

## Syntropic Agriculture

Syntropic agriculture is a process-based form of farming that seeks to mimic (and harness) ecosystem dynamics. While it shares many overlaps with (and is both indebted to and inspired by) indigenous forest gardening, tropical homegardens, permaculture's food forests, holistic grazing, and agroforestry more generally, the specific framework, language and techniques come out of Brazil and the work of Ernst Götsch (below), CEPEAS and many others.



### Why do we need it?

Syntropic agriculture emerges in response to our industrialised input-based model of farming. Industrial farming requires constant external inputs: synthetic nitrogen, mined rock phosphate etc. But despite its prevalence, problems abound with this model. It costs a lot financially (with sharp increases in price of late), straining farmers already caught between predatory banks and a supermarket duopoly that systematically underpays growers. Input-based techniques have also encouraged an approach to farming that costs a lot ecologically, from biodiversity loss to soil compaction, declining fertility, polluted rivers, cancer-causing nitrates in drinking water, significant methane and carbon emissions etc etc.

**Key takeaway:** industrial agriculture is *entropic*. It uses more energy to make a loaf of bread than you can get from eating that loaf.

In contrast, syntropic agriculture is designed to generate the fertility you need to grow crops internally, planting a range of support species that are pruned regularly to provide mulch and 'pulse' sunlight and growth hormone through your system, actually improving your ecosystem's fertility over time. As a pleasant bonus, syntropic agriculture actively stores carbon at one of the highest [scientifically measured] levels: 4.45 tons of carbon per hectare per year, compared with 0.63 tons/ha/year for [the rightly celebrated but less effective] rotational grazing (Hawken, 2017). In this model of farming, the main inputs are *knowledge* and labour. This guide helps with the first!



### What makes a farm (or garden) syntropic?

At a basic level, syntropy can be understood as the opposite force to entropy. Entropy refers to the tendency towards decay, disorder, energy loss, 'sameness' [burning fossil fuels]. In contrast, syntropy refers to the tendency towards growth, structure, accumulation and complexity [the return / transformation of a forest grown out of ploughed fields]. So any agricultural project that is **enriching its ecosystem** can be considered syntropic in this broad sense.

Imagine a 'typical' food forest. There will be a range of different crop species planted in close proximity, with tall sun-loving species forming a canopy that is 'stacked' above shorter shade-tolerating species in the understory below, some shrubby, others closer to the ground. Think apple trees above raspberries with lemon balm and oregano further down. A delicious edible ecosystem!

In a similar fashion, syntropic agriculture also attempts to mimic the **density and diversity** of a rainforest, incorporating plants with **different sun requirements** in complimentary ways. In order to do this, plants are organised into different '**strata**' or layers (image from *agroforestryx.com*).

- Emergent plants need full sun;
- High strata plants can tolerate a small amount of shade;
- Medium strata plants benefit from more shade still;
- Low strata plants require high amounts of shade.



Figure: Layers of the multistory agroforestry design.

When designing a syntropic system, emergent plants can be paired closely with medium plants, and high strata plants can be paired with plants in the low strata. This allows for the creation of a dense system that is stratified into different layers, fitting more plants overall than in a monoculture of equivalent size. [more density = more sunlight capture = more microbial health in the soil]

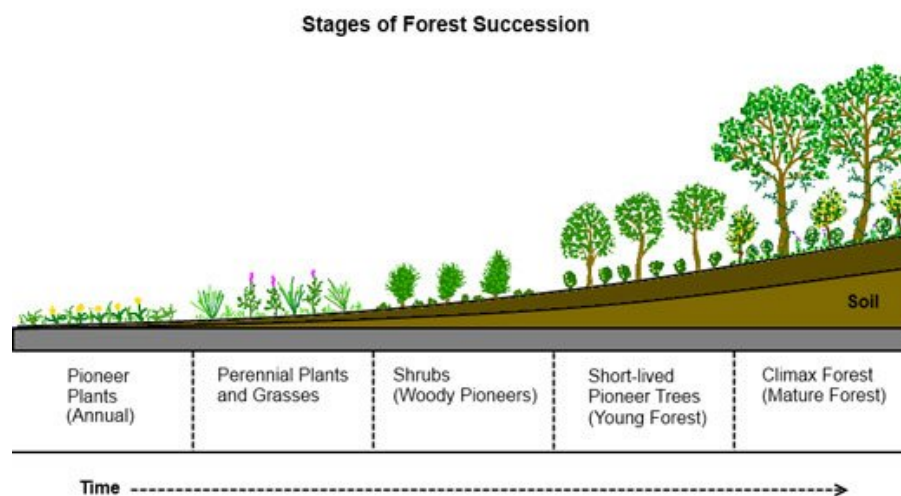
However, syntropic agriculture differs from this more static version of a food forest in a number of important ways.

First of these is the inclusion of a significant proportion of **support species**. These take two main forms: fast-growing trees that can provide shelter to slower-growing seedlings beneath them (e.g., brush wattle, tithonia, acacia, eucalyptus); and lower growing 'chop and drop' species that can be regularly pruned for mulch (e.g., comfrey, sugar cane, canna lily). Maintenance of these support species introduces a dynamic element beyond the seasonal leaf loss of deciduous trees, 'pulsing' sunlight and providing mulch at key times of the year, helping to accelerate a forest's tendency towards accumulating fertility. If you're not including support species and maintaining them regularly, you're not doing 'syntropic agriculture'!

Note that these two functions (shelter for sensitive long-lived species while they establish and mulch production for fertility) can and do overlap in many species (e.g., eucalyptus is a fast-growing canopy and responds vigorously to pruning, providing both biomass and shelter). Similarly, many crop species also provide significant amounts of mulch and shelter (e.g., banana, mountain pawpaw etc). Nature is multifunctional, and our planned ecosystems should be too.

The second key point of difference is that syntropic agriculture incorporates changes in the ecosystem over time, including species with **different lifespans** in order to achieve the density and diversity associated with healthy soil – from the moment of installation right through to maturity. Plants included range from fast-growing vegetables (like radish and lettuce) all the way through to long-lived fruit, nut, and timber species (like pecan, olive and walnut).

The goals of this focus on change over time are two-fold. First, for your system to provide crops at different points over time (rather than waiting empty-handed for your avocado to fruit). Second, to ensure that there is always an abundance of biomass to capture sunlight and feed soil microbes (before being cycled as fertility-generating mulch). In this sense, syntropic agriculture works to mimic (and accelerate) **ecological succession**. [syntropy = accumulating fertility over time]



**Succession** describes changes in a plant community over time as hardier species (like brush wattle) work to improve the soil for the more fertility-demanding species (like avocado) that follow. For a typical farm paddock in Northland, this means kikuyu giving way to thistle, inkweed and gorse before eventually being ‘succeeded’ by native bush. As a nitrogen-fixer like gorse grows, it improves the soil structure and fertility, creating root channels deeper into the soil than kikuyu while also providing a sheltering canopy for natives like mahoe that can mature in its shade. Eventually, these natives grow above the gorse, ‘shading it out’ (gorse is an ‘emergent’; it requires high levels of sunlight) and continuing the march towards a climax forest of (for example) kauri, taraire, and kawakawa. Or to put it another way, the plants we consider ‘weeds’ are simply fulfilling their ecological function: responding to disturbance (bare soil, low fertility etc) with vigorous growth designed to return that land to its original forest cover. We can fight them with poisons and frustration, or we can work with their power by designing systems with ‘weeds’ that work for us.

When combined, including support species and plants with different lifespans allows syntropic agriculture to accelerate succession. How? Dense planting and regular pruning of support species results in the increased accumulation of biomass relative to an unmanaged system. Think about nutrient cycling in a ‘natural’ forest. As storms come and go, leaves and branches fall to the ground where they eventually decay, creating a fertility-rich humus. But there can be a long time between storms, and plants past their prime can occupy space that might otherwise be cleared for new growth. Left to its own devices, succession can take a long long time! Syntropic practitioners accelerate this process by 1) including species known for their vigour; 2) pruning regularly before the plants senesce (avoiding the slowed rate of growth that follows seed production) and 3) accumulating the pruned material into concentrated piles. In essence, simulating regular storms (to encourage more regrowth); and growing our own compost in place.



Note: as with all growing, syntropic agriculture (also called ‘successional agroforestry’ for its focus on change over time) is **highly contextual**, making it important to understand both your climate and the initial **soil health** that you are working with. While many practitioners incorporate an initial boost of fertility to help ‘kickstart’ their systems into a higher level of succession (for example, adding manures, biochar, compost etc when planting), understanding your soil health will allow you to design a system with support plants that can thrive in the conditions you do have (especially grasses!).... while also helping to improve those conditions for more desirable crops later on. For this reason, a **consortium** (the collective name for the various plants in your system) may incorporate many support species with shorter lifecycles – helping to generate fertility early on – alongside a lesser number of slower-growing target crops / tree species. As most plants humans like to eat demand a certain degree of soil fertility, it’s important we include species who can help provide this.

The final key point of difference from our example of a static food forest above is that syntropic agriculture is often **planted in lines** with a deliberate focus on production. While the techniques discussed above (stratification, succession, support) can also be used for single tree (or larger) circle guilds – as in the woodland approach common with many forest gardens – planting in lines makes for easier management, decreasing the labour costs associated with generating your own fertility (internally) and therefore increasing the financial viability of taking crops to market. To do this, many systems incorporate specific ‘biomass rows’ of support species that all have the same management requirements. Think a dense line of sugar cane and canna lily next to your tree row that can be cut mechanically and piled up against the tree row. Note that while lines are compatible with varying degrees of mechanisation (enabling the use of electric tractors/harvesters/mowers etc), they can also be managed manually with far greater ease than the chaos of irregular paths. Their separation also minimises the risk of accidentally chopping down a target tree when pruning a dense and integrated row. Finally, when planted on a north-south axis (as is often recommended), tree lines provide for a standardisation of sunlight; each repeating unit of trees in the line receives the same light (as opposed to E-W systems where rows to the south are shaded in winter and trees on the east and west edges receive more sunlight than those in the middle, causing irregular growth).



Syntropic system from Nairobi. What species can you see? Eucalyptus? Banana? Taro? Plenty more that probably don’t grow here.. But those three do. Note: the space between two tree lines is called an ‘alley’ and can be used for a number of different functions depending on the system’s design and management: growing biomass, growing vegetables or grain, grazing livestock, growing shade tolerant crops like taro or salad-greens, an inground nursery etc etc. Not clear what they’re going to grow here (ginger is a popular tropical choice!), but check out all that soil-protecting mulch..

### **Recap: syntropic agriculture ≠ static ‘food forest’**

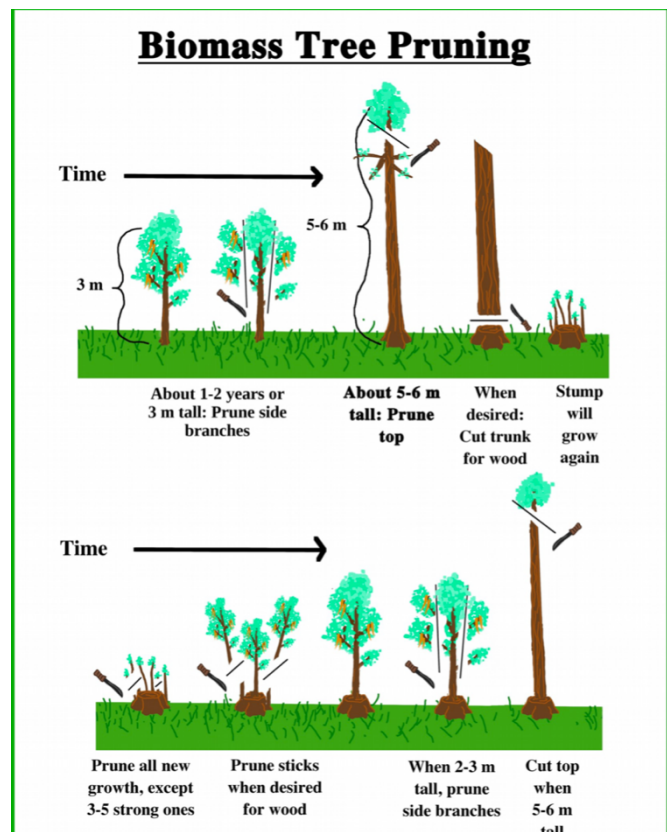
In contrast to many food forest installations (where tiny tree seedlings are planted at spacings that account for their size in 5-10 years time, often in a sort of meandering ‘parkland’ style), syntropic agriculture tends to plant in densely packed rows, including species with a range of lifecycles and sun requirements so that there is always something productive (biomass/crop/both) happening in the system while longer lived plants establish. From a first crop of radish at 45 days to longer lived annuals, biannual and perennial shrubs, then eventually trees of varying lifespans, a syntropic grower observes and manages the system, pruning to avoid or minimise senesce and correcting any ‘tensions’ that might arise between closely planted trees (either pruning them to be complimentary, for example, removing lower branches on a eucalyptus to ‘raise the crown’ and allowing a shorter species to exist beneath it; or removing the less valued plant from the system so its neighbour can grow and the macro-organism / consortium can thrive overall).

### *How important is management?*

**Management** is crucial to the success of such dense plantings. In the early years of a system, management might be every 3 months (or more, depending what you plant and how quick it comes to harvest), slowing after the first couple of years to a pruning every 6 months at the spring and autumn equinox. This provides a pulse of ‘gentle’ equinox sun, a fresh load of mulch and sufficient time so that the system can grow and evolve (juvenile species put on a growth spurt) and then fortify itself for the hot summer or cold winter months to follow (canopy species re-growing to shelter juvenile plants beneath them through climatic extremes).

Management tends towards two main types, reflecting the two types of support species.

- 1. Fast-growing tall trees** (like eucalyptus or grevillia) are pruned into a lollipop shape by removing lower branches and leaving space for species beneath. Eventually, these species are **pollarded** (cut back to a tall stump, maybe with a few whips with leaves on left behind) right at the top, usually around 5 or 6m. As shown in the image on the right (from *Abundance Agroforestry*, available online), this pollarded tree can be cut for timber or firewood. If there is sufficient sunlight in your system, it will re-sprout and from the one initial planting, can become a tree again and again (as in long-standing coppice systems).
- 2. Clumping chop-and-drop species** (like comfrey and sugar cane) are cut off just above ground level so that they can resprout. Their mulch is piled against the trees. For most efficient decay, make sure larger prunings like branches touch the ground, then place grasses / other greenery on top.

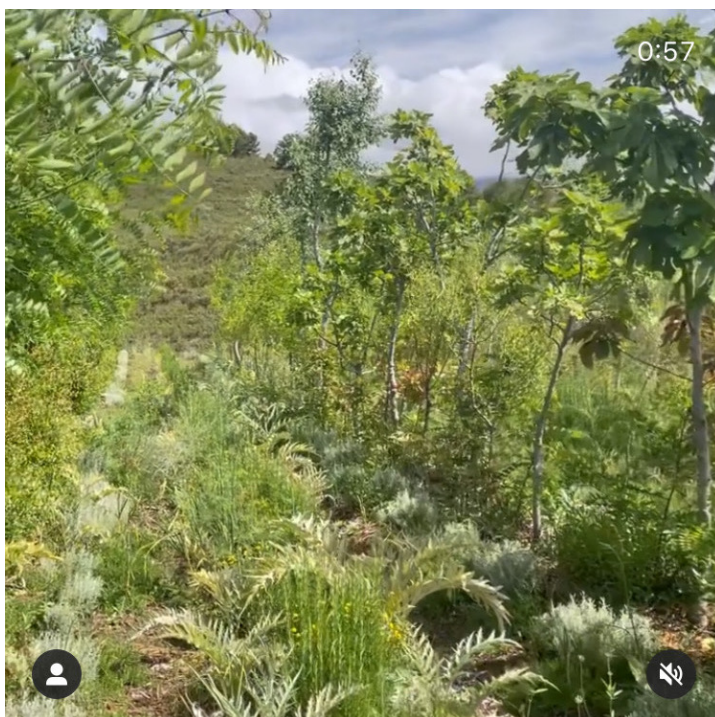


The final main category of management is the pruning required for your crop species, for example, cutting back spent raspberry canes or shaping pip and stone fruit for easy harvest. There is lots of room for grower discretion here. You can only observe how productive your management is and then respond accordingly. As Felipe Caltabiano of *Agroforestry Academy* notes, regular management shows us how “the best fertiliser is the farmer’s shadow”.



Due to the beneficial effects of density and diversity for improving soil health (and the importance of redundancy when dealing with nature's unpredictability), syntropic growers tend to **overplant**, using cheap cuttings and seeds to include plants in at a density in excess of what would be functional when those plants come to maturity (e.g., planting a macadamia seed every 50cm when you want one tree every 6m at maturity; placing poplar cuttings every metre then thinning those that take as the system matures and other target species need sunlight). **Planting from seed** has the added benefit of ensuring good taproot development for increased resistance to drought and wind; so is highly recommended for long-lived species like avocado, lucuma, sapote, cherimoya, loquat, pecan, persimmon... large-seeded and highly abundant forest species. These can be grafted in-situ later with desired cultivars, or (taking a leaf out of Mark Shepard's book and hedging your bets), graft one of two branches with a desired cultivar, and leave the parent stock to develop to see how its fruit tastes. You never know...it could be the next big evolutionary step!

Many growers compliment seeds and cuttings with cheap biomass seedlings (for example, eucalyptus, tagasaste, acacia dealbata can often be purchased from nurseries for as little as \$2.50 a plant), placing these amongst a few more expensive grafted seedlings (e.g., citrus, avocado). Remember to gather/plant lots of mulch species. Leave no soil bare! And while mulch is better than bare soil, nothing beats living roots, so make sure you put even more support species in than u think you'll need. You can always prune them out later [more pruning = more mulch = more fertility]



*Experimental Mediterranean system that's [guessing] maybe 3 years old from La Loma Viva (@lalomaviva) in Spain. Note the alleys full with aromatic herbs suited to the environment (rosemary, globe artichoke, sage, thyme, fennel etc) between taller tree rows (with fig, olive, white poplar, stone pine, mulberry, pomegranate, plum, peach, cypress and many more). Key biomass plants for this environment are cardoon, Napier grass, lavender, willow, and Prickly pear, amongst others.*

#### **Where can I learn more?**

There is a wealth of educational resources available for people interested in learning more about syntropy. The website [adam.nz/syntropy](https://adam.nz/syntropy) hosts a number of free English-language guides (including *Abundance Agroforestry*, and the

excellent *An Illustrated Guide to Agroforestry*). For videos, *Agroforestry Academy* have a free course on Youtube, and many videos from the Brazilian syntropic research centre *CEPEAS* have English subtitles. In the podcast space, *Regenerative Skills* and *Regenerative Agroforestry* are both excellent. Instagram has many different farmers sharing their systems; favourites include @mystycreek.agroforestry @syntropia\_regenerator @forestfoods\_africa and (in Portuguese but still very useful) @agrosintropia, @valedosolagrofloresta, and @marc.leiber. And then of course there's more local content: @permadynamics (who kicked off syntropy in NZ; have some great docos on their established syntropic banana system in Northland; and who run a Patreon course chokka with instructional goodies), @twinfallsnursery (who supply many species used in syntropic agriculture), @seedsforpala (young system near Kerikeri), @backyard.paradise.permaculture (2 year old system, run courses in the Bay of Plenty), and @brettrattay (1 year old demonstration system on a decent scale in the BOP). The facebook group 'Syntropic Agriculture Community' is also excellent :)

## Consortium Planning Exercises

Disclaimer: context is key! There is no substitute for observing plants in your environment, learning their limits, experimenting with different combinations (and sharing your learnings with mates).

Here's a blank planning grid (based on Ernst Götsch's work) showing some potential 'niches' we could fill in a syntropic system. But we don't need to fill them all! There is always a trade-off between ease of management and diversity. Many species might be great for soil health, but if you can't manage what you've planted, you won't see the benefits.. smaller and dense > big and sparse!

PLANT LIFECYCLE (NB: LINES ARE HUMAN IMPOSITIONS; USE THEM TO PLAN BUT BE FLUID...)

	PLACENTA 1 (3-6 MONTHS+)	PLACENTA 2 (1-3 YEARS)	EARLY SECONDARY (3-10 YEARS)	MID SECONDARY (10-20 YEARS)	LATE SECONDARY (20-50 YEARS)	CLIMAX SPECIES (50+ YEARS)
EMERGENT						
HIGH						
MEDIUM						
LOW						

SUN REQUIREMENTS (REQUIRE DYNAMIC MANAGEMENT OVER TIME)

When thinking about a syntropic system, it's a good idea to brainstorm possible species for each niche in your climate. Observation and talking to other growers is key! Here's a Brazilian example from the epic free [online]

Production cycle and Strata	Shading %	Less than 6 months	1-3 years	3-10 years	10-20 years	20-50 years	More than 50 years
Emerging	15%	Maize or sorghum	Papaya or Castor beans	Nettle tree ( <i>Trema micrantha</i> ), Tobacco weed ( <i>Solanum mauritanum</i> ) or Eucalyptus (fenceposts)	Mutamba (fruit and firewood) Tamanqueiro ( <i>Alchornea glandulosa</i> ) Carvoeiro ( <i>Sclerolobium paniculatum</i> ) for firewood Cajá-mirim ( <i>Spondias purpurea</i> var. <i>lutea</i> ) for fruit and live fence posts	Pepper tree ( <i>Schinus terebinthifolius</i> ) for fence posts, Eucalyptus (timber) Chinaberry ( <i>Melia azedarach</i> ) Mandiocão ( <i>Schefflera morototoni</i> ) Carvoeiro ( <i>Sclerolobium paniculatum</i> ) for firewood	Pepper tree ( <i>Schinus terebinthifolius</i> ), Stinkingtoe ( <i>Hymenaea courbaril</i> ), Pink Trumpet ( <i>Handroanthus impetiginosus</i> ) or Pau Rei ( <i>Basiloxylon brasiliensis</i> )
High	35%	Jack beans or cow peas	Cassava, pigeon pea or Cavendish banana	Ice-cream-bean ( <i>Inga edulis</i> ) or "prata" banana	Avocado Pepper tree (fruit) Stinkingtoe (fruit)	Indaiá ( <i>Attalea dubia</i> ) or mango	Copaiba ( <i>Copaifera langsdorffii</i> )
Medium	45%	Eggplant + tree seedlings	Tree seedlings	Achiote or Surinam cherry	Citrus	Citrus	Sapodilla ( <i>Manilkara zapota</i> )
Low	80%	Squash + tree seedlings	Taro or ginger + tree seedlings	Turmeric, arrowleaf elephant ear, coffee or heliconia	Coffee or heliconia	Jabuticaba ( <i>Plinia cauliflora</i> ) or coffee	Jabuticaba ( <i>Plinia cauliflora</i> ) or coffee

book *Agroforestry Systems for Ecological Restoration* (World Agroforestry, 2016). Note how some species overlap between the different boxes. As Scott Hall of *Syntropia* notes, "there's no defined point where placenta 1 ends and placenta 2 begins, they blend... Reality is very different from the construct we use to create a framework of understanding – please don't confuse the two." Ultimately it is the combination of overplanting and active management that realises succession in this step-by-step way.

An alternative strategy is to be a bit more concrete in describing what the ecological niches we want to fill are. When planning, it's best to work backwards from the longest-lived and largest species. Go through this list picking one from each category and adding it to the above planning grid.

**1. Pick a long-lived target tree crop:**

- [high strata; secondary -> climax]
- apple, avocado, olive, macadamia, persimmon, chestnut, pecan

*Think about the original ecosystem each of these comes from and what sort of plants might be compatible with that combination of rainfall, temperature, humidity/airflow/spacing etc... the more you're familiar with the environment that each plant thrives in, the better you can pair complementary species. For example, apple comes from a temperate woodland edge so needs space with minimal canopy; avocado and macadamia are subtropical rainforest species so can handle increased density with a little more canopy, and olive hails from the hot and dry (but also cold in winter) Mediterranean... each have their different growing partners (and many combinations to plant and test out!).*

**2. Pick a productive long-lived understory:**

- [climax low strata]
- tea (C. sinensis), finger lime, Elaeagnus species, gooseberry, rosemary, mushroom logs

*When picking an understory, you want to think about things like spacing (will there be room under your target crop... species like apple have far less room than macadamia or pecan), sunlight (is the species above deciduous or evergreen?) and access for harvests and pruning. Your target tree crops need fertility and are relatively slow growing – so will also need some **support species** to help shelter them and improve the soil while the target species mature.*

**3. Pick some support: early shelter**

- [placenta 2 -> secondary emergent]
- tithonia, brush wattle, tagasaste, whau, acacia, eucalyptus

**4. Pick some support: chop and drop species**

- [placenta 2 -> secondary; mixed strata]
- Comfrey, canna lily, Queensland arrowroot, coxfoot, senna, sugar cane, banana grass

*Because the target crops are slow growing, there's an opportunity for an early perennial crop to generate some income/flavour while your system matures, turning the early abundance of sunlight into high-value foods.*

**5. Pick an early perennial crop:**

- [placenta 2 high strata; ~high soil fertility]
- Raspberry, globe artichoke, pepino, tamarillo, blackberry, redcurrent, strawberry, manzano chilli, Chilean guava, Jerusalem artichoke, yacon, babaco

*Similarly, there is also a 'gap' while perennial species mature (most won't fruit until the second year). You can use this time to plant and harvest annual vegetables, helping feed both the soil microbes and yourself.*

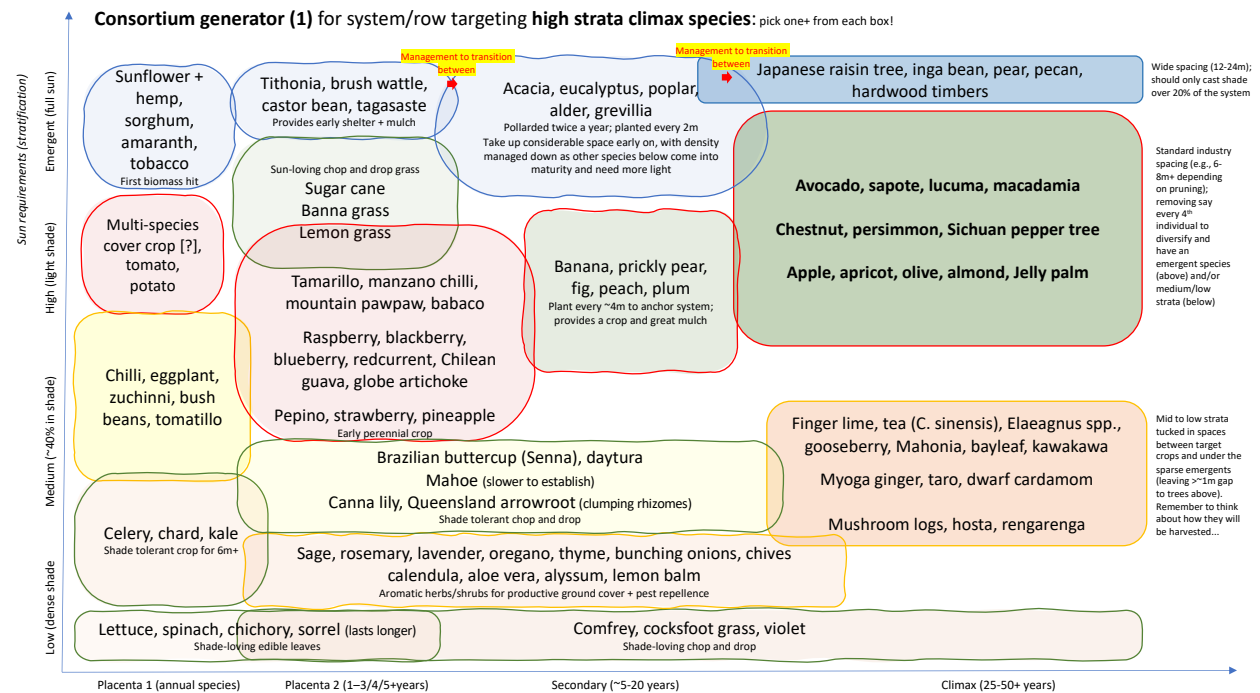
**6. Pick an initial vegetable crop**

- [placenta 1, combining emergent species with veges from other strata]
- Sorghum edge cut regularly to mulch potatoes
- Sunflower with pole beans + chilli, kohlrabi and lettuce
- Amaranth + tomatillo, basil and spring onion
- Incan marigold (huacatay) + rocket, kale and zucchini - [or your selection??]

*Once you've worked backward through time like this – ensuring your target species has ecological supports and additional harvests to keep it and you healthy in the lead up to its maturity – you can think about complexifying your system more. For example, picking a 'legacy species' (a slow-growing, long-lived NZ native like tōtara or miro), or including exotic timber species (like Californian redwood or eucalyptus). Maybe you need to include a multispecies cover crop to generate mulch and wake the soil up before you plant your consortium.. it all comes back to context and what you are game for.*

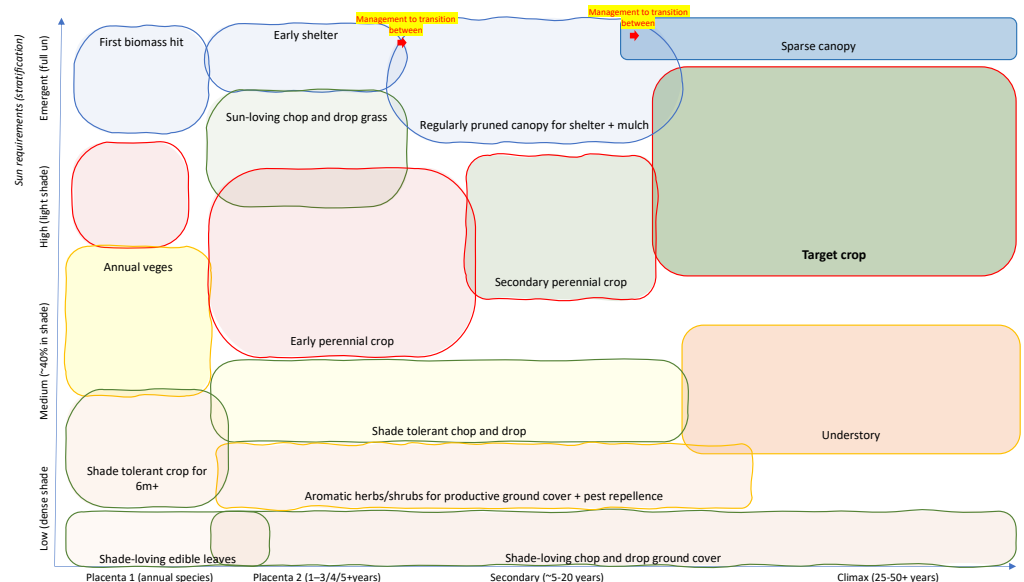


Here's a slightly more complex exercise. Pick one from each category... and that'll give you a basic tree row: a **consortium organised around climax species in the high strata** paired with some low strata species. This row could alternate with another row organised around emergent strata species paired with medium strata species (see the bonus exercise)... but that's probably getting ahead of ourselves!



Are there any other species you can think of that fit these categories? There are many many different options to explore! E.g., could you design a system based on NZ natives? Or one focused on kiwifruit production?

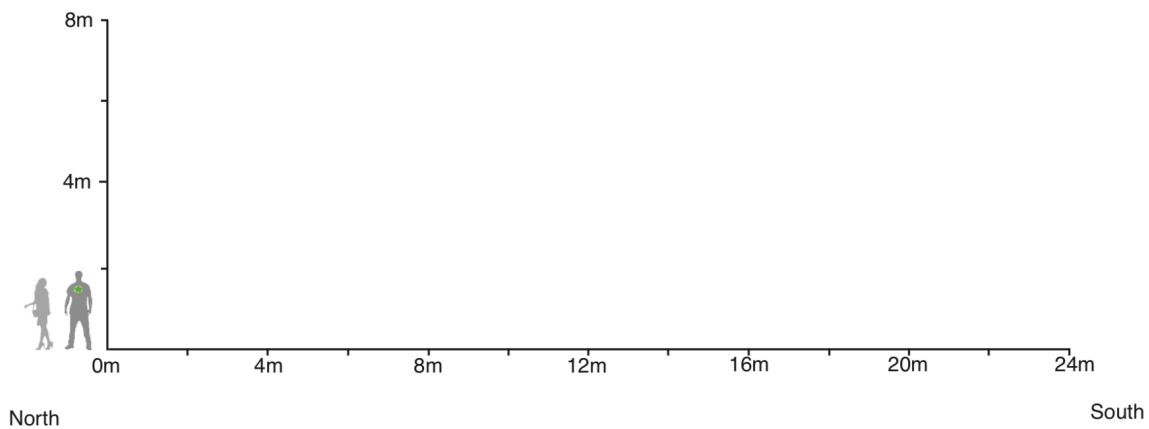
**Fill in your chosen species** into the blank boxes. Remember, diversity sits in tension with ease of management, so while it might be fun to put 2 or 3 species in each box, that can become a headache later on. It all comes back to your knowledge of the different plants, time spent observing dynamics in the system, and the labour you have available to manage pruning & harvesting.



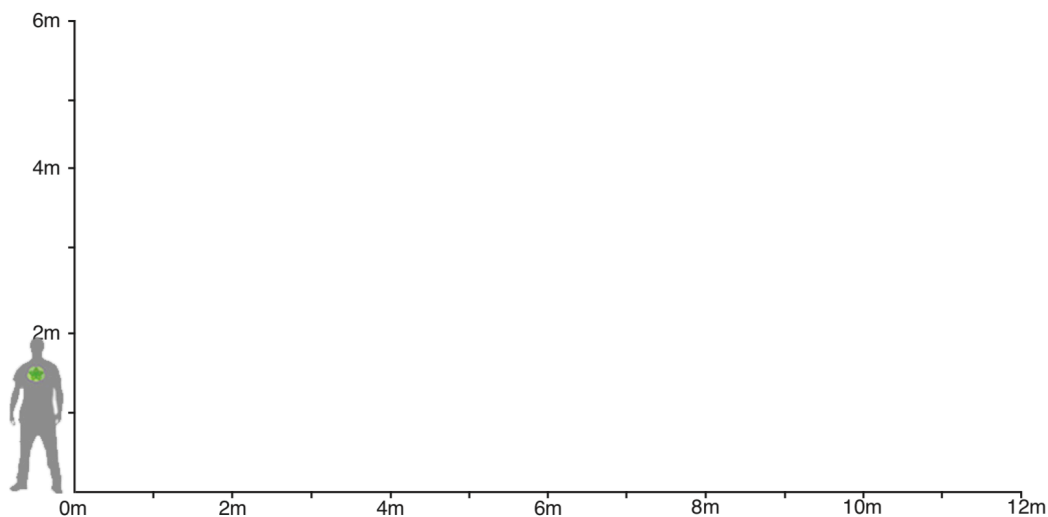
The next step is to think about how these species will actually grow together. Have a go at **sketching a row** layout in profile using the templates on the next page. Start from the longest-lived trees at maturity and fill in the gaps between them working backwards. For years 1–3, each target species gets an 'early shelter' immediately next to it. Bananas/figs can go every 4m with 2 regularly pruned canopy species between them. If you put your target tree at 8m spacing, they can go in-between every second banana pair, alternating with early perennial crops... Maybe you want to include a separate row with the different chop and drop species for easier management... and of course, when it's time to put trees in the ground, remember to overplant!

Start here to get **target tree spacing** right at maturity. Ask: do you want the odd canopy species for shelter/mulch/another crop? Is there room for an understory? How will you access the trees? Syntropy's tradeoff is a decreased density of target species (relative to monoculture) with additional yields and internal fertility/pest resistance from increased diversification.

Template row (24m long): for years 10-20+ [i.e., if want zoomed out view]

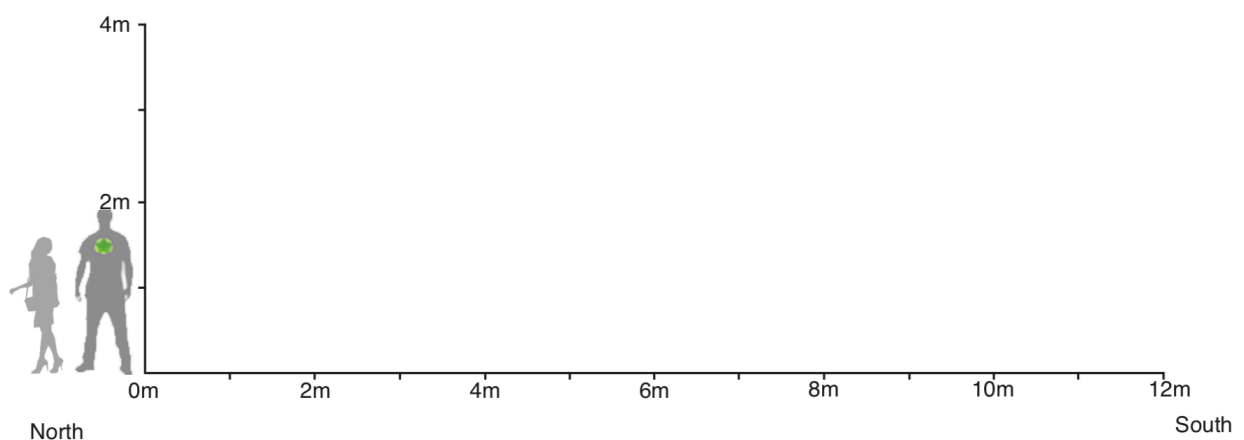


Template row (12m long): for years 3-10+



This allows you to draw your system in the **secondary phase**. Regularly pruned canopy species will be at full size (5/6m, depending the height you choose to pollard them at). Bananas/figs will be fruiting. Early perennial crops will likely transition from being in their prime to being shaded out. Your target species will be nearing productive age.

Template row (12m long): for years 1-3



Vegetables are done. Placenta 2 species predominate. Early shelter species should be up over your target crops, and secondary canopy species will be coming through to succeed them (in the right conditions, eucalyptus can reach 4m tall in just 1 year!). Aromatics, biannual flowers and early perennial crops will be entering maturity. This can be messy to draw because of the high diversity! Overplanting and regular management is key at this stage.

Here's a diagram from Permadynamics (left) showing the different lifecycles of one of their 'consortium'.

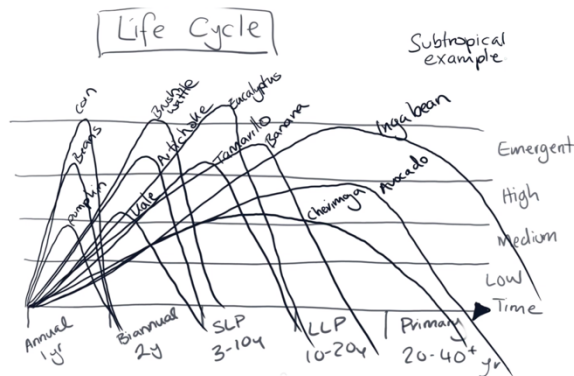


Figure: Layers of the multistory agroforest design.

Note the stacking of plants with different strata (sunlight requirements) at each lifecycle stage (static diagram on the right is from AgroforestryX.com, an excellent free design tool).

At the start, their system will mainly look like corn, beans and pumpkin (a classic indigenous polyculture!). By year 10, the dominant species will be eucalyptus (emergent = full sun; pruned in spring and autumn to provide mulch and a flush of sunlight) above bananas (high strata; a market crop) with cherimoya just coming into production (medium strata). By 25 years, bananas and eucalyptus will have been removed to feed the soil and a long-lived canopy of inga bean (emergent) will sit above avocado (high strata) with cherimoya (medium strata) below and likely other lower sunlight species beneath (kawakawa, rangiora, camellia sinensis etc).

A system like this would have been started with a generous boost of compost, biochar and other soil amendments at the time of planting. This allows an early focus on crop species like corn, then artichoke and tamarillo. However, you may not have access to sufficient inputs to support these more-hungry crop species, so it may be necessary to plant more support species. The more biomass you can generate, the stronger your start will be, and the healthier your plants.

## RE-RECAP

**One way to remember** the components of syntropy is to imagine the complexity of an old growth forest, starting from the thick leaf litter that covers the soil, taking in the density and diversity of species present – their different growth habits and sun requirements – both now and thinking about what came before (and what might come after). Lastly, think about the forces that might disrupt the forest, the storms, floods and animals [us!] that break an established canopy, allowing sunlight to pour in, and different plants to take up the space.

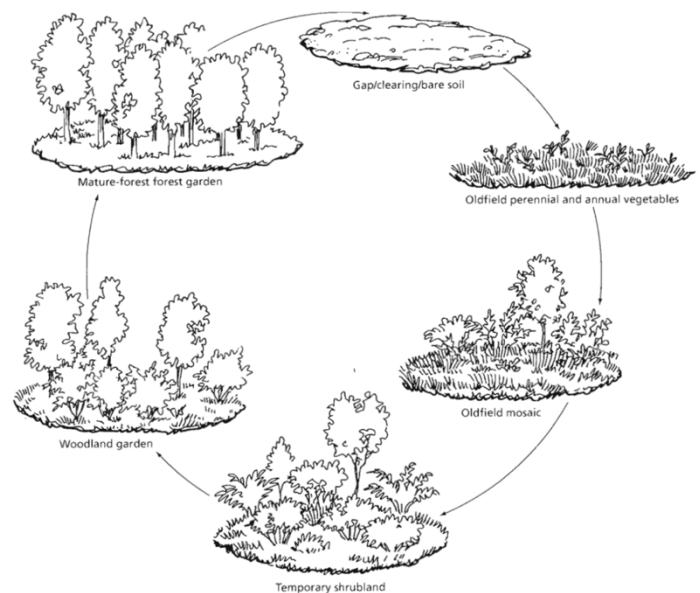
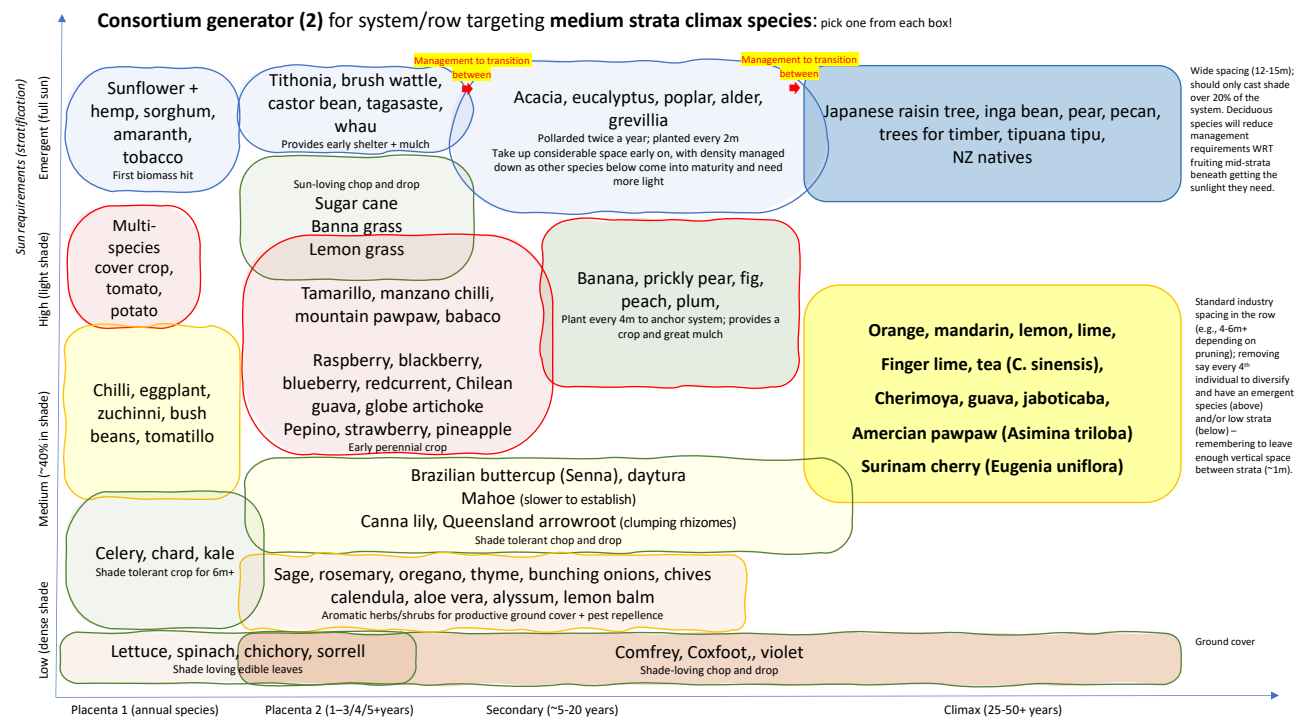


FIGURE 2.20. A possible cyclic successional pattern for one patch in a forest garden. Such a successional round can be the foundation of a shifting-mosaic forest garden.

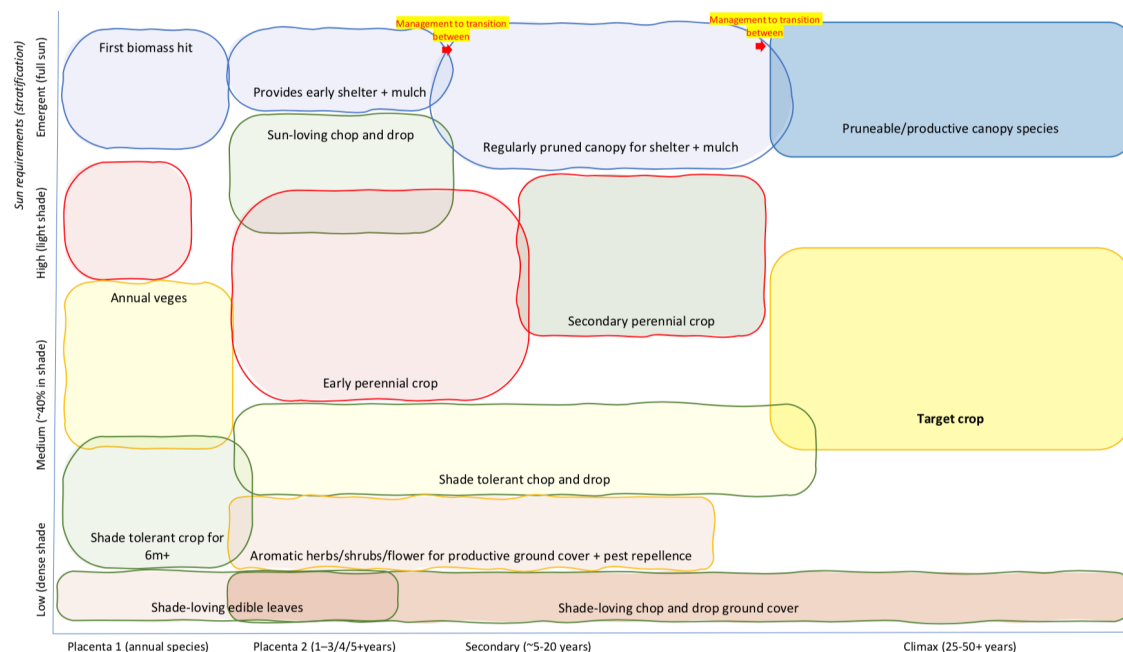
To be syntropic, you: [working from ground up in(to) a forest]

- Keep the soil covered (living roots > mulch > bare soil)
- Plant a diversity of crop & support species (in rows for ease of management)
- Plant densely ('stacking' in space and time)
  - Incorporate stratification/differences in sunlight required [space]
  - Plan for succession [change over time]
- Observe & manage to pulse sunlight and cycle fertility [the storm]

**Bonus exercise for planting a citrus-based system** = medium strata = plants that like up to ~40% shade cover, noting of course that this is dynamic & will be much less after a prune [= pulse of sunlight to trigger flowering]



Fill in the different boxes to come up with your own consortium. Use as many or as few as you wish. More is better...but harder to manage! Remember, syntropic growers often alternate tree rows: one with high and low strata species together, and one with emergent and medium strata species together. This helps keep a clear (~1m) vertical gap between the different strata/layers of the multi-strata forest while balancing the various light requirements in complimentary ways. If planting in this style, you might leave 3-4m between each alternating tree row. Or if focusing more on alley production, tree rows might be every 6, 12, or even 24m.



This document sits under a Creative Commons licence. No rights are reserved. You are welcome to replicate, remix, [correct!], and/or share it as widely as you wish, provided anything you make is also able to be shared. Special thanks to Permadynamics, Scott Hall, Roger Gietzen, Reville Saw, Eric Toensmeier, Agroforestry Academy, NZ tree croppers, Ernst Götsch and the many others who I've drawn on here. All mistakes are my own! If you have any questions, hit me [Dan Kelly] up via email: [kelly.danc@gmail.com](mailto:kelly.danc@gmail.com). Happy planting :)





**BONUS (2): Consortium check list**

Use these questions to evaluate and think through the practicalities of the consortiums you've come up with. There is no cut and paste 'recipe' for syntropy, so while we can learn the techniques and some combinations that work well together (e.g., banana and eucalyptus) it's vital you carefully consider each component you've chosen and whether it is a good fit with you, the other species, and your context.

- **Syntropic techniques:** Is your consortium sufficiently **diverse**? How many species do you have?
  - 5-7 species
  - 8-15 species
  - 15+ species
- Does your system account for change over time and the availability of increased fertility as you manage the early biomass (**succession**)?
  - How many different lifecycles does it incorporate?
- Does your consortium include plants with different sun requirements (**stratification**)? *i.e., from sun-hungry emergent species down to shade-demanding low strata species*
  - How many lifecycle stages have >2 strata occupied?
  - How many lifecycle stages have >3 strata occupied?
- **Target crops:** what are your target crops and when (which lifecycle stage) can you expect yields?  
What are their spacing requirements? Do they need ventilation when setting fruit? etc
  - 
  - 
  -
- **Environment:** are these crops compatible with your current and future **climate** (temperature, rainfall, frost vulnerability, chilling requirements, wind exposure etc)?
  - What about your **soil's fertility**?
  - Will you bring in fertility, or can you generate it in-situ (e.g., with grasses)?
  - Do you plan to plant a **windbreak**? [Crucial in windy NZ!]
  - List several windbreak species you might use
  -
- **Market:** will you sell any of your crops?
  - Are they a species already sold commercially, or will you need to market them?
  - Will you sell wholesale or more direct (e.g., via CSA)?
  - Are there existing supply chains? Neighbours selling similar crops?
- **Support species:** List the main support species you've included in order to mimic (but accelerate) the natural dynamics of ecosystem disturbance.
  - *Fast growing nurse species providing shelter:*
  - 
  - *Clumping chop and drop species for regular mulch:*
  -
- Are the support species planted in **sufficient numbers** to provide the biomass you need to drive your system's fertility? (e.g., does each tree row have its own biomass row? how dense are your early emergent species?)
- **Management:** On what scale do you plan to plant?
  - Homegarden: \_\_\_\_ m<sup>2</sup>
  - Lifestyle block: \_\_\_\_ m<sup>2</sup>
  - Small scale farm: \_\_\_\_ ha
  - Commercial farm: \_\_\_\_ ha
- How often do you plan to manage your system?
- Who will be responsible for management?
  - Will you need to hire people? Or will you involve the community? Family? What will the labour cost be?

- Will you prune manually or mechanically?
  - Have you left sufficient access for management? (i.e., for machine turning etc)
  - What tools will you use?
  - Could the system be redesigned to simplify management?  
(i.e., incorporating chop and drop species in separate biomass rows)
- **Layout:** How will the consortium be organised? (select all that apply)
  - All in a single tree row(s)
  - Tree rows with chop & drop edge
  - Tree rows with separate biomass rows
  - Separate alternating tree rows: emergent with medium; high with low
  - Alley crops (specify what & if it includes a succession planting for when the trees grow and there is more shade)
    - 
    -
- How far apart will each tree row be?
  - What will grow in the space between them (and how will you manage it)?
- How will your rows be oriented? (select one)
  - N-S (*recommended for even sun exposure along tree lines*)
  - E-W
  - On contour / keyline
    - *For steeper slopes.* Will **terracing** be required? Describe the trees/technique you will use
- **Planting out:** How will you prepare the planting beds? (select one)
  - Mulch grown in-situ and raked into rows you later plant into
  - Cardboard to suppress grass and imported compost + mulch (e.g., arborist woodchip)
  - Dig grass out manually (e.g., community working bee)
  - Animals (specify):
  - Walking tractor / roto-till
  - Subsoil rip with a tractor
  - Other (specify):
- Will you include any **soil amendments**? List them (and their source)
  - 
  - 
  - 
  -
- Where will you source your **planting material**?
  - Will you propagate some species yourself?
  - What will be grown from cuttings? From seed? From seedlings?
- **Diversity of outputs** – select all your consortium will provide:

Fruits	Medicinal plants
Nuts	Natural fibres
Vegetables	Meat/livestock
Cut flowers	Dairy
Timber	Oil (machine)
Firewood	Oil (edible)
Nursery (cuttings, seedlings, pups)	Native biodiversity
Mushrooms	Other: