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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"? These are a few questions I tried to tackle this week in my peer-reviewed reading.

In David H. French's paper Ethnobotany of the Pacific Northwest Indians, (1965), he outlines a number of seeds, nuts, roots, leaves, stems, berries, and other fruits eaten by natives of the Pacific Northwest region. Many of these plants are still foraged and gleaned today. Though not much breeding has happened to promote bigger, tastier, or otherwise "improved" fruit quality, I think it would be a smart approach, especially in light of climate change, to strategically use native edible plants. This is in fact what I focused on in the summer of 2016 in my Native Berry Plants ILC. This paper acts as a small inventory for choice edible plants.

I followed this paper with another similar paper, Urban Foraging and the Relational Ecologies of Belonging by Melissa Poe et. all (2014). This paper highlights the many ways people become connected to place via foraging. This was a soft paper as what they highlighted was largely qualitative information. Nevertheless it is meaningful information. As they explain, foraging bridges cultures between native foragers, citizen foragers, and immigrant foragers; people who forage tend to be acutely aware of seasonal and ecological differences; people who forage tend to be connected to the other-than-human creatures who also participate in the foraged plants' life cycle; foraging connects people to their cities the same way the poke-go phone ap attempts to do. In all, foraging is a community builder and in my opinion, should correlate positively to a healthy urban microenvironment.

Producing Edible Landscapes in Seattle's Urban Forest by Rebecca Mclain, et al (2012) analyzes the state of Seattle's urban forests. They explain that green management projects have largely focused on ecosystem services while neglecting ecosystem products. So, while park space may be set aside for a handful of native or exotic trees to make people feel good and freshen up the air, that same space is being removed from food production. There are a few causes the authors outline for this, mostly zoning laws, or rules which discourage gleaners, or, as they say,

> "...the configurations they [urban forests] take are never politically neutral. The distribution of sociopolitical power shapes normative views of the purpose of urban forests. Whose vision dominates affects how urban forests are managed, who uses them, the kinds of activities considered appropriate in them, and, ultimately, their species composition and structure."

Straightforward enough, however, the problem they pointed out, is as urban sprawl continues outwards into rural lands, so to disappears land zoned for food production. As they say, with more than half of the world's population now living in cities, rural forests should return to what they historically have been used for: products like lumber, firewood, maple syrup, berries, livestock, etc. Depending on the agency in charge of the urban forests, far-reaching effects can be felt from any decision made. Should the urban forest just be designed for it's ecosystem services, or should it also provide products? The authors define urban forests as a number of Seattle's municipal agencies define urban forests: all of the trees on private and public land within the city. If a city were to be seen as a microhabitat within a further reaching arbitrary boundary line, than is it fair to say that a product/service-providing urban forest would help promote the health of the urban microenvironment and thus bring out the emergent properties of the community therein? What would that look like and how would you know when a city's emergent properties have surfaced? The number of trees defined as above within the city of Seattle is censused at 715,000+. What if those trees were treated as crops within the city?

What would urban agroforestry look like at such a scale? What economic effects would follow? How self reliant could a city be if they used their greenspace to service *and* produce?

However, who would be in charge of such operations? How would a task like edible urban agroforestry get funded? The paper highlights some avenues Seattle used to walk down such a path, these included the Urban Forestry Commision, the Parks and Recreation Department, the Department of Transportation, the Seattle Department of Neighborhoods, and the Beacon Food Forest. Could the same or similar entities be willing to do the same things here in Olympia? The paper mentions that the original and quickest interest to the public in relation to urban food was fruit: apples, plums, cherries, berries. These were products people got excited about, and thus, could they serve as the same needle eye for reform in Washington's capitol city?

I followed the above paper with the paper Lawn and Toxin: An Ecology of the City by Paul Robbins, et. al (2001) which inventoried and explored the usage of a couple common and harmful lawn chemicals. They start out with demonstrating how heavy yard chemical use has become a cultural norm. Through the efforts of chemical companies in advertising a standard (green lawns), emphasizing the problems (weeds), and providing the solutions (pesticides), they have managed to define a good neighbor as one which meets such this standard by any means necessary. This is so much so the case that neighbors will force legal action on a neighbor's yard, maybe even mow the yard themselves through trespassing, in order to maintain property values in correlation with such a standard. This does not bode well for any kind of ecological activist solely because of property lines. If we could take a step back and view each backyard of a neighborhood or city from a landscape perspective, the toxic pictures of this ecosystem is daunting. For each house to maintain this early seral, colonizer stage community they must use gross amounts of harmful chemicals. As the paper says,

“Representative of such problems is the acute question of urban water quality, which can be viewed through the lens of the lawn. While seemingly innocuous, lawns represent problems of urban ecology on a vast scale. In the United States, the toxic chemicals of lawn maintenance — including 2, 4-D, atrazine, glyphosate, diazinon, and dicamba — are significant contributors to nonpoint source water quality problems that continue to elude solution almost 30 years after the passage of the Clean Water Act (Adler et al., 1993). Lawn pesticides are applied on a scale to rival agricultural toxins; 23% of the total 2,4-D applied in the US is used on lawns; 22% of glyphosate, 31% of chlorpyrifos, and 38% of dicamba used nationally is applied to home lawns (United States Environmental Protection Agency, 1996). Moreover, US lawn maintenance entails heavy use of chemical fertilizers with their environmentally problematic nitrate loads. In 1984, more synthetic fertilizers were applied to American lawns than the entire nation of India applied to all its food crops combined (Talbot, 1990).”

Again, I want to highlight the urban sprawl problem I mentioned earlier: cities are getting bigger- more people are moving to the cities. How many hectares of lawns out of the already existing 16 million hectares will be doused in these harmful pesticides in the next month to add to the ecoload felt within the agricultural community? The paper articulates my next point quite well, so I’ll quote them again:

“The agricultural economy of the urban household, therefore, has its own “operational logic”, fitted to the demands of a local social economy (following Chayanov, 1986). Lawncare can be seen, in this way, to reflect investment in “landesque capital” (Blaikie and Brookfield, 1987) that, though a source of regional degradation, realizes value over time, **externalizing costs into the ambient ecosystem**, where degradation of groundwater, riverine environments, and wetlands all become public costs of private accumulation. The lawn problem is in this way similar to that of other urban common property systems, like auto emissions and unregulated garbage disposal, in that disaggregated private decisions and value-maximizing behaviors accumulate as systemic costs to society.”

This means that to realize personal gain from property values, homeowners are willing to externalize the damaging portions of their actions into the public domain.

The paper did a study on the demographics of harsh chemical users and found that it is the well educated, upper middle class population who uses the most chemicals most often. This is precisely my target market. What does that say? Even when people know about the damaging effects of these chemicals, they will still use them. To me that

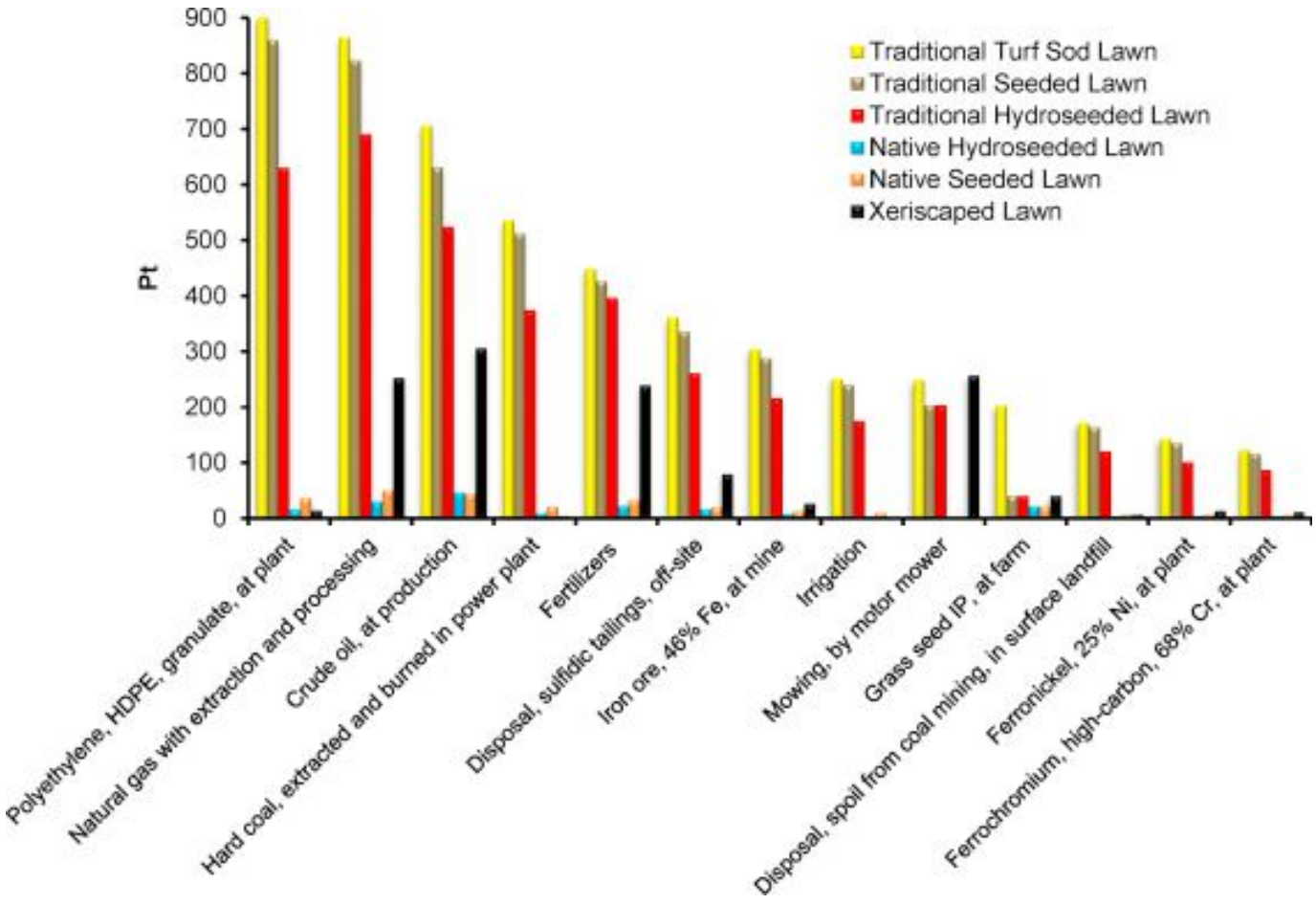
says that cultural norms -fitting in- are stronger than empirical data. Surely it has always been this way. However, how am I supposed to compete with that? If I'm making edible landscapes for people who have repeatedly and knowingly doused their lawns with toxins, how am I supposed to discourage that behavior? What kind of design would require the least amount of chemical applications from the layman? This is the question I explored in the following papers.

Sustainable Plants in Urban Parks: A Life Cycle Analysis of Traditional and Alternative Lawns in Georgia, USA is a study done by Smetana and Crittenden (2013) on six different landscape scenarios: (1) Traditional turf sod installation of bermudagrass; (2) traditional seeding of bermudagrass; (3) traditional hydroseeding of bermudagrass; (4) native prairie hydroseeding of four different spp; (5) native prairie seeding of four different spp; and (6) xeriscaped seeding of bermudagrass. They analyzed the cradle-grave life cycles of the above scenarios to identify which scenario during which portion of its life required the most/least resources to live, and what that meant to society overall. While they present very interesting data to compare the six scenarios against each other, they emphasize that the most expensive cost of all of them were the external resources each method necessitated:

"The highest impacts for the six scenarios were found in the areas of respiration inorganics, fossil fuel consumption, land use, carcinogens, and climate change..;.Of all compared scenarios, traditional turf sod scenario (1) has the highest impact values, which are connected with large expenditures of resources and energy during construction (growth of turf sod during the year before installation). Turf sod growth dominated almost all main impact categories (except crude oil production and transportation use). The scenario contained five main impact processes: irrigation (35.3%), growth and storage of grass seeds (17.6%), transportation (17.2%), fertilizer application (12.4%), and mowing (10.8%). It is difficult to propose any changes to make this scenario more sustainable because it is effective only with this combination of the

selected inputs. Therefore, we recognize scenario (1) as the least sustainable. Comparison of the LCA results for the maintenance stages supports this as well."

They have some very lovely graphs and tables visualizing the data they gathered. My favorite is the one below: **Fig 6** in the article- **The highest impact processes and comparison of their influence rate within different lawn scenarios at the maintenance stage**. Here we can see that traditional turf sod lawn (1) is the most demanding scenario, followed closely by traditional seeded lawn (2) and so on. This is problematic as "lawns are the main "crops" grown in the USA and Europe." So I know for my edible landscaping business that lawn care should not, ethically, be in my offered services package.



This next paper is one I got very excited about: The Emergy Evaluation of Food Production in Urban Residential Landscapes by Travis Beck et. al (2003). This paper is amazing, it 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. This type of experiment is pertinent to what I want to do- how can I be sure that I'm doing the right thing for the environment which urban landscapes externalize costs into? How can I prize "sustainability" in my mission statement and prove that I am doing so?

By translating different qualitative and quantitative values to calculable values, the authors were able to quantify the units of renewable resources, non-renewable resources, materials, and services and compare that to the units of yield each system provided. Fascinating data, really well done. They did these calculations using real data in year one, then projected the data for the following four years. They adjusted these data for perennial growth and decreasing necessities and average rainfall and sunlight to achieve what they hope is an accurate measurement. In the end they found that none of the above scenarios even came close to their unit value of "sustainable" (0=not sustainable, 1=most sustainable), which is to say that the systems did not yield more in outputs than it took to establish them in inputs. In descending order, the most "sustainable" system was the intensive organic garden, followed by the edible landscape and the forest garden, and finally the ornamental garden. Of course the biggest cost for edible landscapes and forest gardens were the external materials taken ex citu and transported in situ. Very sad news indeed. However when they compared

these systems to the same systems taking place close to the equator which surpassed their unit value of “sustainable” (1.78, 1.81, 1.42), it started me thinking that we northerners will never reach such a value because we do not have year around growth. There is a cold season in which deciduous plants go dormant. Perhaps however, in light of the changing climate and the decreasing cold days projected for our region, we might just have year round growth for hardier plants, and might end up meeting the “sustainable” unit value with certain systems. Furthermore if materials can be produced on site or very close to the site, the “sustainable” unit values for each system might look very different.

I supplement my article readings with a few chapters out of the Urban Soils book my Phillip Craul.I’m mainly taking notes from this book and don’t wish to rewrite those notes in this paper. However there are a few bits of information which were new to me and got me thinking about things a little differently.Chapter three talks about points of heat and how that heat energy is passed to a tree. This is an important aspect because as Craul says on page 41 paragraph 1 in regards to surface temperature in cities,

“...research by the department of Meteorology at Pennsylvania State University...shows very significant rise in surface temperatures caused by urban development as detected by satellite imagery. The average increase from 1987-1996 over Chester County, Pennsylvania, area was 36%. In an area enclosing a state park, the increase was 109%.”

That is a massive increase in temperature and definitely something to think about when dealing with urban edible landscape designs. The heat energy is either being convected through the wind, conducted through different masses in contact with each other, radiated from the sun, or dissipated through latent heat transfer via evaporation and/or water condensation. Then add in any reflective surface and heat mass nearby, and

suddenly we have a different environment than what native Washington plants are evolved for. The urban heat-island effect reminds of planting in a greenhouse and thus, should I choose for plants comfortable in such an environment?

As I say the Urban Soils book offers much more information than I can share, but in all, everything I have read this last week has given lots to think about as I move forward in my business.

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