

# Polyculture Patterns

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For most budding musicians, it helps to learn some basic scales—groups of notes that go well together—before trying to compose a song. Similarly, for budding polyculture designers (sorry, pun intended), it helps to learn some basic polyculture patterns—groups of plants that work well together—before trying to design an entire food forest. As you learn the basics of polyculture “pattern language” from nature and from human designers, you may start to vary the plant species, vary the patterns, and over time find and/or create new polycultures yourself.

In my work with the Apios Institute wiki over the years, it’s been interesting to observe some widely occurring patterns; in this article, I explore several of the most common.

## PLANTS THAT USE SUNLIGHT IN COMPLEMENTARY SEASONS

The higher our latitude (moving away from the Earth’s equator towards one of the poles), the more sunlight becomes a limiting factor for plant growth. Shade cast by a tall tree can prevent smaller plants from thriving beneath it. Some species (and human designers by extension) have adapted to limited sunlight by growing at different times of the year. In the wiki, polycultures with plants that use sunlight in different seasons was a very common pattern.

### Licorice Milkvetch and Ramps



At Paradise lot, we grew licorice milkvetch (*Astragalus glycyphyllos*) and ramps (*Allium tricoccum*) together.

Licorice milkvetch is a great nitrogen-fixing ground cover but not a perfect one. It regrows from a crown each spring, leaving a wide open space around it until June. In mid-summer, the reverse happens, leaving an open space at the crown.

If you stagger the milkvetch every 24 to 48 inches apart, they overlap each other’s bald spots. Meanwhile in the spring, when they are emerging, ramps fill the niches in between. The milkvetch and ramps work

great together and seem very well timed.

Licorice milkvetch will sprawl over anything under 18 to 24 inches tall, so this polyculture would be appropriate in the understory of taller woody plants the size of a jostaberry or even taller (over 5 feet).



## "Pioneer Pink" Strawberry and Chocolate Lily

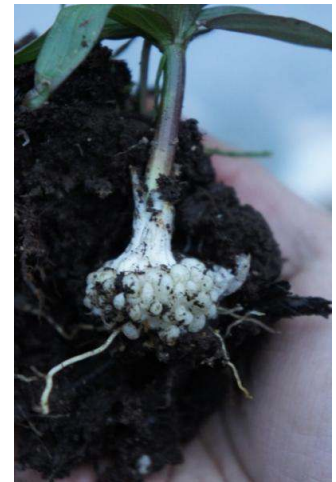
Another excellent example of plants growing and being harvested in different seasons is "Pioneer Pink" strawberry and chocolate lily (*Fritilaria camschatsensis*, also known as sarana). The wiki user Cloudberry<sup>3</sup> writes:



*In the spring, while the summer buds of the strawberry are just forming, the chocolate lily shoot up a good foot in height ... at this point, [they] normally stand no taller than 1½-2 feet, are finishing out their flowering process and just beginning to set their seed. In this time of our growing season the sun is high, the sparse form of the sarana doesn't cast much shade [and] this is perfect because the strawberries need all the sun they can get while their fruit are ripening. ...*

*[In] the early fall the sarana tops yellow back completely letting us know it is time to harvest their starchy bulbs. As we dig sarana roots we remove older unproductive strawberry plants (just gentle thinning in general)... [The] small holes that are created during the harvest of the roots are filled up [with] new soil and fresh compost, duff, or mulch ... to create pockets of fertility that nurture all the plants that happen to be growing in the vicinity of the disturbance. ...*

Cloudberry explains that "Pioneer Pink" strawberry is a reliable strain that has been grown in Ninilchik, Alaska for almost 100 years; the pink or pale red fruit (see photo above) are ripe. Sarana bulbs (see photo on right) can be eaten fresh or cooked. When preparing them for the winter, Cloudberry cooks them lightly and then dries them; later they are used in soups, stews, stirfries, or ground as a flour. A sarana bulb sets many smaller bulbs. Cloudberry says "the cooked bulblets are very much like grains of rice but with more of a potato texture and taste."



## Aralia and Nettle

Another interesting polyculture that follows this pattern was Aralia and nettle, which wiki user KylePDougherty<sup>4</sup> describes:

*[This] combines two aggressively running and unpleasantly spiky species together, and is designed to be placed in a location away from frequently travelled paths ...*

*The main edible part of Aralia elata is the terminal shoots, available from mid-April to the beginning of May [which] will be harvested before the nettle appears and makes it difficult to walk through the patch. The Aralia elata [see photo on next page] should be coppiced when stalks exceed harvesting height (6' maximum). This coppicing every year or two encourages suckering (more terminal shoots) and also discourages the plants from setting seed, while making their harvest as easy as possible. Plants should also be cut back to ensure the patch can be walked easily and to allow adequate sunlight to the nettle plants. ... After the Aralia harvest is complete, the patch functions similarly to a straight species nettle patch. ...*

*After seeing how dense of a shade Aralia elata casts, I think Laportea canadensis is the best nettle species [rather than Urtica dioica] to grow underneath it. I'm going to be trialing Aralia spinosa [also has edible shoots] and Laportea canadensis on my property.*



## NITROGEN-FIXING SHRUB OR TREE

Nitrogen is a macronutrient required for plant growth. In both naturally occurring and human-designed polycultures, the presence of nitrogen-fixing plants can support the growth of other species.

Nitrogen-fixing plants can be included in polycultures in various ways. Basically, the nitrogen fixer can be larger than the other species and possibly provide them structural support, or the nitrogen fixer can be smaller than the other species and possibly grow around or climb up the others.



In the Apios wiki, there were several good examples of using nitrogen-fixing shrubs or trees in polycultures.

### Alder, Salmonberry, and Sword Fern

This naturally occurring polyculture was interesting: not only does it follow the pattern of the complementary use of sunlight (which I explored above), but it also demonstrates the pattern of a nitrogen-fixing overstory with useful plants below it.

Wiki user MidcoastPermaculture<sup>5</sup>, observed red alder (*Alnus rubrus*), salmonberry (*Rubus spectabilis*), and sword fern (*Polystichum munitum*) in the Northwest on disturbed land that was often clearcut. Of this multifunctional association, MidcoastPermaculture explains that alder fixes nitrogen and the bark can be used medicinally; salmonberry has spring shoots and edible fruit; and sword fern is/was used by Indigenous people for baskets and the rhizomes were eaten in the spring as a starvation food. MidcoastPermaculture writes: “alders give a dappled light and leaf out late enough to give the salmonberry an opportunity to fruit (May-June) before the canopy gets too dense. The sword ferns under the salmonberry could very well have been opportunistic, filling the space under the shrub layer, but the companionship was so commonplace.”

They also suggest that ostrich fern (*Matteucia struthiopteris*) could be substituted in this polyculture.

### Seaberry and Beach Plum

I loved this SEAberry (*Hippophae rhamnoides*) and BEACH plum (*Prunus maritima*) polyculture (see photo on right) designed for the Camp Epworth Apple Forest Garden in 2006. The seaberry is a nitrogen-fixing shrub that also provides fruit.

The spot was very sandy and in full sun. One of the wiki contributors, EthanAppleseed<sup>6</sup> writes:







*both of the main shrubs were chosen to adapt to these site conditions. ... The best groundcover in this polyculture was not consciously planted—it is the sheep sorrel (*Rumex acetosella*), volunteering from the meadow nearby. It spreads quickly but is very low-growing, and does not seem to outcompete our other planted groundcovers. It also tastes great! ...*

*[After 3 years] we got our first seaberries! They taste like mini-citrus—a burst of delicious sunlight.*

*The successional horizon of this polyculture has the crowns of the beach plum and the seaberry just barely touching. After 4 full ... growing seasons (starting with 2-year old plants) we're probably 2/3rds of the way there.*

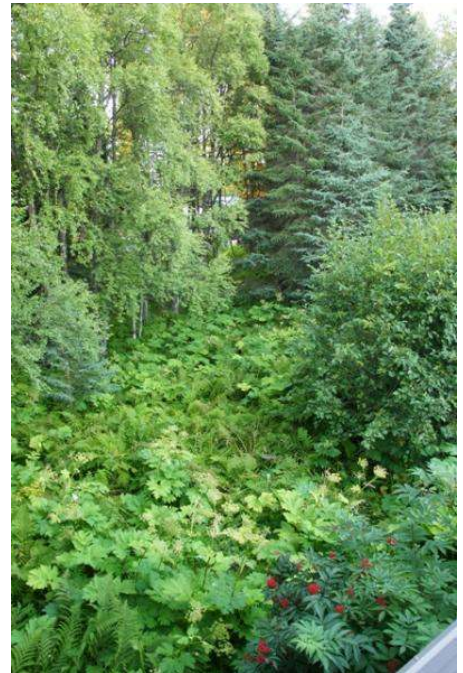
In the photo above, notice the relatively well-covered ground within the patches; also visible is a pawpaw tree (near the red building) and a weed-excluding comfrey hedgerow (on right edge of photo).

### **Kenai Birch, Ladyfern, Lutz Spruce, and Sitka Alder**

In this naturally occurring polyculture, Sitka alder (*Alnus crispa*) is a large shrub or small tree that fixes nitrogen and is also a self-coppicing fuel crop (see photo on right).

Wiki user Cloudberry<sup>7</sup> explains that the Kenai birch (*Betula kenaica*) provides sap, fresh twigs and leaf for tea, edible cambium, and fuel. They write:

*[The Kenai birch, Lutz spruce (*Picea x lutzii*), and Sitka alder are] all surrounding, shading, protecting, and amending a large patch of Ladyfern (*Athyrium filix-femina*, a provider of choice spring shoots, and abundant mulch). We harvest large amounts of fiddleheads from this patch each spring which we eat fresh mostly, though they can be blanched and pickled or frozen. This polyculture is at least 18 years old, the majority of it is designed by nature (in particular the position of the Birch, Spruce, and older fern crowns). About 7 years ago we began encouraging the formation of a protected fern court by going through the patch each year and removing Puchki crowns here and there, replacing them with Ladyfern crowns, and allowing a row of Sitka Alder to form a large nitrogen fixing hedge which acts to protect the ferns from fierce summer sun and wind.*



*... you can also see a Red Elderberry (*Sambucus racemosa*) ... [T]he*



*blooms in early summer ... are delicious batter and deep-fried, fermented into a bubbly beverage similar to champagne, and also dry well. Later in the summer we harvest large amounts of the berries (preferably before they turn dark red) specifically for wintertime chicken feed, we dry them or mix them with ripe dock seed and freeze them in large ziplock bags [see photo on previous page]. The berries also make great jelly, but it's important that they be cooked well and have their seeds strained out of the syrup (to remove cyanoglycoside).*

## NITROGEN-FIXING CLIMBER OR GROUND COVER

Instead of (or in addition to) nitrogen-fixing trees or shrubs, having ground cover or climbing plants that fix nitrogen are a useful polyculture pattern.



### Sunchoke and Hog Peanut

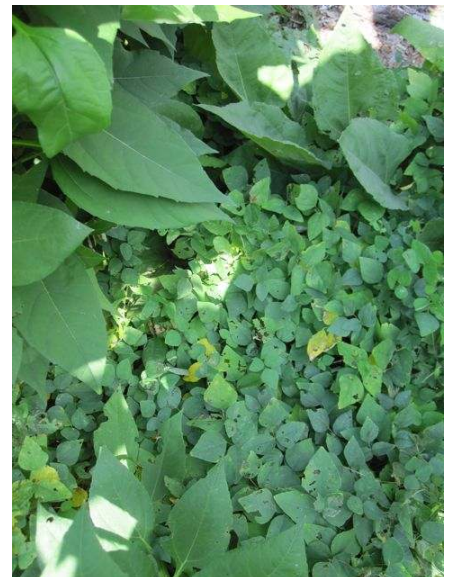
While there were fewer examples of nitrogen-fixing climbers/ground covers in the wiki, the “three brothers” was a user-favorite; you can read more about it in our article “Top 20 Plants and Favorite Polycultures.”

After trialing a few variations of the three brothers—sunchoke (*Helianthus tuberosus*), groundnut (*Apios americana*), and mintroot (*stachys affinis*)—we decided to abandon it in favor of sunchoke and hog peanut (*Amphicarpaea bracteata*). With the three brothers, groundnut did not seem to thrive and

mintroot yielded much better on its own. By contrast, hog peanut provided an excellent cover for most of the summer—with a better ground cover density than groundnut. When we dug them in the spring, we had good yields of both sunchoke tubers and hog peanut subterranean beans.

Sunchokes are vigorous and grow tall (8 to 12 feet), while hog peanuts are vigorous and grow lower (1 to 3 feet). Sunchokes like full sun and need nitrogen; hog peanuts do fine in partial shade, fix nitrogen, and like some stalks to climb on. Both produce underground foods. Both benefit from annual digging, harvesting, and thinning. (My experience is that with both plants, even if you think you’ve harvested everything, some will come back.) This polyculture really matches the niche and disturbance preferences of both species.

At Paradise Lot, we used 10-inch aluminum flashing as rhizome barrier, with several sunchokes escaping the patch that summer. Wiki user KylePDougherty<sup>8</sup> planned to plant the sunchoke variety “Supernova” with “Crispy Snack” hog peanut. They write: “The area is surrounded by a mown path and foundation, so





nothing should get away. I have been hesitant to plant hog peanut elsewhere for fear of it taking over while providing no real harvest. Planting it under the sunchokes will at least incentivize digging up the area each year.”

## COPPICES AND HEDGES

Particularly with human-designed polycultures on human-maintained landscapes, it is important to consider what the plants require and what the people can provide.

Coppicing (which was mentioned in the earlier example of Aralia and nettle) can be a way to maintain plants at a certain size while also encouraging productive growth. When nitrogen-fixing plants are coppiced, the trimming of above-ground mass causes them to shed some of their roots and liberate nitrogen in the soil for use by others in the polyculture. The coppiced material can be used as mulch around other plants in the polyculture; this is widely referred to as “chop and drop.”



### Hazelnut and Coppiced Autumn Olive



In this polyculture, wiki user Inilegna<sup>9</sup> describes how the autumn olive (*Eleagnus umbellata*) is coppiced and used for mulch:

*The Autumn-olives were growing wild in this location and were full-size ... We cut the Autumn-olives down to about 16" above the soil level. The (relatively) large stumps sprouted within weeks after coppicing and we planted the comfrey and two hazelnuts shortly after this. The Autumn-olives put on 3 to 5 feet of growth last year, and upon the time of this year's coppice ... I spotted many fruits on the one year-old sprouts.*



*Hazelnut prior to chop and drop coppice of Autumn-olive [see previous page, first photo].*

*Hazelnut mulched with the Autumn-olive biomass after coppicing [see previous page, second photo].*

*View of the Autumn-olive's stool and resprouted growth—and a fruit [see photo on right]!*



## Salad and Edible Hedges

This polyculture with all edible leaves (see photo below), was designed by Ethan Roland and Benneth Phelps in 2008 and planted in 2009. It includes American basswood (*Tilia americana*), Turkish rocket (*Bunias orientalis*), littleleaf linden (*Tilia cordata*), goji berry (*Lycium barbarum*), dame's rocket (*Hesperis matronalis*), Carolina silverbell (*Halesia carolina*), day lily (*Emerocallis* hybrids), and fragrant spring tree (*Toona sinensis*).



Wiki user Inilegna<sup>10</sup> explains the “[g]oal is a perennial salad hedge, managed by coppice mainly for young, tender leaves. It will also provide flower buds from the Day lilies, along with the seedpods of Carolina Silverbell, which are said to taste like peas! Other possible candidates for this polyculture would be Sassafras, Beech, and Climbing Spinach.”

In a different polyculture hedge, species were chosen to provide food and/or fix nitrogen. Hazelnuts (*Corylus* x hybrids) have edible nuts. Japanese bush cherry (*Prunus japonica nakai*) has edible fruit. Both goumi (*Eleagnus multiflora*) and autumn olive (*Eleagnus umbellata*) have edible fruit and are nitrogen fixers. Siberian pea shrub (*Caragana arborescens*) fixes nitrogen. Inilegna<sup>11</sup> writes, “Aside from pruning and harvesting, the hedge will be no maintenance.” Cultivars in this polyculture were: autumn olive ‘Amber’, goumi ‘Red Gem’ and ‘Sweet Scarlet,’ and hazelnut ‘Ken’s Select.’

## Coppiced Mulberry and Nitrogen Fixer

Finally, I observed this polyculture at Las Canadas in Veracruz Mexico. They have a fantastic food forest in the cloud forest: a very interesting high-altitude tropical ecosystem with temperate-zone trees, like oaks and sycamores, and tropical understory, like aroids and tree ferns; there are also lots of epiphytic ferns, cacti, and orchids encrusting the branches.





They have many excellent polycultures which we can learn so much from, even if they are not suited to our climate. This particular polyculture only needs one substitution to grow in temperate climates.

The main purpose is coppice production of mulberry leaves for human consumption. They have a variety called “tigrinum” with tender post-coppice growth that is best for eating. This polyculture is right outside the kitchen for ease of harvest.

In the middle of this four-foot by eight-foot bed is a nitrogen-fixing shrub that coppices well too: *Flemingia macrophylla*. In our colder climate, we can easily replace this with something like Italian alder, Siberian pea shrub, mimosa, or any other coppicing, nitrogen-fixing trees or shrubs. (Ideally, one without poisonous leaves, just in case of a mix-up!)

The photo on the previous page shows the polyculture before the coppicing of mulberry leaves, and the photo

on the left shows it after coppicing; note Flemingia is now exposed in the second photo.


I also mentioned to Ricardo Romero at Las Canadas that they could replace Flemingia with chipilin (*Crotolaria longirostrata*), a nitrogen-fixing shrub with edible leaves. That way they could simply cut everything at once and cook up all the leaves. For those of us in a colder climate, we don’t have much in the way of cold-hardy, woody nitrogen fixers with edible leaves; Albizia supposedly has edible young leaves but they taste pretty bad. Ah well, we can’t win em all.

I hope you will look for and try out existing and novel plant combinations that are appropriate for your own region. Have you seen local plant associations that use sunlight in complementary seasons? Do nitrogen fixers occur more in the overstory or as climbers/ground cover? Have you noticed local polyculture coppices and/or hedges?

I hope this article inspires you to learn, observe, and experiment more. I look forward to hearing about your polyculture discoveries.



## NOTES

1. The main author of this article is Eric Toensmeier, with additions and edits by Bonita Eloise Ford. The photos for which credits are not indicated are by Eric Toensmeier. This article was made possible by the Apios Institute.
2. The main text and the photos in this article were originally posted on the Apios Institute wiki and licensed under a Creative Commons Attribution-ShareAlike 3.0 United States License (<https://creativecommons.org/licenses/by-sa/3.0/us/>). 
3. Cloudberry. “‘Pioneer Pink’ Strawberry, Chocolate Lily, and more.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/pioneer-pink-strawberry-chocolate-lily-and-more>. Photos of this polyculture by Cloudberry.
4. KylePDougherty. “Prickly Pair.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/prickly-pair>. Photo of this polyculture by KylePDougherty.
5. MidcoastPermaculture. “Alder salmon berry sword fern.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/alder-salmon-berry-sword-fern>.
6. EthanAppleseed. “Seabeach polyculture.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/seabeach-polyculture>.
7. Cloudberry. “Kenai Birch, Ladyfern, Lutz Spruce, Sitka Alder.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/kenai-birch-ladyfern-lutz-spruce-sitka-alder>. Photos of this polyculture by Cloudberry.
8. KylePDougherty. “Trying this one!” Apios Institute wiki. <https://apiosinstitute.org/comment/1098#comment-1098>.
9. Inilegna. “Hazelnut with Autumn-olive coppice.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/hazelnut-autumn-olive-coppice>. Photos of this polyculture by Inilegna.
10. Inilegna. “Salad Hedge.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/salad-hedge>. Photo of this polyculture by Inilegna.
11. Inilegna. “Edible Hedge.” Apios Institute wiki. <https://apiosinstitute.org/wiki/polyculture/edible-hedge>.