

Agro-forestry & Silvo-pasture: the future of food and restorative land management

The rate of social change is unimaginably rapid. Take the example of electricity: lights, trains, the internet, mobile phones & refrigeration. Less than a hundred years ago, most of the world lived without these things, and even today about 1/3 of the world's people continue to live without power or a reliable source of it. In this article I will be discussing *agro-ecosystems*, not social change. The example merely serves to charge the imagination a little; to make it capable of stretching out to view possibilities beyond its container of mind, a thing also ordinarily limited by its appetite for objects of study, e.g. the present day, books and media also focused on the present or the past. Please bear with me, dear reader, as the commentary shifts again.

I like to study history for imagining *the future*. *Changes in the Land* by William Cronon is one book of many that have aided me in understanding the inseparable history of ecology and society and in particular of how rapidly culture and economic need leads environmental change. Is it possible the Eastern woodlands may again be drastically diminished? Due to shortages of heating oil, for instance, how many years would this rich forest survive millions of homes seeking an alternative heat source? I would not like to waste time pondering this question because it is much too urgent *now* to imagine solutions for present-day problems. Understanding the entangled issues of society and environment, it becomes a vital necessity to work on agricultural systems that will become models for designing and managing farm ecosystems for resiliency. Doing so will prevent further disturbance to soil, land and water when changes arise in the social system.

In its biggest usage, agriculture is the production of not only food, but also fuel, fodder, fiber and medicine. Everyone eats and because of this, they make agricultural choices that directly affect climate change, ecosystem destruction, species extinction, social justice, racial and gender equality. Agriculture weighs heavily in all of these issues. Unfortunately, agriculture has never produced much money in its dependence on uncontrollable natural forces, commodity price windfalls, lack of everyday production (duration from input to output) etc. For this very reason, rural districts worldwide have experienced ongoing '*brain drain*' as the smart kids leave for better pay and the remaining ones become exploited by businesses unsentimental for consistent harvests, clean water, fertile soil and family livelihoods. This is when I invite the reader to imagine robotic arms and diesel machines raking the earth of its dry derivatives from single-crop fields of chemical-controlled waste-farms (please, let's not talk about farm animals).

On the bright side of industrial agriculture, there is a movement rapidly gaining momentum to rehabilitate land devastated both by industrial agriculture and the pressure of subsistence economy populations. The main tool of these new land managers is the integration of production systems for maximum output while reducing inputs through an exchange of ecological services. This exchange could fill a university level agro-ecology class, so I will keep it simple and funnel words into imagination again: *animals graze an improved mixture of broad-leafed plants, grass & legumes between rows of trees. These trees are of multiple distinct species, multi-strata and multi-purpose; some produce nuts and fruit. A few rows away, an electric wire keep the grazing ruminants away from vegetables, root crops and grain growing*

between rows of trees. A number of workers are trimming the lower branches of some tall-looking, fast growing tree species and spreading their leaves and branches as a fertilizer for the nut and fruit trees. The leaves are carried away as a feedstuff for animals and used as green manure for the annual crops. Nearby, a tractor purrs with its diesel hiss, waiting for the augur of a mechanical nut raker to finish loading its trailer with chestnuts bound for the co-operative mill.

For an example of this kind of system watch the video titled **Syntropy** from Brazil, highlighting Ernst Gotsch's efforts there. The rate of carbon sequestration and implications for climate change mitigation & *reversal* is incredibly high with such an integration of production systems (E. Toensmeier, 2016. *'Carbon Farming'*). Sequestration of carbon dioxide in the soil by the action of plant photosynthesis and root exudates plus *effective management* (take note of this for later) is paralleled by a rise in soil fertility. This means reduction of inputs like synthetic fertilizer and chemicals. Additionally, the production of food can be massively higher than any rice paddy or cornfield, possibly 7-10 times higher (M. Shepherd, 2013). *Silvo-pasture* systems that incorporate timber or orchard trees into animal pasture and contour alley cropping of agro-forestry systems are getting lots of attention. In light of this, 60 experts published an article in the UN's Trade and the Environment Review (*'Wake Up Before it's Too Late'*, 2013) stating that despite good efforts underway, industrial farm systems that tweak their standards of production will *not* mitigate land degradation and climate change or be able to feed the world. The article says only integrated agro-ecological and organic systems practiced widely offer hope of both feeding the world and regenerating land and managing it sustainably. Agro-forestry and *Silvo-pasture* are brightly included terms in the cover letter of "key recommendations".

I will now highlight my work in this field, working on three sites in Eastern North America doing multi-species orchard installations. I am hopeful these fields will be managed for maximum production and used as education sites. Here, maximum production means incorporating N-fixing trees for coppice/fertilizer/fodder, continually re-planting them on a regular cycle, running animals in the field, and producing annual crops in conjunction with the trees. The first site is adjacent to my home in North Carolina on 19 acres of steep pasture with an existing dairy operation of six cows. The land dries out on account of being so steep, so we have dug water retaining ditches called *swales* to hold moisture and as a means of preparing the ground for rows for trees. Temporary electric wire protects the young trees from grazing. So far, we have planted 100 Black Locusts, 95 Chinese Chestnuts, 40 apples and pears, 20 Hazelnuts, plus 40 each of Mulberries, Russian Olives and Persimmons.

The second site is two hours west of there in Tennessee. **Ananda Arpana** is a project of comprehensive scope associated with the economic ideas of Prabhat Sarkar on decentralization embedded in his *Progressive Utilization Theory*, or PROUT and materialized in the form of what he called a *Master Unit*. He used this term to describe multi-dimensional centers for service, innovation and sustainability with the goal of elevating rural districts worldwide. These projects strive to create replicable models in numerous areas of human endeavor, including agriculture, education and medicine, to name a few. At Ananda Arpana, I have designed and helped install 1,200 beneficial trees on a rolling 2.9 acre field. We prepared the field by cutting swales with a plow and 80 HP tractor, then planted trees, including 500 nitrogen fixers, 100 chestnuts and 120 Hazelnuts.

The third orchard is on 1.2 acres of old hay field at another Master Unit project called **Ananda**

Viplava near Albany New York. Here, the land is flat so I have spaced trees father apart for alley cropping in between trees. This installation incorporates Black Locust and Siberian Pea Shrub as fodder/fertilizer trees plus Chestnuts, northern Pecans and hybrid Hazelnuts. With it's attainable plans for a seminar business and close proximity to many centers of higher education I am hopeful this project will help to promote agro-forestry in the Northeast.

Such integrated planting schemes using high density plantings of beneficial trees and perennial crops provides a variety of ecological services through diversity and a demonstration in how rapidly old farmland can be improved and made productive by the *appropriate* application of science. This cropping pattern foretells of a direct shift from dependence on annuals as staple foods (carbohydrates, proteins and fats) to include perennials. Perennial plants like trees grow year-after-year undergoing their reproductive stages of life after 1-10 years of vegetation whereas annuals complete vegetative and reproduction within one year, typically aided by farmers who eliminate competition of other plants through cultivation of the soil or chemicals.

The key to maximum production is *management*. By proper design, dense planting, pruning & cutting the fodder/fertilizer trees, rotational grazing and rotationally cropping in between rows of trees, an efficiency of nutrient-cycling is reached that requires no inputs. The necessity of increased management via trimming and dense plantings ensures ongoing productive returns with the priceless investment in long-term fertility of the soil. In contrast, modern industrial farming is like a mining operation in the sense that it employs chemical inputs and a *minimum* of human management to extract crops with negative returns year-after-year unless added inputs are used. The soil is merely a substrate to anchor plants feeding on a chemical solution.

Many people declare that silvo-pasture is easily practiced by turning their animals loose in the forest, but this is where such simple thinking gets muddy. The colonial settlers of the eastern states did this commonly with terrible consequences. Not only did the forest offer little animal forage because the soil and plants were not prepared for browsing, but their animals often got sick. A productive and sustainable silvo-pasture system is actually an intentional process, requiring that the forages be of such species capable of growing back from heavy browsing (typically grasses and forbs of European origin), appropriate for eating, and that the grazing be seasonal + rotational and not exceed recommended stocking rates of animals per unit land. Trees in this systems should be managed for soil fertility as much for their production of timber, timber by-products, fruit, nuts and medicine.

The questions arises: are animals necessary? This depends of course on the interest and goals of the farm and it's capacity to manage unintended growth of other species by mowing, pruning or chemicals. The one idea that I will volunteer in this regard is that wild ecosystems always have animals and because our goal is to create agro-ecosystems it is important to incorporate animals in order to obtain a peak of productivity and efficient cycling of nutrients. Here, scientific management means maintaining plants at the height of their bell curve by not grazing our domestic animals too early or too late. Grazing or trimming many types of plants well before flowering (solstice) maximizes their vegetative states, enabling them to become more productive later on. Incidentally, this sequesters huge amounts of carbon into plants and the soil.

It has been estimated that in the next 15 years another 2 to 3 billion hungry human beings will come to Earth before the global population begins to plateau. Without a sharp increase in the

amount of farmland appropriately using science to integrate production systems, wild lands will continually be thrashed and existing farmland will fail to produce without chemical controls. Supporting farmers, agro-foresters and permaculturalists working at the farm-scale is going to be an essential part of repairing the damage of the last century. A new vision of the natural world and a new experience of how we live becomes possible when the terms *agriculture* and *ecosystem* collide. The desperate race to save species and the last wild places of the Earth comes into focus when we understand the necessity and possibility of radically, rapidly changing the farm and forestland we're using and abusing already, if not in the seat of a tractor, with our money and food choices. Such changes in land management with an increasing development of perennial crops may imply shifts in human dietary patterns. If you're interested in this subject, there may be a ready market for a cookbook titled something like **Food Forest Cuisine**. That's all for now, you may contact me here: ravenridgefarm@gmail.com.

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