Is Sustainable Agriculture an Oxymoron?

This is a guest post by Toby Hemenway, author of Gaia's Garden, a Guide to Home Scale Permaculture. It is being republished with the author's permission. It was previously published on his blog, Pattern Literacy.

Jared Diamond calls it "the worst mistake in the history of the human race."(1) Bill Mollison says that it can "destroy whole landscapes."(2) Are they describing nuclear energy? Suburbia? Coal mining? No. They are talking about agriculture. The problem is not simply that farming in its current industrial manifestation is destroying topsoil and biodiversity. Agriculture in any form is inherently unsustainable. At its doorstep can also be laid the basis of our culture's split between humans and nature, much disease and poor health, and the origins of dominator hierarchies and the police state. Those are big claims, so let's explore them.

Permaculture, although it encompasses many disciplines, orbits most fundamentally around food. Anthropologists, too, agree that food defines culture more than our two other physical needs of shelter and reproduction. A single home-building stint provides a place to live for decades. A brief sexual encounter can result in children. But food must be gotten every day, usually several times a day. Until very recently, all human beings spent much of their time obtaining food, and the different ways of doing that drove cultures down very divergent paths.

Anthropologist Yehudi Cohen (3) and many subsequent scholars break human cultures into five categories based on how they get food. These five are foragers (or hunter-gatherers), horticulturists, agriculturists, pastoralists, and industrial cultures. Knowing which category a people falls into allows you to predict many attributes of that group. For example, foragers tend to be animist/pantheist, living in a world rich with spirit and in which all beings and many objects are ascribed a status equal to their own in value and meaning. Foragers live in small bands and tribes. Some foragers may be better than others at certain skills, like tool making or medicine, but almost none have exclusive specialties and everyone helps gather food. Though there may be chiefs and shamans, hierarchies are nearly flat and all members have access to the leaders. A skirmish causing two or three deaths is a major war. Most of a forager's calories come from meat or fish, supplemented with fruit, nuts, and some wild grain and tubers.(4) It's rare that a forager will overexploit his environment, as the linkage is so tight that destruction of a resource one season means starvation the next. Populations tend to peak at low numbers and stabilize.

The First Growth Economy

Agriculturists, in contrast, worship gods whose message usually is that humans are chosen beings holding dominion, or at least stewardship, over creation. This human/nature divide makes ecological degradation not only inevitable but a sign of progress.

While the forager mainstays of meat and wild food rot quickly, domesticated grain, a hallmark innovation of agriculture, allows storage, hoarding, and surplus. Food growing also evens out the seasonal shortages that keep forager populations low.

Having fields to tend and surpluses to store encouraged early farming peoples to stay in one place. Grain also needs processing, and as equipment for threshing and winnowing grew complex and large, the trend toward sedentism accelerated.(5)

Grains provide more calories, or energy, per weight than lean meat. Meat protein is easily transformed into body structure—one reason why foragers tend to be taller than farmers—but turning protein into energy exacts a high metabolic cost and is inefficient.(6) Starches and sugars, the main components of plants, are much more easily converted into calories than protein, and calories are the main limiting factor in reproduction. A shift from meat-based to carbohydrate-based calories means that given equal amounts of protein, a group getting its calories mostly from plants will reproduce much faster than one getting its calories from meat. It's one reason farming cultures have higher birth rates than foragers.

Also, farming loosens the linkage between ecological damage and food supply. If foragers decimate the local antelope herd, it means starvation and a low birth rate for the hunters. If the hunters move or die off, the antelope herd will rebound quickly. But when a forest is cleared for crops, the loss of biodiversity translates into more food for people. Soil begins to deplete immediately but that won't be noticed for many years. When the soil is finally ruined, which is the fate of nearly all agricultural soils, it will stunt ecological recovery for decades. But while the soil is steadily eroding, crops will support a growing village.

All these factors—storable food, surplus, calories from carbohydrates, and slow feedback from degrading ecosystems—lead inevitably to rising populations in farming cultures. It's no coincidence, then, that farmers are also conquerors. A growing

population needs more land. Depleted farmland forces a population to take over virgin soil. In comparison, forager cultures are usually very site specific: they know the habits of particular species and have a culture built around a certain place. They rarely conquer new lands, as new terrain and its different species would alter the culture's knowledge, stories, and traditions. But expansion is built into agricultural societies. Wheat and other grains can grow almost anywhere, so farming, compared to foraging, requires less of a sense of place.

Even if we note these structural problems with agriculture, the shift from foraging at first glance seems worth it because—so we are taught—agriculture allows us the leisure to develop art, scholarship, and all the other luxuries of a sophisticated culture. This myth still persists even though for 40 years anthropologists have compiled clear evidence to the contrary. A skilled gatherer can amass enough wild maize in three and a half hours to feed herself for ten days. One hour of labor can yield a kilogram of wild einkorn wheat.(7) Foragers have plenty of leisure for non-survival pleasures. The art in the caves at Altamira and Lascaux, and other early examples are proof that agriculture is not necessary for a complex culture to develop. In fact, forager cultures are far more diverse in their arts, religions, and technologies than agrarian cultures, which tend to be fairly similar.(3) And as we know, industrial society allows the least diversity of all, not tolerating any but a single global culture.

A Life of Leisure

We're also taught that foragers' lives are "nasty, brutish, and short," in Hobbes's famous characterization. But burial sites at Dickson Mounds, an archaeological site in Illinois that spans a shift from foraging to maize farming, show that farmers there had 50% more tooth problems typical of malnutrition, four times the anemia, and an increase in spine degeneration indicative of a life of hard labor, compared to their forager forebears at the site.(8) Lifespan decreased from an average of 26 years at birth for foragers to 19 for farmers. In prehistoric Turkey and Greece, heights of foragers averaged 5′-9″ in men and 5′-5″ in women, and plummeted five inches after the shift to agriculture (1). The Turkish foragers' stature is not yet equaled by their descendants. In virtually all known examples, foragers had better teeth and less disease than subsequent farming cultures at the same site. Thus the easy calories of agriculture were gained at the cost of good nutrition and health.

We think of hunter-gatherers as grimly weathering frequent famine, but agriculturists fare worse there, too. Foragers, with lower population densities, a much more diverse food supply, and greater mobility, can find some food in nearly any conditions. But

even affluent farmers regularly experience famine. The great historian Fernand Braudel (9) shows that even comparatively wealthy and cultured France suffered country-wide famines 10 times in the tenth century, 26 in the eleventh, 2 in the twelfth, 4 in the fourteenth, 7 in the fifteenth, 13 in the sixteenth, 11 in the seventeenth, and 16 in the eighteenth century. This does not include the countless local famines that occurred in addition to the widespread ones. Agriculture did not become a reliable source of food until fossil fuels gave us the massive energy subsidies needed to avoid shortfalls. When farming can no longer be subsidized by petrochemicals, famine will once again be a regular visitor.

Agriculture needs more and more fuel to supply the population growth it causes. Foragers can reap as many as 40 calories of food energy for every calorie they expend in gathering. They don't need to collect and spread fertilizer, irrigate, terrace, or drain fields, all of which count against the energy gotten from food. But ever since crops were domesticated, the amount of energy needed to grow food has steadily increased. A simple iron plow requires that millions of calories be burned for digging, moving, and smelting ore. Before oil, one plow's forging meant that a dozen trees or more were cut, hauled, and converted to charcoal for the smithy. Though the leverage that a plow yields over its life may earn back those calories as human food, all that energy is robbed from the ecosystem and spent by humans.

Farming before oil also depended on animal labor, demanding additional acreage for feed and pasture and compounding the conversion of ecosystem into people. Agriculture's caloric yield dipped into the negative centuries ago, and the return on energy has continued to degrade until we now use an average of 4 to 10 calories for each calorie of food energy.

So agriculture doesn't just require cropland. It needs inputs from vast additional acreages for fertilizer, animal feed, fuel and ore for smelting tools, and so on. Farming must always drain energy and diversity from the land surrounding cultivation, degrading more and more wilderness.

Wilderness is a nuisance for agriculturists, a source of pest animals and insects, as well as land that's just "going to waste." It will constantly be destroyed. Combine this with farming's surplus of calories and its need for large families for labor, and the birth rate will rise geometrically. Under this brutal calculus of population growth and land hunger, Earth's ecosystems will increasingly and inexorably be converted into human food and food-producing tools.

Forager cultures have a built-in check on population, since the plants and animals they depend on cannot be over-harvested without immediate harm. But agriculture has no similar structural constraint on over-exploitation of resources. Quite the opposite is true. If one farmer leaves land fallow, the first neighbor to farm it gains an advantage. Agriculture leads to both a food race and population explosion. (I cannot help but wonder if eating high on the food chain via meat, since it will reduce population, is ultimately a more responsible act than eating low on the food chain with grains, which will promote larger populations. At some point humans need to get the message to slow their breeding.)

We can pass laws to stop some of the harm agriculture does, but these rules will reduce harvests. As soon as food gets tight, the laws will be repealed. There are no structural constraints on agriculture's ecologically damaging tendencies.

All this means that agriculture is fundamentally unsustainable.

The damage done by agriculture is social and political as well. A surplus, rare and ephemeral for foragers, is a principal goal of agriculture. A surplus must be stored, which requires technology and materials to build storage, people to guard it, and a hierarchical organization to centralize the storage and decide how it will be distributed. It also offers a target for local power struggles and theft by neighboring groups, increasing the scale of wars. With agriculture, power thus begins its concentration into fewer and fewer hands. He who controls the surplus controls the group. Personal freedom erodes naturally under agriculture.

The endpoint of Cohen's cultural continuum is industrial society. Industrialism is really a gloss on agriculture, since industry is dependent on farming to provide low-cost raw materials that can be "value-added," a place to externalize pollution and other costs, and a source of cheap labor. Industrial cultures have enormous ecological footprints, low birth rates, and high labor costs, the result of lavishing huge quantities of resources—education, complex infrastructure, layers of government and legal structures, and so on—upon each person. This level of complexity cannot be maintained from within itself. The energy and resources for it must be siphoned from outlying agricultural regions. Out there lie the simpler cultures, high birth rates, and resulting low labor costs that must subsidize the complexity of industry.

An industrial culture must also externalize costs upon rural places via pollution and export of wastes. Cities ship their waste to rural areas. Industrial cultures subsidize

and back tyrannical regimes to keep resource prices and labor costs low. These tendencies explain why, now that the US has shifted from an agrarian base to an industrial one, Americans can no longer afford to consume products made at home and must turn to agrarian countries, such as China and Mexico, or despotic regimes, such as Saudi Arabia's, for low-cost inputs. The Third World is where the First World externalizes the overwhelming burden of maintaining the complexity of industrialism. But at some point there will be no place left to externalize to.

Horticulture to the Rescue

As I mentioned, Cohen locates another form of culture between foraging and agriculture. These are the horticulturists, who use simple methods to raise useful plants and animals. Horticulture in this sense is difficult to define precisely, because most foragers tend plants to some degree, most horticulturists gather wild food, and at some point between digging stick and plow a people must be called agriculturists. Many anthropologists agree that horticulture usually involves a fallow period, while agriculture overcomes this need through crop rotation, external fertilizers, or other techniques. Agriculture is also on a larger scale. Simply put, horticulturists are gardeners rather than farmers.

Horticulturists rarely organize above the tribe or small village level. Although they are sometimes influenced by the monotheism, sky gods, and messianic messages of their agricultural neighbors, horticulturists usually retain a belief in earth spirits and regard the Earth as a living being. Most horticultural societies are far more egalitarian than agriculturists, lacking despots, armies, and centralized control hierarchies.

Horticulture is the most efficient method known for obtaining food, measured by return on energy invested. Agriculture can be thought of as an intensification of horticulture, using more labor, land, capital, and technology. This means that agriculture, as noted, usually consumes more calories of work and resources than can be produced in food, and so is on the wrong side of the point of diminishing returns. That's a good definition of unsustainability, while horticulture is probably on the positive side of the curve. Godesky (10) believes this is how horticulture can be distinguished from agriculture. It may take several millennia, as we are learning, but agriculture will eventually deplete planetary ecosystems, and horticulture might not.

Horticulturists use polycultures, tree crops, perennials, and limited tillage, and have an intimate relationship with diverse species of plants and animals. This sounds like permaculture, doesn't it? Permaculture, in its promotion of horticultural ideals over

those of agriculture, may offer a road back to sustainability. Horticulture has structural constraints against large population, hoarding of surplus, and centralized command and control structures. Agriculture inevitably leads to all of those.

A Steep Price

We gave up inherently good health as well as immense personal freedoms when we embraced agriculture. I once thought of achievements such as the Hammurabic Code, Magna Carta, and Bill of Rights as mileposts on humanity's road to a just and free society. But I'm beginning to view them as ever larger and more desperate dams to hold back the swelling flood of abuses of human rights and the centralization of power that are inherent in agricultural and industrial societies. Agriculture results, always, in concentration of power by the elite. That is the inevitable result of the large storable surplus that is at the heart of agriculture.

It is no accident that permaculture's third ethic wrestles with the problem of surplus. Many permaculturists have come to understand that Mollison's simple injunction to share the surplus barely scratches the surface of the difficulty. This is why his early formulation has often been modified into a slightly less problematic "return the surplus" or "reinvest the surplus," but the fact that these versions have not yet stabilized into a commonly held phrasing as have the other two ethics, "Care for the Earth" and "Care for People," tells me that permaculturists have not truly come to grips with the problem of surplus.

The issue may not be to figure out how to deal with surplus. We may need to create a culture in which surplus, and the fear and greed that make it desirable, are no longer the structural results of our cultural practices. Jared Diamond may be right, and agriculture and the abuses it fosters may turn out to be a ten-millennium-long misstep on the path to a mature humanity. Permaculture may be more than just a tool for sustainability. The horticultural way of life that it embraces may offer the road to human freedom, health, and a just society.

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