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I started out winter quarter asking the questions: “How safe is a lawn? Can we eat food grown on it? Should raised beds be recommended or is a form of remediation viable? What’s more appropriate, edible landscaping, backyard agroforestry, organic subsistence food production, or a lawn? How do you assess what a backyard needs, vs what it can do, vs what is “sustainable”?” This is the question of appropriate land use with regard to client desire. How am I supposed to know the wisest decision for a piece of land? Answering questions like these is why I consult scientific articles. My goal is to not swim up stream, but instead turn the current in my favor. That’s what all my clients are going to want- my current client is looking for the silver bullet of landscaping. She wants plants she doesn’t have to take care of. She wants edibles, plants that won’t get too weedy. This translates to- she wants hardy, native plants that look pretty and are edible, and can compete with weeds because they have an evolutionary advantage.

I feel this trend of clients telling me what they want to see is going to reflect what an optimum ecosystem looks like. So, what does an optimum ecosystem look like? What are the components to guarantee a hands-off, self-run, backyard ecosystem? What I’m really asking is, “Is there a fundamental pattern applicable to all landscapes and habitats, with shared components serving necessary functions basic to the emergent properties found within all thriving ecosystems?”

These are the questions I’ve ended at now that winter is coming to a close. The journey from week 2 till now has been informative. There are a few readings I’d like to highlight which have helped develop my thinking. Most of the information reinforced what I’ve learned in prior classes, which shouldn’t be strange as I’m approaching graduation. I do feel like I’ve grasped the beauty of properly designed experiments- there is a sort of elegance to a questioned asked just the right way. Reading about well executed experiments makes me want to perform a few of my own. To do so, I must let the right question evolve through the osmotic behavior of new information.

Urban Foraging and the Relational Ecologies of Belonging by Melissa Poe et. all (2014) highlights the desire, either dormant or acted upon depending on the culture, the individual, and the ease of access to land, of a person to connect to their local environment in one of the most intimate ways- eating. To ingest a piece of land is to let the land become a part of you, you allow it to help build your muscles, heal skin, continue existing. What does it say to not know how to procure your own food? To have to buy your food from someone else? What does it mean to accept the terms of externalizing the necessities of your own existence to somebody else's land? I'm learning that questions and sentiments like these are the invisible drivers that encourage people to buy my service. This is an insecurity in a basic need, and people recognize the risk of not being able to grow food on the land they "own or rent". This is what's called a "benefit"- the abstraction of what's to gain when people buy my service, the tangible offer.

The same can be said on a bigger scale- the city-wide scale. Producing Edible Landscapes in Seattle's Urban Forest by Rebecca Mclain, et al (2012) analyzes the state of Seattle's urban forests and talks about how highlighting ecosystem services in a mostly quantifiable way has lead to the installation of domestic wildspaces. There are many entities in Seattle working to put in, and maintain greenspaces, but the paper brought up a question- How should the harvestable goods of a commonspace be utilized? For example, if the piece of wood is going to be established anyways, why not incorporate edible plants? But then, who takes care of the plants, who harvests the goods, and who keeps the goods? The paper mentions that the history of in-city-woods was to make natural resources safely accessible to the surrounding community. It acted like a pantry, or hardware store for the common folk. Now that we have hardware stores, do we need in-city greenspaces? If we correlate back to Melissa Poe, 2014, than yes, we do, because those greenspaces offer an intangible, primal satisfaction for lining up with the movements and transitions of nature. The desire for easily accessible greenspaces is there, and I feel this means good things for my target market because the demographic I'm looking at has the money to burn, will be forward thinking, and enjoy nature- *easily accessible nature* that is. I'm offering the luxury of connecting with nature's rhythms and bounty in one's yard, a luxury these papers show, is in demand.

The paper Lawn and Toxin: An Ecology of the City by Paul Robbins, et. al (2001) started out with the figure 16 million hectares, which represents the amount of land under use as a yard. They then explained that landowners are pressured into maintaining an early seral colonizer/grass successional phase (the hardest phase to keep, dare I say), through the advertising efforts of pesticide and fertilizer companies. These companies affect a social norm that is reinforced by the average consumer. Now, from a landscape point of view, the amount of chemicals used on all of these 16 million acres rivals that of agriculture. In fact a quote from the paper says, "In 1984, more synthetic fertilizers were applied to American lawns than the entire nation of India applied to all its food crops combined." That was 1984, what is the figure now? That's a reading for another day. What this shows is, the desire for a healthy environment has always been there. Let me explain- why are people buying the "silver bullet" to plant health in the form of chemicals? Because they want healthy looking, productive, hands-off plants. What they're looking for a is what I started this paper with: they want hardy, native plants that look pretty and are edible, and can compete with weeds because they have an evolutionary advantage. They want a self-reliant ecosystem. These chemical companies know this, so that's what they advertise their products to do. Now I am tapping into the same market, but will design small, backyard ecosystems to properly cycle nutrients, as closed loop as I can make them. Imagine, I'm not a two acre farmer, nor am I a hundred acre farmer- there is 16 million hectares of yards with an average chemical application rate to eclipse that of other nations. If I can affect positive changes on any amount of those yards, what does that mean for the creatures, people, and systems downstream?

I wonder sometimes how limited I am in what I can do because of the period in time I live in. Unless a new development comes along, by me, or someone else, or a lot of other people, I feel like something is missing. The problem, in my point of view, is the mindset that humans can even come close to designing that which nature does in her sleep. We are short lived creatures and can't begin to grasp the effects of a finely aged ecosystem- the emergent properties therein that started from a seed planted long ago. How do I know I am making the right choices? What do I grade it on? The Emergy Evaluation of Food Production in Urban Residential Landscapes by Travis Beck et. al (2003) gives me one possible method of grading my success. This study inventories the emergy yield ratios (EYRs) of four different plots modeled after four different yard designs: (1) a conventional ornamental landscape; (2) an intensive organic garden; (3) an edible landscape; and (4) a forest garden. In other words, how much energy do any of these system need to get started, vs, how much energy do they produce throughout the years? What do the results mean for "sustainability"? You can find the result values in Beck's paper, but I'd like to highlight that even the forest garden scenario, which I prize most out of the four scenarios, did not give a good return on investment within the subsequent year or two. Of course a system as perennial as a forest garden needs more time to pay off, so maybe the results weren't representative. However, the long wait time does present a stumbling block for potential clients who want results fast. What this means is I either have to market to clients who don't mind waiting years for their return on investment, or I need to mix annuals and perennials with a slow succession to the perennials as they begin to produce more.

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Week 3 saw my worry in soil toxins budding. As I explained in that week's upper division reading review paper, I realized that Olympia has been subjecting the agricultural area around it to urban sprawl. In essence Olympia has annexed a lot of land that use to be amended with agricultural chemicals, which through the use of a tractor was spread out homogeneously throughout the soil profile. Additionally, Olympia is on the southern reach of the historic Tacoma Asarco smelting plume. Furthermore we have acidic soils here. All this spells out a conflict of interests. To limit liability of toxicity through phytoaccumilating edibles, I need a soil test, a list of plants which do not phytoaccumulate toxins to the edible parts of the plants, or I need to convince my clients either invest in raised beds, or to lime their soils year after year until the passive pool has been forever changed.

Szolnoki, Farsang, and Puskas (2013) wrote the article Cumulative Impacts of Human Activities on Urban Garden Soils: Origin and Accumulation of Metals, took an inventory of 50 Hungary soils and the metals found therein. They found that garden soils were higher in metals than the surrounding soils, and that copper (Cu) was by far the most common chemical found. Through their data I was able to hypothesize that 1.8-2 out of 10 potential clients will have unsafe lawns. Or rather, 1 out 5. That's a rather high number. This number could increase depending on how close to the road the lawns are, specifically in regards to zinc (Zn), cadmium (Cd), and Pb.

Fiona Wong et. al (2012) article Fate of Brominated Flame Retardants and Organochlorine Pesticides in Urban Soil: Volatility and Degradation. Brominated Flame Retardants (BFRs) highlighted that chemicals found in the soil will be absorbed into micropores very fast, and then slowly, over time, until biological activity "humifies" and makes them unavailable to plants. This is a very long time however, and homeowners already have decades of the land's prior "owners" actions to answer to. This paper essentially highlights how important it is to speed up the soil restoration process, limit exogenous chemical applications, and possibly pair up with mycoaccumilator entrepreneurs and scientists. We are entering an age where the technology and understanding of biological processes can help remediate soil damage, and thus buffer the effects of climate change. The ecosystem services therein are obvious, and I really feel the call to action to right wrongs spurred out of irresponsibility and negligence. Unfortunately I'm bound to capitalism and must affect positive change on the lawns of wealthier people who could probably go out and buy locally grown food to support their local farmers. However, there are these new legal entities called Social Purpose Corporations who have share holders, but aren't legally bound to increase profits for their shareholders because they are focusing on social or environmental issues. This opens up the door to many new possibilities and yards, so maybe, in the future, I'll be able to join or start one of those.

I explain in more depth what the article from Groffman, P. M., et al. (2006) titled Land Use Context and Natural Soil Controls on Plant Community Composition and Soil Nitrogen and Carbon Dynamics in Urban and Rural Forests aimed to study in my reading recap papers. My take-away message from this article however, were the passive compositions of the urban forests they studied; Urban forests had more tree canopy gaps which opened up light for the lower layers, and had a high vining plant spp beta richness (6 different spp). This is the system which the forests in this study will passively support- which means it is the least expensive system for my clients to manage. Which means this is the system I should promote: lightly leafed canopy trees supporting fruit producing vining plants with fruit producing shrubs, perennial vegetables, and a section for annual vegetables. Or, maybe I'm looking at this conclusion from the wrong perspective? Maybe I should look at the urban forests here in Olympia and see what composition they support? Maybe that's the composition I want to promote?

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Density and Stability of Soil Organic Carbon Beneath Impervious Surfaces in Urban Areas by Zongqiang Wei et al. (2014) told me that impervious surfaces found within the urban landscape do nothing to sequester C into the soil. Most urban technosoils are clay, mineral, with a very small organic horizon- they do not sequester that much C. Which means that my work is that much more imperative. Imagine 16 million hectares sequestering some amount of C. That would be wonderful.

The paper by Nezat et al. (2016), Heavy Metal Content in Urban Residential and Park Soils: A Case Study in Spokane, Washington, USA is a locally based, inventory-eque article. Spokane and Olympia have had similar economic histories: both have side-effects from mining, timber, and agricultural activity, so their data could compare directly with what is to be expected in Olympia's technosoils. They found higher levels of As, Pb, Ba, and Zn between rural plots, urban and garden plots, and residential plots. The takeaway data from this paper as applied to my Edible Landscaping business is 2/30 or 1/15 of my clients will have As and Pb levels that are too high for me to ethically garden their land for edible plant use. This further highlights my need to administer soil tests.

If I'm to include soil tests as part my package, what should I include that the soil labs won't include? Or what should I analyze concurrently with the labs? Soil Health as a Predictor of Lettuce Productivity and Quality: A Case Study of Urban Vacant Lots by Knight, A. et al 2013 explained how they did a couple of their soil tests. Here's my options as listed from this paper: pH; moisture content; soil texture; SOM; active carbon; ammonium; nitrate; microbial biomass N; nematode community parameters; bacteria feeding nematodes; fungal feeding nematodes; plant parasitic nematodes; number of nematode genera; nematode food web enrichment index and structure index. Additionally they tested plants on their dry biomass content; numbers of leaves/plant; and subjective appearance. So now the question for me becomes which of these tests are the most feasible, the most useful, and the least time consuming, and how can I do that for my clients? I already plan to do pH test using test kits, a soil moisture test with a tensiometer, a soil texture test with the soil triangle, and I've considered doing the SOM tests using sieves and ovens as well as the biomass test using a Berlese funnel and my microscope. Are the rest of the tests worth my time at this point, especially in comparison to what a lab has to offer?

So let's say I have a client with a mineral heavy technosoil. How am I suppose to amend it, and what with? This is when I consult the paper Modelling Long-Term Carbon Dynamics in Soils Reconstituted with Large Quantities of Organic Matter, Vidal-Beaudet et. al, 2012, which explored what happens to urban soils (technosoils) when they are amended with organic matter compost. What they found was it didn't really matter what soil type the target soil was, or how much compost they applied- what mattered was how cured the compost was. As in, was there still green material that was breaking down, or was the compost's Carbon more stable? They also found that compost will continue to break down and add to the soil after 5 years. What does this mean for a soil I'm trying to actively remediate? If a compost is effective 5 years after initial application, would one application of compost be enough, then followed by covercrops → green manure and leaf mould? It's the integration that's important- the invitation of earthworms to drag the organic matter throughout the soil. The health of the soil isn't the top dressing of OM.

Which brings me to what I learned from the paper Effects of Endogeic Earthworms on the Soil Organic Matter Dynamics and the Soil Structure in Urban and Alluvial Soil Materials, by Amossé et al, 2015. Earthworms are soil engineers: their activities through the soil promotes good aeration, creates water channels for deep soil-water percolation, cycles nutrients throughout the food webs, and helps keep carbon bioavailable. Earthworms help make soil with good tilth. However, just like any other creature in any other system, certain worms can only live in certain environments. Being that technosoils are new, and frequently disrupted, the kind of worm we can expect to see in technosoils will be those found in similar soils: alluvial. Indeed, it is the green worm [A *chlorotica*] which, from this study, survives better in the urban soil environment because they are geophagus, they eat dirt. This is important to highlight, because the regular earthworm A. *rosea*, is a grazer which prefers to eat from the plant roots. This gives us an idea of the in-soil landscape we're dealing with. If I'm starting on a badly damaged technosoil, then I can expect the greenworms to being doing all of the soil engineering until the earthworms find the habitat suitable for them. This is an example of succession, and if I'm thinking about succession above ground, I need to think of it as well below ground. Indeed the presence of earthworms could infact be a milemarker used to grade my success at soil reconstitution.

The next article helpful to me this quarter, Lead and Arsenic Uptake by Leafy Vegetables Grown on Contaminated Soils: Effects of Mineral and Organic Amendments by McBride et al, 2013, explored what stabilizing amendments could be used for soil toxicity to prevent toxic phytoaccumulation of Pb and As. They used the stabilizing materials: composts, peat, Ca phosphate, gypsum, and Fe oxide. These materials would ideally prevent the plant from taking up Pb and As because they would chelate, or bind, to the metals. This question is important- what amendments are appropriate and successful for my future clients if they're worried about soil contamination? The answer- nothing worked. The only amendment that came close to working was Fe oxide, which had a limited effect which was not long-lived. The amendments either immobilized one toxin while it mobilized another, or did nothing at all. So, I'm not left with that many options for the 1/15-2/10 clients with toxic soils. Either those clients won't get edible landscapes from me, or they're going to go to somebody else to put in the wrong plants and continue the problem of heavy chemical application.

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This next article marks the time in my winter quarter where I started to really focus on climate change. Carbon Storage and Sequestration by Urban Trees in the USA by Nowak et al, 2002 showed that urban trees, including those in people's yards, were left largely un-competed against, and due to the urban island heating effect, some trees could continue to sequester carbon throughout the whole year (depending on the tree and zone). This means that the whole 16 million hectares of backyards split between property lines, in this country can stand to grow 1-2 full sized trees (each) which will continue to sequester carbon throughout its whole life. Therefor, could I ethically advertise my edible landscaping business as a means to offset my client's carbon footprints? To answer that, I suppose the data would look into how much energy was spent sourcing and maintaining the trees after installation, vs the homeowners carbon footprint and how much carbon the tree sequestered in a year. Being that the tree doesn't have to share with other top canopy trees (it's got room to spread out), this carbon sequestration value could be rather high. The scientists did a bunch of math and by their calculations, "individual urban trees contain approximately four times more carbon than individual trees in forest stands...large trees can store 1000 times more carbon than small trees." Seems like I'm ethically in the clear to make the claim on the carbon footprint reduction.

What can we expect for the PNW with climate change? I read the next article by Rosenberg et al (2003) to get a better understanding of this question. It's titled Integrated Assessment of Hadley Centre (HadCM2) Climate Change Projections on Agricultural Productivity and Irrigation Water Supply in the Conterminous United States and it takes a broad look at the expected changes in the Pacific Northwest's temperature, precipitation, and water resources for the next century. The scientists forecast the PNW temperatures to swing between -1.8C cooler to .6C hotter in ten years, and between .9C and 3.0C hotter in 2095. They calculate the PWN between 16% to 59% more precipitation in ten years, and by 2095 the PNW will have between 6% to 44% more precipitation. The PNW will have summers and fall temperature ~2C cooler, and winters as much as 4C warmer. By 2095 the PNW will have very dry summers comparatively. What does all this mean for my business? I need to incorporate plants which can handle drier, hotter summers, and warmer, wetter winters. That shouldn't be too hard as what this translates to me is a northern migration of the hardiness zones, which opens up a lot of plants to almost year around growth, if daylight hours aren't a consideration. This does not permit the production of sugar maples, or apple trees sensitive to frost days. However, being that apples are a hot commodity I'm not too worried because breeding programs are most likely already underway.

This plant migration hypothesis is emphasized in Pfeifer-Meister's et al (2013) article, Pushing the Limit: Experimental Evidence of Climate Effects on Plant Range Distributions, in which they documented the migration of prairie plants between hardiness zones in response to temperature and precipitation. Essentially these prairie spp will migrate north with the coming climate change. This highlights the weeds I can expect to see as competitors as time goes by, and the niches I should fill before those plants get here.

I became very interested in Plant Production Frontiers after reading Huxley and Ong's Tree-Crop Interactions, which I'll talk about later. One of the only articles I looked at concerning PPFs was by Radha Ranganathan, who was referenced a number of times by Huxley and Ong. His paper Production Possibility Frontiers and Estimation of Competition Effects: The Use of A Priori Information on Biological Processes in Intercropping looks at the PPFs of three intercropping studies and analyzes the results. It was a combination of PPF articles that inspired me to consider an experiment of Kale/Lettuce/Clover intercrop. Again, a question asked just right is one considered elegant. I'd like to do an experiment someday where kale and lettuce are planted as an intercrop with decreasing numbers of each starting at their highest densities at opposite ends and decreasing in the middle. The goal would be to find the perfect mixture.

The above readings came from scientific, peer-reviewed articles and relate to my edible landscaping business in specific ways. Likewise I also read through a handful of books from which I took many notes and have highlighted throughout my weekly reading recaps. Below I'd like to talk more about the most important bits of information from those books.

Dr. Dickson Despommier's book The Vertical Farm: Feeding the World in the 21st Century (2010) paints what the future might look like if we allocated the horizontal acres of food production to vertical acres, specifically within the hearts of urban environments.Essentially, the advantages to doing so, as he listed them, would be: 1) year round crop production; 2) no weather related crop failures; 3) no ag runoff; 4) ecosystem restoration; 5) no cides or ferts; 6) use 70-95% less water; 7) reduced food miles; 8) more control over food safety and security; 9) new employment opportunities; 10) purification of grey water to drinking water via evapotranspiration, and 11) animal feed from post harvest materials. Now, I have some concerns about farming in absence of the true soil, mostly the importation of so many materials and nutrients, but if we shifted the way we compost our waste products, and even our own dead bodies, we might be able to balance these issues. Additionally, if the tower windows were lined with photovoltaic panels, we could generate a lot of electricity therein. I'm not sure how close the vertical farm reality is, but if the earthships movement and the Venus Project movement is any indication, this is a very attractive idea.

Then there was The Bio-Integrated Farm by Shawn Jadrnicek (2016). This was a comprehensive book demonstrating the techniques used by Shawn on his many permaculture farm ventures. My main takeaways from his book were the methods to stacking functions, the interactions between landscape components, like an herb spiral made from soil sourced from a new pond which is used for plant starts and heating for the house in winter- his approach is, what I'd describe as spatially and temporally birdseye. His goal is to let the landscape produce its emergent properties through stacking 7+ functions on a single component. He emphasizes chinampas as his inspiration and functional example. He says one component's output should be another's input. It's like following a string that laces between tree, to the lower strata, to the running water, to the compost, to the chicken coop, to the soil profile, and up to the sun. It's understanding where the nutrients come from, go, are used, and are lost, and limiting those losses to create more products. This book should be a staple in any permaculture enthusiast's library.

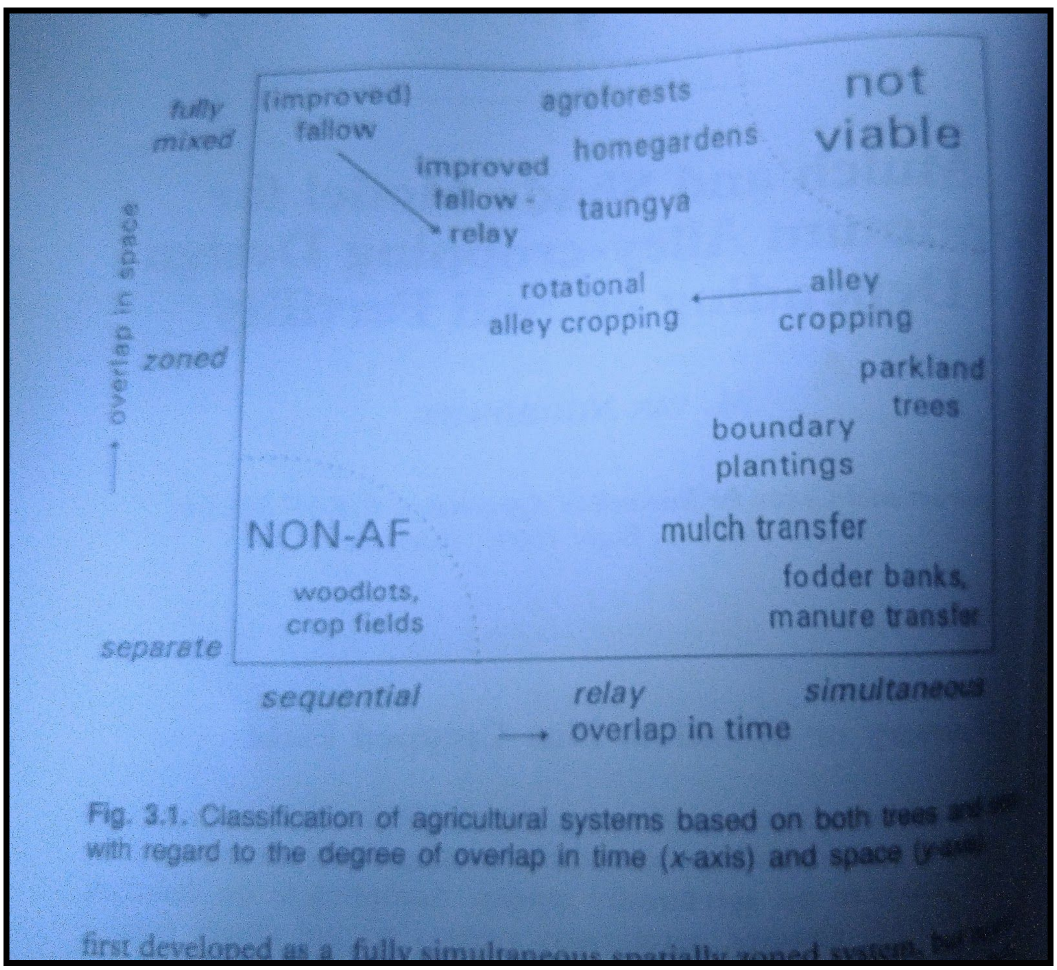
Now I'm on to Huxley and Ong. They are the bulk of my book reading because their book Tree-Crop Interactions is very meaty and hard to chew through and takes a lot of re-reading to understand. While the notes taken from them can be found in the reading recap papers between weeks 7-9, I'd like to review the most important, overarching takeaways found therein.

This is all about how to intercrop plants for production on land that isn't mine. It's best to simplify things as much as possible. Page 59 says "When intercropping between woody and non-woody plants, the basic factors at play are those moderating the energy balance of vegetative architecture and the plant water use productivity." Essentially what I'm looking at when I see an ecosystem is the methods of nutrient cycling, beginning with and powered by the sun, and the evolutionary usage strategies of the plants found therein. Spatial and temporal complementarity between cropping spp can best be seen on a growth curve. I've thought about this a lot- if I could create a matrix showing the growth curves of different plants in response to different stimuli throughout the year, I could theoretically create the perfect planting and cultivation calendar where all plants work together cohesively. This concept is talked about on page 27. The growth curves between intercrops can be seen on a Production Possibility Frontier (PPF), which, as Huxley and Ong explain, calculates at what densities two crops can be plants together for the most production of both, specifically against their market value.

Huxley also talks about stacking functions on page 28 when he says that the yield of one crop must be seen as the function of another if the crop pairing is to be compatible. There are lots of methods a plant can use to become compatible with other competitors in the same environment- it's called fitness. One of these ways include the spreading and exploitation of plant roots to refugium. Some plants spread their roots and utilize these resources in pulses, using some for growth and the rest for storage. Other plants require a very fertile soil because their roots don't go looking for refugium. Knowing plant root structures is just as important as knowing above-ground plant architecture when it comes to mixing crops.

When it comes to intercrops it's all about resource sharing. Plants are very good at this- some specialize and live off of the refugium of their specialty, others generalize and need higher levels of this and that to compete. Additionally the strategy of the plants can be between using the nutrient resources effectively (making more with little), or hogging all of the resources by ripping it from the clutches of other plants. The degree to which a plant can do either of these will determine its success in a habitat. This is said concisely on page 75, "to increase the productivity in situations with high population densities, the plants must either capture more resources or use them more efficiently." Additionally, page 74 highlights that intraspecific competition will call on the same nutrients used by the same plant spp vs interspecific competition which calls on different nutrients used between different plant spp. Of course the pros and cons of this competition can be quantified via Land Equivalency Ratios, Crop Performance Ratios, and Area-Time Equivalency Ratios. Page 78 says, "The basic principle underlying the concepts of resource capture is that complementary or competitive interactions between spp depend on their ability to capture and use the most limiting essential growth resources effectively.” Meaning that if I want to limit competition between crops, I need to differentiate between R and K spp, and possibly focus on scavengers in between the perennial crops. Additionally, If one crop is over yielding, it’s probably taking nutrients from the crop that is under yielding.

There are different ways of looking at the methods of agroforestry- mainly temporally and spatially. Depending on the goals of the landowner I’m going to have to decide on the appropriate system. Figure 3.1 on page 52 illustrated this point nicely (Fig 1 for this paper)- Fig 1 below allows me to choose the type of system appropriate for my client based on their level of involvement and the desired level of production:



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There's a question I've been asking of tree crops since I learned about agroforestry: when you remove trees, you remove nutrients. Where do those nutrients come from? How sustainable is a tree harvest? Page 5 finally shed some light on this issue. I'm paraphrasing here- trees improve the soil in multiple ways, especially leguminous trees. However, trees, when treated as a crop, can deplete the soil. When trees are short rotation crops, they mine nutrients from the soil on a regular basis and those nutrients are largely removed from the system. Pair their harvest frequency with the method of harvest and its effects on the soil (compaction), and then in some ways, trees do more harm than good. This reminds us that just because trees are involved in the harvest, it doesn't mean the land is being treated responsibly. Maybe trees would be best used as fodder crops for animals (mulberries and pigs), or hedgerows, or coppicing/pollarding, or living fences, but think twice when they're used for wood. Page 57 talks about what to consider when dealing with trees as a hedgerow: 1) What tree spp are you considering? 2) What is the smartest distance between the trees in the hedgerows? 3) What pruning regime are you going to use? Specifically height and frequency. 4) What crop cultivars will you use in between the tree hedgerows? At what density? At what spacing? 5) What additional fert or soil amendment will be necessary?. Additionally, page 63 describes the perfect hedgerow tree as one "...with a high M:S [mulch:shade] ratio, which can be based on a combination of narrow, but compact hedgerow canopy, thick leaves, the major part of the tree canopy not exceeding that of the crop, a high N content and a suitable N release pattern from the prunings, coinciding with crop demand."

Light needs to be considered as well. Page 85 talks about the capture of light which depends on two factors: - PAR, or the incidence of photosynthetically active radiation and - The efficiency of conversion of the intercepted radiation via photosynthesis. Everything about a leaf affects how much light it absorbs and how efficiently it does so. Dry matter production is linearly correlated with the quantity of radiation absorbed by the canopy: meaning the more light that is captured, more biomass is produced, up until the point the leaves are saturated with too much sunlight. This is where the canopy architecture becomes very important in distributing light. So, while it's important to take note of each leafs' contribution to the radiation capture, the structure of the canopy is going to affect how much radiation is converted where. It was mentioned in later chapters of the book that a tree can be seen as a collection of autotrophs sitting on a pile of Carbon. Indeed this is a helpful way to think about trees. Pages 111-112 are very interesting. Here Huxley talks about the quantity and quality of light penetrating the canopy. Plants are green because they absorb wavelengths in the red and blue sections while they reflect the green wavelengths. The upper canopy is absorbing the useable wavelengths up until the leaves are light saturated. They refract the rest of the spectrum in every direction, including down the vegetative strata. Thus the plants on the ground level have to evolve to a diffused quality of light. This is why, I think, the ground level plants have evolved to spread out and cover the ground: because they need to capture that light and it's more energy efficient to not fight gravity.

Page 94 mentions that water use can be thought about in the same way radiation use is, with additional considerations to stomatal openings and gas exchange. Water uptake is regulated in the short term and long term. Short term mechanisms operate over minutes or hours to reduce transpiration per unit area, like stomatal closure, leaf movements, and leaf rolling. Long term mechanisms happen over days or weeks and include the early termination of older leaves or slowing down the production/development of new leaves. Essentially less transpiration = less growth. Page 104 held a similar sentiment as page 85, "Dry matter production is often linearly related to the quantity of water transpired."

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Of course I gleaned much much more from this book, most of which within week 9 which I haven't even begun to talk about. All of these readings highlighted what there is to think about outside of the usual business work due when running a sole proprietorship on Edible Landscaping. Inspired by all this science I made a small and simple graph of my own which can be found here. It's also below as Fig 3. The X axis gives the month and the Y axis gives the billable hours within the month, and the lines connecting the data points represent the ebb and flow of billable hours I'll spend between various products of my business as projected on my Profit Projection spreadsheet.

As you can see, there is a very cyclical pattern to my work, as can be expected with something a seasonally based as Edible Landscaping.I do more maintenance and installation for my 6 month subscribers, which increases dramatically in year 2. I rely on consultation and design work for established clients (projects) to take up the bulk of my time, especially in winter. I install and maintain landscapes for the clients who aren't subscribers mostly during the growing season, with very little recruitment in the winter months. And I give myself mainly 10 hours a month to consult and design for new clients as part of the recruitment process. I like how my work flow slows down just in time for tax season.

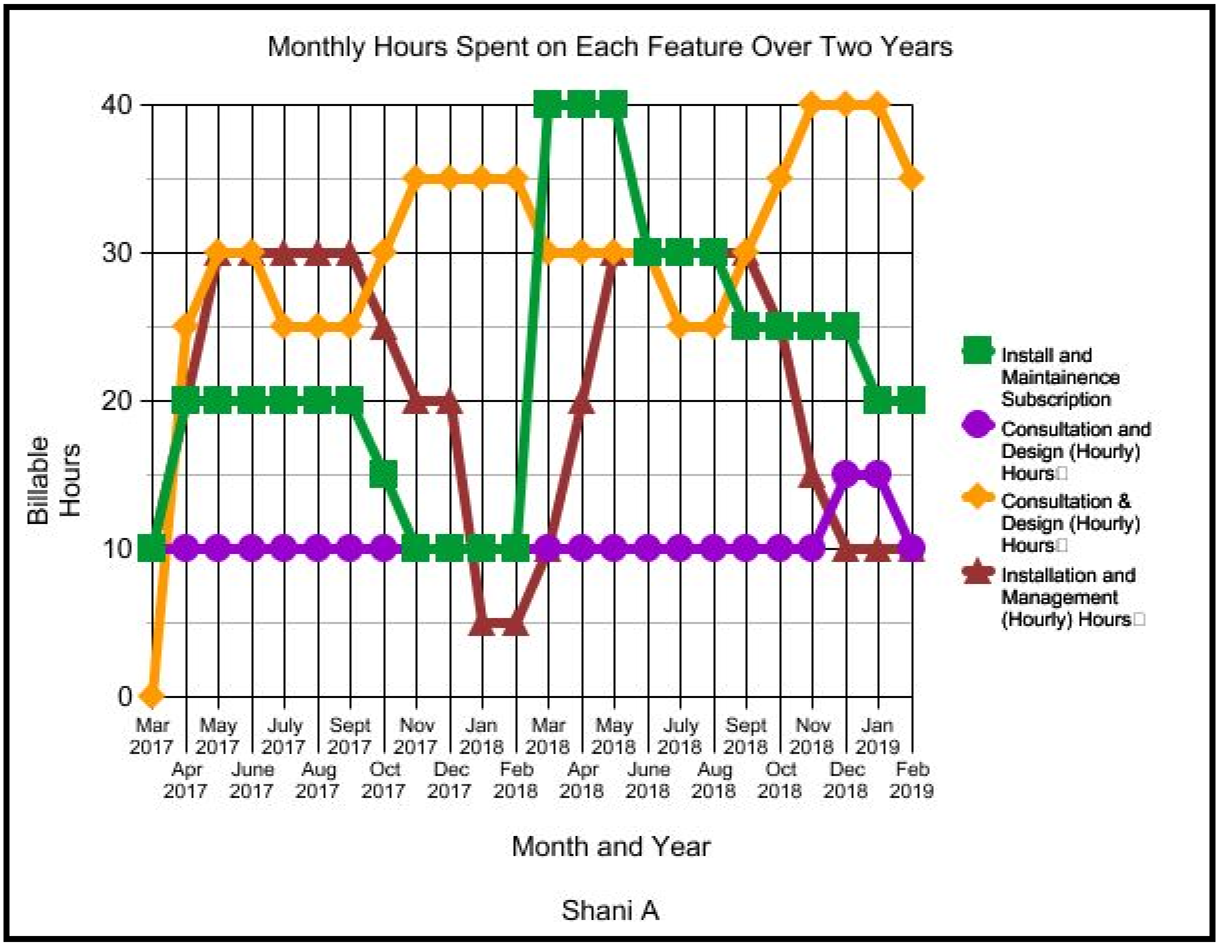

Fig 3

What am I to do now? I hope to keep reading Huxley and new articles as they come out, and as the expensive subscriptions allow me access. For next quarter I plan to do a lot of field work, specifically soil analyses of my client's yards, continue reading, and documenting my findings for 13 upper division credits. These analyses are inspired by that which I've read about this quarter. I hope this paper highlights how much I've learned, how dedicated I've been to understanding these complex interactions, and how I plan to incorporate it all for the most strategic utilization for my clients. Thanks very much for reading.

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