

Intro to Forest Garden Design

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What a Food Forest is and why you might want one

A food forest is a way of laying out a garden that incorporates many types plants in a way that structurally and ecologically mimics natural forest systems. This has many benefits to the gardener and the environment including:

- High diversity supports ecosystem health and human health, as well as increasing resiliency in a changing climate.
- A focus on soil health means plants need less attention and inputs, while also sequestering carbon in the soil.
- While there is often a labor intensive establishment phase, forest gardens over the long run require less management than many other systems.
- Food forests produce not just food, but also Fiber, Fuel, Fodder, Fertilizer, Farmerceuticals (Medicine) and Fun. All in a regenerative system that benefits everyone.

Layers and Niches of the Food Forest

Forests are often described as having several layers, these are the major structural niches of the ecosystem.

- **Canopy:** These are large trees that form the uppermost layer of the forest, due to their size and access to light they are able to produce large amounts material, be it food for humans (mostly in the form of nuts) or food for soil (leaves and root exudates). In temperate forest gardens the canopy layer is often only partially covering the garden, or absent entirely in small spaces.
- **Sub-Canopy:** These are smaller trees, most of the familiar fruit trees fit into this category, they can be arranged in and around larger trees or where upper canopy is absent for the canopy themselves.
- **Shrub:** Woody shrubs fill in small gaps in the canopy and line edge spaces, they often produce fruits or nuts.
- **Herbaceous:** These plants die back to soil every year, if they provide food to humans it is more likely to be leaves or roots. They also provide habitat and food for beneficial insects and do other ecosystem services that trees and shrubs often can't do.
- **Ground Cover:** These low lying plants protect the soil and reduce weed pressure.
- **Vines and Climbers:** These plants are able to climb between layers filling in gaps.
- **Rhizosphere:** Underground layer, mostly the realm of fungi, bacteria, archaea. While these species often don't directly offer a food source to humans, none of the plants in the forest garden can produce without them.

Within all these layers there are many services and functions that each species can provide, most species serve multiple functions.

- **Beneficial accumulators** provide habitat and/or food for organisms that help maintain the balance of the forest garden. These are mostly wasps, flies and beetles.
- **Dynamic accumulators** are plants that are adapted to be able to pull hard to find nutrients from their surroundings and accumulate them in their leaves and other tissues, when these leaves die and decompose those hard to find nutrients become more widely available in the soil.
- **N₂ fixers**, under ideal conditions all plants can interface with free living bacteria capable of fixing atmospheric nitrogen, however ideal conditions can't always be counted on, so including some plants that are specially adapted to support nitrogen fixing bacteria in your forest garden may be a good idea.
- **Ornamental**, Some plants are just plain pretty and pleasant to have around, or produce flowers especially well suited for cutting and enjoying indoors.
- **Human Food**, Many trees are amazing at producing fruit and nuts, but not so much edible leaves, shoots, spices or the like, however herbaceous layer plants fill this niche very well. These food plants are typically perennials and often are harvested at time of year when annual crops are not producing (at least not without a hoophouse) making them very worthwhile even if you also cultivate annual vegetables.
- **Medicine**. Many medicinal herbs make great forest garden plants.
- **Aromatic Pest Confuser**, these plants may be particularly good at confusing the chemical sensing abilities of pest insects, leading to less incidence of pest damage in forest gardens that that contain them.

Succession

Succession is a process of change in the mix of species that live in an ecosystem over time. In the context of a forest garden being planted on open ground, the first few years there is little or no shade and the spaces between trees are well suited to annual plants, but as the trees start to cast more shade annuals begin to struggle and perennials and shrubs come to dominate the spaces between trees and under trees. As a forest gardener, you may need to plant new things or move plants as succession progresses.

Designing layouts and Resource Partitioning

The first step of designing a layout for a forest garden is deciding what sort of forest ecosystem you will be mimicking, this will be based on your goals and the specifics of the site. The two most common ecosystems to mimic in our climate are multi-layered temperate forest and savanna.

- **Multi-layered forest:** as described above the multi layer forest garden is comprised of several layers, by the time you get to ground cover level there is minimal light left. This model provides many spaces for many species. It is not well suited to mechanical management. Initial spacing of trees can be roughly based on typical orchard spacing or imagining the full grown spread of the trees and laying them out so the edges of the crowns barely touch, however it is often wise to space a bit wider as this leaves patches of space where shrubs and sun loving perennials can thrive for many years.
- **Savanna / Silvopasture:** Savanna is a tree covered ecosystem where the canopy is open enough to allow enough light to reach a lower layer dominated by grasses. The most common mimic of this system is called silvopasture, where widely spaced trees and shrubs are mixed with pasture for grazing animals. The trees support the growth of the grass to some degree, as well as providing shade and cover for grazers. The trees can be managed for human food, extra food for grazers or both. Protecting the young trees from being eaten is key to establishing this system.
- **Alley cropping:** Alley cropping is the practice of having rows of forest garden alternating with rows of annual cultivation or herbaceous perennials. The alley row could be annual vegetables, pasture, perennial veggies, or rotate between options. The forest garden areas provide habitat for beneficial insects and soil biology, thereby supporting the crops grown in the alley.

No matter the model, the most important rule of thumb when laying out a polyculture (many plants growing together, the opposite of a monoculture) is *Resource Partitioning*. The basic idea is to layout the plants spatially so that they compete for resources minimally. A easy resource to understand is sun light, a big tree casts a lot of shade, so placing the largest trees near the north end of the garden ensures that you get the most out of the available sun. Another example is rooting patterns, a tap rooted plant will happily grow through a dense mat of shallow rooted plants, neither will be significantly effected negatively.

Planting the Food Forest

Unless you are planting into an existing woodland, forest garden planting nearly always starts planting trees removing existing vegetation for a few feet around the trees. If time and materials allow, you can plant the entire forest garden in year one, although as the years go on replanting will be necessary. My favorite way of establishing a new planting is sheet mulching which involves laying a layer cardboard or newspaper over existing vegetation, this smothers it out and creates a blank slate to put in new plants. Compost and other amendments are usually placed under the sheet layer and hay, leaves, wood chips or other mulch layers are usually placed on top. If you encounter soil compaction, this should be remedied as soon as possible. On a small scale, the ideal tool is a broadfork (or spading fork for shallow compaction), on a larger scale subsoil plowing can be very effective.

Working with Soil Biology

Always keep the health of the soil in mind and you shouldn't have to worry much about the health of the plants. Care for soil life by:

- Enhancing diversity by adding compost or compost tea
- Avoiding compaction by creating permanent paths and not walking in beds when possible
- Keeping the soil covered with living plants or dead plants (fall leaves, hay, straw, wood chips etc)
- Avoiding soil disturbance by not tilling and only digging as needed.
- Avoiding pesticides, fungicides and herbicides
- When possible, returning human wastes to the garden.

Solid waste must be composted, urine can be diluted and applied directly.

Working with Water

How water moves across the landscape has a large effect on plant growth and success. Whenever possible water should be captured and stored in the soil. To accomplish this use swales and/or berms to slow water moving down slopes. In poorly draining soils, ponds can store water at surface level. Ditches can be used to move water from poorly drained areas to more suitable areas. High carbon soil stores water (and nutrients) better than low carbon soils.

Recommended Species

Don't feel in any way limited by this list, most plants that will grow in our climate can be incorporated into a forest garden, these are simply ones that I have found to produce useful products and services and be easy to grow.

Canopy Trees

Common Name (Botanical Name)	Functions	Notes
Oaks (<i>Quercus</i> spp.)	Human Food, Insect Habitat, Mulch, Shade, Structure, Fuel, Lumber	Acorns are everywhere around us in southern Maine and are one of our most underutilized food sources. All native acorns need to have the tannins leached out of them to be edible. Collection and processing are reasonably easy. Acorn production is typically inconsistent, so if you have the option of diverse species that may help with spreading out mast years.
Hickory (<i>Carya</i> spp)	Human Food, Insect Habitat, Mulch, Shade, Structure, Fuel, Lumber	Hickories are a large group of delicious nut species ranging from the shag-bark (the only hickory with good food value that is native to Maine) to the shell-bark or king-nut hickory to the more familiar pecan. Hickory x Pecan hybrids are also available and worth experimenting with. Season length / heat are issues for species other than the shag-bark.
Chestnuts (<i>Castanea</i> spp.)	Human Food, Insect Habitat, Mulch, Shade, Structure, Fuel, Lumber	Chestnut species can rival any tree crop for its ability to produce a staple food, relatively easy to collect and process with high starch nut has a similar nutrient profile to corn. Pure American trees are prone to early death by disease, pure Chinese tend toward breakage in early snows, hybrids seem to be the way to go with a wide variety of types available to fit almost any need.

Honorable Mentions: Walnuts (*Juglans* spp.), Pine Nuts (*Pinus* spp.), Ginkgo (*Ginkgo biloba*), Hackberry (*Celtis occidentalis*), Sugar Maple (*Acer saccharum*)

Sub-Canopy Trees

Common Name (Botanical Name)	Functions	Notes
Cornelian Cherry (<i>Cornus mas</i>)	Human Food, Insect Habitat, Mulch, Fuel	One of the most reliable of fruit crops, either a large shrub or small tree depending how it is pruned. Bright yellow flowers bloom just before Forsythia, giving way to small, bright red oval fruits, which ripen in late summer. Very tasty fresh or in jams, pies etc. No real pest or disease issues. Occasionally will lose a crop to weather if flowers open too early.
Mulberry (Morus spp.)	Human Food, Insect Habitat, Mulch, Fuel	Wonderful fruit unfamiliar to many in Maine, kind of like a seedless blackberry that grows on a tree. Choose hardy cultivars for best fruit quality. Illinois Everbearing is the standard for medium trees and Giraldi Dwarf for small.
Paw Paw (<i>Asimina triloba</i>)	Human Food, Insect Habitat, Mulch, Fuel	While you should select seedlings of early ripening cultivars and provide some shade during the first couple years, these trees are highly pest and disease resistant and the fruit (which resembles a cross between a mango and a banana) is amazing. Plant at least 2 for pollination.
Peach (<i>Prunus persica</i>)	Human Food, Insect Habitat, Mulch, Fuel	Maine is in a sweet spot for Peach production right now, our climate has warmed enough to grow great peaches, but our pest pressure is still quite low. Peaches are pretty short lived trees, but they come to bearing age quickly and prolifically.

Honorable Mentions: Cherries (*Prunus* spp.), American Plum (*Prunus americana*), Pears (*Pyrus* spp.), Persimmon (*Diospyros americana*, early ripening only), Quince (*Cydonia oblonga*), Sassafras (*Sassafras albidum*), Toona sinensis.

Shrubs

Common Name (Botanical Name)	Functions	Notes
Elderberry (<i>Sambucus</i> spp.)	Human Food, Insect Habitat, Medicine	These elegant multi-stemmed shrubs have beautiful blooms in early summer changing into bunches of black berries in fall. Native and European species available, as are purple leaved and variegated cultivars. The berries make excellent jams and syrups and are a well respected anti-viral. Available at most nurseries. 2 are needed for cross pollination.
High Bush Blueberries (<i>Vaccinium corymbosum</i>)	Human Food, Insect Habitat	These native fruit are familiar and fairly easy to grow. Their main challenge is their need for acidic soil. Pine needles and oak leaves will NOT make your soil acidic, if your PH is too high you need to amend your soil with sulfur. They like lots of water, but can do OK without it. If you don't want to bother with something that may need special attention plant Haskaps / Honeyberries (<i>Lonicera caerulea</i>) instead. 2 are needed for cross pollination.
Black Raspberries (<i>Rubus occidentalis</i>)	Human Food, Insect Habitat	While all cane fruits (<i>Rubus</i> spp.) could be considered low maintenance, their tendency to sucker all over the place can be quite annoying. Black Raspberries on the other hand mostly sucker right at the base of the plant and by tip layering. If trellised I find them easy and reliable.

Honorable Mentions: Goumi (*Elaeagnus multiflora*), Seaberry (*Hippophae rhamnoides*), Flowering Quince (*Chaenomeles* spp.), Nanking Cherry (*Prunus tomentosa*), Shrub Hazelnuts (*Corylus* X)

Vines and Climbers

Common Name (Botanical Name)	Functions	Notes
Schisandra (<i>Schisandra chinensis</i>)	Human Food, Medicine	A beautiful vine with delicate white flowers and red leaf stems. Thrives in part shade, tolerates full sun with adequate moisture. The bright red strings of berries are beautiful and are the most flavorful fruit I have ever tasted, although not everyone likes the flavor. Highly regarded in herbal medicine. Plant a few seedlings or the self-fertile cultivar "Eastern Prince".
Concord Type Grapes (<i>Vitis labrusca</i> X)	Human Food, Insect Habitat	While grapes are a little more prone to pest and disease issues less tolerant of shade than some other vines, they are still a good option. Concord types, especially the cultivar "Beta" are the best bets in this climate. If you keep chickens, trellising grapes over the chicken yard / on the fence has many benefits to chickens and grapes alike.
Kiwi (Actinidia arguta and A. kolomikta)	Human Food	These hardy relatives of the familiar fuzzy kiwi set a smaller, more flavorful fruit, with smooth skin, that is eaten whole. The vines are very aggressive (especially on arguta kiwis) and require a strong trellis. They take awhile to start bearing (5-7 years) but are very long lived and productive once they start bearing, they are dioecious, meaning each vine is either male or female, both are required to produce fruit. Planting kiwis means a commitment to a lifetime of pruning.

Fungi

Names	Culture	Notes
Shiitake (<i>Lentinula edodes</i>)	Log	These tasty and dense mushrooms can be grown fairly easily on hardwood logs in the shadiest parts of the forest garden. They do require some care, but generally produce enough to make it well worthwhile.
Winecap (<i>Stropharia rugosoannulata</i>)	Mulch Beds	This species thrives in the mulch layer, especially in chipped wood. They require minimal care and can thrive and produce for years, as long as new chips are added. Similar to a portobello in shape and flavor.

For more info on fungi, see Mycelium Running by Paul Stamets. For local spawn sources see <https://northspore.com/>

Herbaceous layer

Hablitzia (Hablitzia tamnoides)	My personal favorite vegetable. Highly productive vine grows in part-shade to full sun, producing edible shoots and leaves over a long season. Delicate leaves taste somewhat like spinach, but with a milder flavor. Fresh or cooked. Fedco carries seeds.
Sea Kale (Crambe maritima)	Edible shoots, leaves, buds and green seed pods. Leaves are much like collard greens, seed pods taste like peas. Flowers heavily scented like honey. Very pretty. Fedco carries seeds.
“Bocking 14” Comfrey (Symphytum uplandicum)	A classic dynamic accumulator, this plant is incredibly useful and should find a place in most gardens. It is pretty, bees love it, it makes excellent compost and mulch, it makes a nice border that keeps weeds out, it is medicinal and good animal fodder. Doesn't spread unless you disturb the roots, but if you till it in you will have a whole field of it.
Turkish Rocket (Bunias orientalis)	Vigorous perennial with edible flower buds that taste much like Broccoli-Raab, leaves are also edible, but not so good as the buds. Whatever buds you don't harvest turn into large sprays of bright yellow flowers that attract beneficial syrphid flies.
Dystaenia (Dystaenia takesimana)	Vigorous perennial leaf crop that tastes a lot like celery. Rather long season, coming up as the snow melts it is available to harvest when almost nothing else is and then continues to produce through the summer with another big flush of growth in early fall. The leaves are highly nutritious with more total digestible nutrients than alfalfa. In mid-summer it starts blooming with large white umbels that are very attractive to many beneficial insects, especially wasps.
Mouse Garlic (Allium angulosum)	A great choice for a perennial allium, larger and more robust than chives/garlic chives, with a milder flavor. Very low maintenance. Beautiful purple flowers, which are of course, edible.
Good King Henry (Blitum bonus-henricus)	A classic perennial vegetable, grows fast in full sun, but will take shade too. The spinach-like leaves are best cooked, as are the young flower buds. If you have a good sized patch you can also harvest the seeds, which cook up a bit like quinoa.
Lovage (Levisticum officinale)	This once common perennial is quite pretty, along with being very attractive to many beneficial insects and a highly flavorful addition to soups, stir fries and other savory dishes. Use in moderation, its flavor can overwhelm more subtle flavors.
Sorrel (Rumex acetosa)	Garden sorrel is long season perennial leaf crop with a distinctive sour lemony flavor. Easy to grow. Choose a non-flowering cultivar for longest productive season.
Stinging Nettles (Urtica dioica)	While you might not think of a plant covered in tiny hypodermic needles full of irritating acid being good to eat, it actually is. The early spring leaves are the best, but anytime before the plant blooms you can harvest leaves to eat, make tea or dry for later use. Cooking or drying deactivates the sting and very young plants don't have the sting to begin with. One of the most nutrient dense foods around.
Hosta (Hosta spp.)	Young leaves and green seed pods edible. Spring shoots are excellent cooked like asparagus. Leaves get tough shortly after unfurling from shoot.
Violets (Viola spp.)	Edible leaves and flowers. The flowers add some great color to salads. Contain rare phytonutrients not found in other plants.
Skirret (Sium sisarum) / Hemlock Water Parsnip (Sium suave)	These 2 closely related species have similar characteristics. Both are medium sized herbaceous perennials with white flowers that attract a wide range of beneficial insects. Both form large clusters of fleshy roots that taste somewhat like parsnip. The plant can be dug up, a portion of the roots harvested and rest returned to continue growing. S. sisarum is the European species, it is more commonly cultivated and often has larger roots. S. suave is the American species. Both plants like damp soil, with S. suave commonly growing in standing water, but both are OK growing on dry land as well.
Ground Nut (Apios americana)	Another perennial root crop. This one in the form of a nitrogen fixing vine with beautiful reddish flowers. The tuberous roots form strings, these roots are highly nutritious, including being a good source of protein, which is unusual for a root crop. Ground nuts have been cultivated by humans in this part of the world for thousands of years.

Common Name (Botanical Name)	Services	L48 Native	Bloom Period
Anise-Hyssop (<i>Agastache foeniculum</i>)	F,M,B,A, P	Y	July-Sept
Baptisia (<i>Baptisia australis</i>)	B,N,A	Y	Jul-Aug
Beebalm (<i>Monarda didyma</i>)	M,B,A,P	Y, ME Native	Jun-Sep
Black-Eyed Susan (<i>Rudbeckia hirta</i>)	B,A	Y, ME Native	Jun-Sep
Bloody Dock (<i>Rumex sanguineus</i>)	F,D,A	N	
Blue Vervain (<i>Verbena hastata</i>)	M,B,A	Y, ME Native	Jul-Sep
Boneset (<i>Eupatorium perfoliatum</i>)	B,M,A	Y, ME Native	Jul-Sep
Chives (<i>Allium schoenoprasum</i>)	F,B,D, P	Y?	Jun-Aug
Clustered Mountainmint (<i>Pycnanthemum muticum</i>)	F,M,B, P	Y, ME Native	Jun-July
Comfrey (<i>Symphytum xuplandicum</i>)	D, M	N	Jun-Sep
Common Milkweed (<i>Asclepias syriaca</i>)	F,B	Y, ME Native	Jul-Aug
Daylily (<i>Hemerocallis</i> spp.)	F, A	N	
Dystaenia (<i>Dystaenia takesimana</i>)	F,B	N	
Garden Sorrel (<i>Rumex scutatus</i>)	F,D	N	
Garlic (<i>Allium sativum</i>)	F,A,P	N	N/A
Good King Henry (<i>Chenopodium bonus-henricus</i>)	F,D	N	
Ground Cherry (<i>Physalis</i> spp.)	F	Y/N	
Groundnut (<i>Apios americana</i>)	F,B,N	Y, ME Native	Jun-Sep
Habitia (<i>Habitia tamnoides</i>)	F	N	Jul-Aug
Hemlock Waterparsnip (<i>Sium suave</i>)	F,B	Y, ME Native	Jul-Sep
Horsetail (<i>Equisetum arvense</i>)	D	Y, ME Native	N/A
Hosta (<i>Hosta</i> spp.)	F,D?	N	
Hyssop (<i>Hyssopus officinalis</i>)	M,B	N	
Joe-Pye Weed (<i>Eutrochium maculatum</i>)B	B,A	Y, ME Native	Jul-Sep
Lemon Balm (<i>Melissa officinalis</i>)	F,M,B,P	N	Jun-Sep
Lovage (<i>Levisticum officinale</i>)	F,M,B	N	
Lungwort (<i>Pulmonaria saccharata</i>)	B,A	N	
Meadowsweet (<i>Filipendula ulmaria</i>)	M,B	N	
Mouse Garlic (<i>Allium angulosum</i>)	F,B,P	N	Jun-Aug
New England Aster (<i>Symphyotrichum novae-angliae</i>)	B,A	Y, ME Native	Sep-Oct
New Jersey Tea (<i>Ceanothus americanus</i>)	B, M	Y, ME Native	May-July
Pennyroyal (<i>Mentha pulegium</i>)	F,M,B,P	N	Jul-Sep
Purple Coneflower (<i>Echinacea purpurea</i>)	M,B,A	Y	Jun-Aug
Queen Anne's lace (<i>Daucus carota</i>)	F,B,D	N	
Redosier Dogwood (<i>Cornus sericea</i>)	B,N,A	Y, ME Native	Apr-Jun
Rhubarb (<i>Rheum rhabarbarum</i>)	F,B,D	N	
Salad Burnet (<i>Sanguisorba minor</i>)	F,B	N	Jul-Sep
Sea Kale (<i>Crambe maritima</i>)	F,B,A	N	Jun
Siberian Peashrub (<i>Caragana arborescens</i>)	F,N	N	Apr
Spotted Beebalm (<i>Monarda punctata</i>)	M, B, P	Y	Jun-Sep
Stinging Nettle (<i>Urtica dioica</i>)	F,M,D	Y?	
Strawberry (<i>Fragaria hybrid</i>)	F	Y/N	
Sunchoke / Terasol (<i>Helianthus tuberosus</i>)	F, B,A	Y, ME Native	Aug-Oct
Sweet Alyssum (<i>Lobularia maritima</i>)	B,A	N	Jun-Sep
Sweet Cecily (<i>Myrrhis odorata</i>)	M,F,B	N	Jun-Aug
Tansy (<i>Tanacetum vulgare</i>)	B,M,A,P	N	Jul-Sep
Turkish Rocket (<i>Bunias orientalis</i>)	F,B,D	N	
Valerian (<i>Valeriana officinalis</i>)	B, M	N	June
Walking Onion (<i>Allium xproliferum</i>)	F	N	N/A
White Clover (<i>Trifolium repens</i>)	M,F,N	N	May-Sep
Wild Lupin (<i>Lupinus perennis</i>)	B,N,A	Y, ME Native	May-July
Yarrow (<i>Achillea millefolium</i>)	B, M, P	Y	Jun-Sep

F= Human Food
 M= Medicinal
 N= Nitrogen Fixer
 P=Pest Confuser
 B=Food/Habitat for Beneficial Insect
 D= Dynamic accumulator
 A=Aesthetic / Cut Flowers

More Resources:

Gaia's Garden: A Guide to Home-Scale Permaculture Book by Toby Hemenway
Edible Forest Gardens Book by Dave Jacke and Eric Toensmeier
Around the World in 80 Plants Book and/or **Edimentals.com** by Stephen Barstow