and Toensmeier texts become indispensable, particularly if you live in the northeastern United States, the region where these two forest gardeners reside and upon which the volumes are focused. These are encyclopedic tomes: the first volume is a thorough exploration of forest ecosystem theory, while the second contains detailed explanations of site assessment and design processes, forest garden implementation and maintenance, and includes a near-exhaustive list of useful perennial plants for temperate climates. There is so much information in these two volumes that I fear, for the uninitiated, they may make forest gardening ap-

Kagawa — and began his own experiments with (what was to later be called) forest gardening, on 1/8th of an acre of old orchard. On this tiny piece of land, Hart developed a productive garden (yielding food and basketry materials mainly), far more ecologically complex than any form of agroforestry then being practiced, and far closer to the chaotic tropical forest gardens that agroforestry sought to simplify. This is hardly surprising, as agroforestry is focused on production for a market-economy, whereas Hart sought a decentralized and de-industrialized society where households and villages would be largely self-sufficient. The great irony here is that Hart was conducting his experiments in the Welsh border lands of Shropshire, England, the precise place where the industrial revolution began. Hart's vision of the forest garden was one of raising the self-sufficiency of households to facilitate economic down-sizing and a return to highly localized economic activity, of creating sites of practical education for children in the life skills of feeding and sheltering themselves through co-operation with diverse species in living systems, and of a means of re-greening the forest environments that agriculture and urbanism had denuded.

Robert Hart's work has inspired a subsequent generation of neo-forest gardeners, particularly in the United Kingdom, continental Europe, the United States, Australia, and New Zealand. While Hart's forest gardening idea is often thought to be synonymous with permaculture, it was pioneered independently of permaculture,⁷ and if the practice has been widely adopted by permaculturalists, it is because, in many ways, it could be considered the quintessential permaculture

⁷ As practitioners view permaculture as a "toolbox" of techniques, as well as a design system, they have the tendency to label anything that resembles it, or is useful to it, as "permaculture." While this infuriates some horticultural innovators who do not want to be thought of as permaculturalists, Robert Hart seems to have been only too happy to be included in the permaculture fold.

ing certain types of insects, necessary to the overall health of the garden.

Tropical forest gardens tend to be planted on small plots of land, often only ¼ to ½ acre in size. In the tropics, as there is a year-round growing season with more intense sunlight, and many more shade adapted plants, forest gardeners are able to plant very large numbers of species in small areas. While in the tropics, a ¼ acre of forest garden may be sufficient for a household,⁵ in temperate regions with less sun and fewer plants that remain productive in shade, more space is required to allow for wider tree spacing, which, in turn, allows more light to reach the understory, keeping the plants there productive. Temperate climate forest gardens, geared towards the needs of a single household tend more towards 1 to 2 acres in size.

In forest bioregions, the land, if left alone following disturbance, will quickly move through successive stages of development until it is again clothed in forest: the forces of nature are always tending toward a forest ecosystem. If working in opposition to this natural tendency, hefty energy inputs required to maintain the land in a non-forested state, and the further from forest one goes, the higher the requirements become. Thus, agriculture — keeping a field where there would otherwise be forest, dependent almost exclusively on annual plant species where there would otherwise be perennial species — is the most energy-intensive way of meeting our needs: it requires the most labor (or the most fossil fuels).

The forest garden works with the natural tendency of the land. In some forms of forest gardening, the garden literally hitches a ride, as the site is cleared, planted, and then let revert to forest at its natural rate, a new garden site being opened

⁵ It should be noted that tropical forest gardeners often also have access to much larger forest areas and so it should not be thought that everything is coming from the forest garden. Many wild foods, medicines, materials, and particularly firewood will often be gathered from outside the forest garden.

elsewhere as the forest canopy closes.⁶ In many forms of forest gardening, reversion to mature forest is arrested prior to full canopy closure, largely through the selective harvesting of trees to re-open the canopy.

In the forest garden, the major energy input comes in the establishment of the garden – the clearing and preparation of the garden site and the planting of the garden. As the planting is of mostly perennial plants, the planting only needs to be done once, not every year (though plantings are typically added to or changed, and replacements of varieties are made – after all, it is gardening, and gardeners are potterers). Clearing and preparing of the site, in sedentary models of forest gardening, can also be done but once. In shifting models, typically found in large tropical forests, the clearing and site preparation may be done as often as every five years. Following establishment, the main activity of the forest gardener (or forage gardener) is harvesting.

As the forest garden closely approximates a stage of natural forest succession, it can, like the young forest it mimics, be self-fertile and thus largely self-maintaining. The normal processes that fertilize the forest, such as the decomposition of woody organic matter and leaf litter by fungi, insects, and soil organisms, are also present in the forest garden. And sig-

⁶ This practice, often derogatorily referred to as slash-and-burn agriculture, when viewed in the light of what ecologists have called the patch dynamic theory of forest succession (Jacke 2005 : 268) – in part, the idea that a forest, rather than taking a single, linear path towards a static, climax state, is rather continuously cycling through all stages of succession across different parts of the forest – may in fact be a very sensitive mimicry of natural forest disturbance patterns. Naturally, such disturbances might occur when a large tree falls in the forest, taking a good number of surrounding trees with it, some uprooting and disturbing the soil, leaving a clearing where primary and secondary stages of forest growth will now manifest. Other natural occurrences such as windstorms and wild fires can also create such patches. The size of the patch that can be created by a large tree falling in a forest is not dissimilar to the size of many shifting forest gardens.

nificant quantities of bird, insect, and animal manure are to be found, as they are in young forests. The use of many leguminous nitrogen-fixing species by forest gardeners – to improve soil conditions for the surrounding plants – is a mimicry of the ecosystem function of pioneer species. Pioneer plants, present in the early and mid stages of forest succession, enrich the soil and nurse the young trees that will later become the canopy of the mature forest, protecting them from wind and animal browse.

Like a forest, yet unlike agriculture, the underground space of the forest garden is partitioned as well. In monocultures, the plant roots are all down at roughly the same depth in the soil and looking for exactly the same minerals and nutrients as their neighbors. In the highly diverse perennial polycultures of forest gardens, different soil depths are occupied and the precise needs of the plants (being different species) differ, thus plants may be grown in close proximity to each other without resulting in soil depletion and excessive competition between plants.

It took the monocultural minds of Westerners a good while to recognize that the chaotic mess of vegetation surrounding homes and village sites in such diverse places as Sri Lanka, Tanzania, or southern Mexico was, in fact, an ecologically-sophisticated way of meeting most of the essential needs of the gardeners. Yet agroforestry, the agricultural approach to three-dimensional perennial polycultures that came into being in the early to mid-twentieth century – large scale, machine-harvestable, market-oriented – when it recognizes forest gardening at all, sees it only as a distant and difficult relative.

The revival of forest gardening in the west is due largely to the experiments of Robert Hart, a Tolstoyan anarchist, author, and small-hold farmer. In the 1970's, Hart developed an interest in agroforestry – in particular, the system of “three dimensional farming” developed in the 1950's by Toyohiko