

## **In Defense of Livestock-Based Agriculture**

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This paper will explore the thesis that livestock are the foundation of post-oil agriculture. Arguments will be presented to support the necessity of a) shifting the balance between perennial and annual crops; b) re-integrating crop and livestock agriculture on farms in general, and on organic farms in particular, and c) focusing not on individual enterprises, but rather on mixtures strategically designed to capture positive economic and ecological synergies.

An overarching theme is the need to get your ducks well aligned before aiming at the target. If the goal is to redirect the trajectory of agriculture in anticipation of a resource-limited future, then first be sure to distinguish *problems* from *symptoms* of problems. *Fixing symptoms* obscures the issues and dilutes the focus needed to redress the root causes.

Limitations: Livestock-based agriculture is viewed solely through the lens of ecological, and to a lesser extent, economic sustainability. Equally critical arguments bearing on such issues as human nutrition, sector consolidation, animal rights, livestock pandemics and so on are left to other commentators.

### **FACTORY FARMING**

Livestock means factory farming for many of those who take the time to enquire about where their food comes from. Of concern to many, and rightly so, are the health and welfare of factory-farmed livestock, as documented in everything from John Robbin's The Food Revolution to Robert Kenner's newly released Food, Inc.. Add to this the transparent inefficiency of feeding grain to livestock, as well as the GHG evolving from livestock, the health and epidemiological risks arising from prophylactic antibiotics in livestock feed, the 20,000 square km (and growing) hypoxic zone at the mouth of the Mississippi created largely by runoff from corn destined for livestock feed, and .... well, take your pick - the list just goes on and on. Plenty of easy targets.

But are livestock the problem, or is it the context in which we have placed them? Is the rejection of livestock in favor of a plant-based diet the best solution, or might it actually make things worse? Might livestock, and specifically grass-fed livestock, be an essential prerequisite to sustaining food production, period?

Big Picture Message? The unsustainability of agriculture did not originate with Cargill, Tyson, or factory farming. Whether the American Dust Bowl, the vanished Anasazi, or the lost empire of Mesopotamia - humans have a long history of farming themselves to oblivion. It follows then, that to sustain agricultural capacity into the future we need to look aim much higher than just ending factory farming.

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<sup>1</sup>In the interests of transparency, I will disclose at the outset that I write from a nearly 30 year career as an academic specializing in grass farming, and more recently, in organic farming systems.

## WHAT WOULD ECOLOGICALLY SUSTAINABLE AGRICULTURE LOOK LIKE?

Organic? For sure. But organic according to contemporary North American organic standards is not enough. Organic standards do indeed help us to avoid many of the needless harms we've imposed upon ourselves in recent decades. But as practiced today, some forms of organic are clearly unsustainable, and not just those that aim to reach global markets. Why unsustainable? I would suggest that the absence of livestock is just one of the many elements that detract from sustainability on many organic as well as conventional farms. Unlike biodynamic standards that require livestock to be integrated into farm operations, contemporary organic standards have been interpreted to permit the same commodification, polarization, and specialization which have rendered unsustainable our conventional neighbors.

So what's to be done? Those intending to fix a problem must start by clearly identifying the problem, and most importantly, by clearly distinguishing the problem from the symptoms created by the problem. *Fixing symptoms* just prolongs the problem, like putting a band-aid on skin cancer.

I put it to you that factory farming is actually just a symptom of a broader malaise, and that it is the broader issue which should be occupying our creative efforts in redesigning agriculture.

As a first step, consider that avoiding the fate of countless other failed cultures before us - most of which had little or no livestock - requires a significant shift away from *annual<sup>2</sup>-based* agriculture to a *perennial<sup>3</sup>-based agriculture* centering on grass-fed livestock<sup>4</sup>. Judging from the scientific and popular press, this is an argument that is not quite so outlandish today as when it first appeared.

## WHAT'S WRONG WITH ANNUALS?!

Most of global nutrition today comes from barely a dozen crops, with **large-seeded annuals** like corn, rice, and wheat accounting for the lion's share. So what?

As elaborated in Jared Diamond's Guns, Germs, and Steel, large-seededness in annuals is really an adaptation to the distinctive stresses of the Mediterranean environment. Large-seededness appears to be a strategy to survive the rigors of the protracted summer drought and uncertain winter rains characteristic of Mediterranean zones, including the Near East where human settlement arose some 10,000 years ago.

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<sup>2</sup> plants that live out their lives out within a single year, including most vegetables and all grain crops, such as corn, soy, wheat, barley, and oats

<sup>3</sup> plants that live 3 or more years, including most fruits and nut-bearing trees,

<sup>4</sup> horses, cattle, sheep, and goats evolved to consume grass and some woody species; pigs can consume diets largely or wholly made of grass, while grass can be part of a diet for chickens and turkeys

While adaptive in the Mediterranean zone, the large seeded annual crops carried by human migration around the globe have proven to be not just ill-suited but even mal-adaptive to the ecological sustainability of agriculture. Paraphrasing from Wes Jackson, David Tilman, and others:

- Annuals introduce **periodicity into nutrient sinkness**, leaving gaps early and late in the year. These gaps coincide with times when precipitation exceeds evapotranspiration and the net direction of water movement is downwards. Water flushing through and over the soil leads to leaching, erosion, and/or gaseous losses of soil fertility, as we've seen at the mouth of the Mississippi, in Chesapeake Bay, and elsewhere. Because little or no active nutrient uptake occurs in spring before planting and in fall after harvest, agriculture centering on annual crops necessarily introduces nutrient leakiness and loss. Cover crops help, to be sure, but it is a real challenge to manage an annual crop system that approximates the tight nutrient cycle naturally achieved by a perennial sward.
- Annuals require **bare soil**. Nature has evolved strategies, such as the soil seedbank, seed rain, and laterally encroaching vegetation to keep the ground covered. Keeping soil bare, apart from the sown crop, means perpetual war with Nature, whether through tillage or herbicides. A perennial grass sward, however, behaves a lot like Nature, keeping the ground covered year-around, but with an economically valuable crop.
- Annuals are almost always sown in **monocrops**, impoverishing the plant **biodiversity** so vital to many of the functions that sustain natural ecosystems, including controlling pestiferous populations. Perennial grass swards, in contrast, quickly become biodiverse even if sown to just a few species, and are thus better able to sustain ecosystem functions.
- Annually re-setting a field back to the pioneer stage loses the accumulating advantages of **succession**, which include building soil organic matter and nutrients, with follow-on benefits in water conservation, risk management, and disease/pest control. Again, perennials intrinsically capture these advantages, which is why withholding land from cultivation under a perennial grass sward actually builds and regenerates soil damaged by annual cropping (see Regeneration Through Grass Ley Farming below)
- Modern agriculture **linearizes** nutrient flow, extracting nutrients to deficit in one place and concentrating them to excess in another. In factory farms, the excess is in the form of manure, which creates its own suite of pest, pathogen, and odor problems. By generating both scarcity and excess, linear nutrient cycles shorten the lifespan of a civilization, as discerned a hundred years ago in King's Farmers of Forty Centuries. Real sustainability - not for 10 or 20 years but for 4000 years, demands nutrient return - popularized as Howard's 'Law of Return'. All marketed commodities export nutrients, but implied nutrient export in the form of meat, milk, or eggs is typically an order of magnitude less than from the same land marketed as an annual crop. For this reason, stockless organic farms typically have to counterbalance their exported nutrients by importing manure from neighbors - who are often not organic - profiling one of the several conflicts of stockless organic farming.

From this perspective, where humanity has transgressed - exceeded the forgiveness limits of Nature - in both historic and contemporary times is in giving annual crops such a prominent place at the table<sup>5</sup>. And be very clear that this reasoning pertains whether it is cauliflower or soybean, conventionally or organically grown, and arguably, independent of tillage practices. Using conservation-till practices<sup>6</sup> in order to prolong annual cropping is at best a weak proxy for the robust benefits of withholding land from cultivation under a perennial grass sward.

Doubts about the sustainability of agriculture didn't arise overnight. After all, humanity has been based on annual and especially cereal-based agriculture for some 10,000 years, apart from those inconvenient intervals of oblivion. Annual crops are part of what we are - of what we eat - of where we came from. Who can resist the eloquence of a Wendell Berry or a David Kline, evoking the sights, sounds, and scents of spring plowing? But at what cost, this annual working of the soil?

Designing for a post-oil future needs to tailor agricultural crops, practices, and expectations to the constraints of each agro-ecological zone. And for much of North America, that means a whole lot less annual - and especially grain - cropping. In other words, tailor the agriculture to fit the environment, rather than manipulating the environment with increasingly scarce and costly fossil fuel-based technologies to shoehorn-in annual crops that don't belong - just because that is how we've always done it. It's time to step over the traces, get right outside of our comfort zone, and take a hard critical look at what is driving the downward spiral in agricultural sustainability in our time.

Too much to handle? Too scary to even imagine an agricultural landscape populated by perennial swards and groves of trees interspersed with directly-consumable annual crops, displacing those miles upon miles of corn and soy (or wheat)? Remember that some 40% of global grain production - and anywhere from 70 to 90% of North American grain production - is grown just to feed livestock<sup>7</sup>, and much of it to feed livestock that evolved to eat grass - not grain.

Adopting ecologically sound farming practices will necessarily end factory farming. Why? For the past 100 years in North America, and until recently even globally, the habitual problem with grain has been low prices brought on by overproduction - not infrequently under the aegis of government subsidies (see King Corn). Factory farming evolved in part to capitalize on artificially cheap grain, to sop up the excess. Remove the excess and the foundation of the paradigm - with all that it means to the livestock themselves, to the environment, and to human

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<sup>5</sup>This does not discount the historic devastation wrought by livestock overgrazing in some regions

<sup>6</sup>Contrary to conventional wisdom, conservation-tillage practices are demonstrably effective in sequestering carbon and improving soil organic matter only in some agro-climatic regions. Conservation-till is a two-edged sword, enhancing perennial weeds, delaying spring planting, and favoring denitrification as well as some pests and pathogens, while slowing the rate of loss of soil organic matter

<sup>7</sup>Or in recent times, as a substrate for ethanol, that unabashedly oversold concept

health - disintegrates.

## WHY LIVESTOCK?

Perhaps we can agree that perennials are better suited than annuals to sustaining the land, water, and air, but there are good reasons why we've evolved an annual crop-centered agriculture. Humans don't do well on grass - at least not on perennial grass swards. Other perennials yield fruit and nut products, but they make a tiny contribution to global food needs. Annual grains have key advantages missing from fruits and nuts: they yield reliably, store and travel well owing to a low moisture content, and conform admirably to the demands of commerce. So, unless and until Wes Jackson's Land Institute succeeds in creating perennial grain crops, we're at an impasse: annuals are arguably incompatible with ecological sustainability, but perennials produce insufficient human-consumable food.

This is where livestock come in, as a bridge to convert perennial grass swards - which are essential for ecological sustainability - into human-usable products. Livestock provide the economic justification for 'doing the right thing' by the planet - and for human sustenance.

To illustrate the concept of livestock as a bridge, I once saw a pile of termite nests near a dwelling deep in the rainforest of Nicaragua. The home had screenless window openings, and was in an area infested by night-flying mosquitoes carrying not just malaria but dengue fever. Each night, one of the termite nests - which look like a large rugby ball - was placed upwind of the house, set on fire, and allowed to smolder and smoke for hours to discourage the mosquitoes. The resident hen, chicks in tow, capitalized on the free lunch by scratching continuously at the termite nest, teaching the chicks to gobble up the termites as they tumbled out of their smouldering home. In effect, the chicken filled a missing link in the transformative chain of nutrition that started with a wholly inedible product - decaying wood - passed through the termites and chickens, and culminated in eggs and ultimately meat for the farm family.

By analogy, livestock effectively integrated into a mixed farming system perform the same function. The grass which sustains the soil and fittingly emulates Nature is transformed via the livestock into meat, milk, and eggs for human use.

Regeneration Through Grass Ley Farming. But what about yummy cantaloupe and sweet peas and oatmeal? A foundation of grass-based agriculture does not mean reducing the agricultural landscape to a sea of grass. We like - and need - balanced nutrition from the various food groups, as clearly articulated by everyone from Marion Nestle to Michael Pollen. Instead, ecologically sound post-oil agriculture for much of North America and elsewhere means re-integrating grass into arable crop rotations, to regenerate and replenish land damaged by growing those tasty and necessary annual crops. Thus, to sustain agricultural land use, grass can no longer be relegated just to land that is too rough or rocky for anything else. Grass must be recognized as the glue that holds everything else together - the foundation of whole farm management.

Back in the 1940s, George Stapledon and others coined the term 'grass ley farming', meaning to strategically intersperse multi-year intervals of grass in arable rotations to sustain the land

indefinitely. The particular balance of grass:annual crop years - 50:50, 75:25? - and the disposition of years - 2 years in a row? 5 years? - needed to balance the benefits of grass with our need for grain, fruit, and vegetable crops may vary from place to place. But grass ley farming is the key to resolving the apparent conflict between what we need and what the planet needs.

And Organics? It is with a sense of frustrated embarrassment that I feel compelled to point out that excluding livestock from farming causes the same harm to organic as well as to conventional farms. This seemingly self-evident truth must nonetheless be stated because contrary to the fervent admonition of Sir Albert Howard, one of the founders of modern day organics:

“Mother Earth never attempts to farm without live stock; she always raises mixed crops; great pains are taken to preserve the soil and prevent erosion; the mixed vegetable and animal wastes are converted into humus; there is no waste; the processes of growth and the processes of decay balance one another; ample provision is made to maintain large reserves of fertility....”,

many contemporary organic farms are nonetheless incurring the debt of unsustainability by choosing to be stockless.

Now, if land area is ample and economic return is not an issue, you can practice grass ley farming without livestock. The grass ley years can be viewed as sabbatical or rest years with no economic return. Alternatively, the grass can be harvested and marketed to livestock farmers, although implied nutrient export in whole plant crops, such as hay, is another order of magnitude greater than from vegetable or grain crops. An Ontario survey found that stockless organic hort<sup>8</sup> farms actually sold hort crops just 4 years in 10, with the remaining 6 years allocated to forage and grain ‘service’ crops. Service crops internalize costs of production by performing whole-farm services, such as adding or conserving N or adding organic matter to the soil, controlling weeds, or suppressing disease. The stockless organic hort farms nonetheless proved to be fully dependent upon livestock farming, whether as a source of imported manure to replace the nutrients exported in their marketed vegetable crops or as a buyer for the grain or forage harvested from their service crop years. These findings support the conclusion long espoused by Rudolph Steiner and others, that livestock are essential to the sustainability of agriculture.

## **SYNERGISTIC BENEFITS OF RE-INTEGRATION**

The rationale for not just tolerating but indeed, welcoming grass-fed livestock into post-oil agricultural systems is more than just avoiding the harm from ecologically unsound annual cropping or converting the requisite grass into human food. Strategically re-engaging crops and livestock also offers *economic and ecological synergies* which are denied to polarized farms specializing in one or the other.

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<sup>8</sup>Horticultural farms, selling fruit and vegetable products

Livestock were traditionally viewed as **tools of production** - and I don't mean just as draft animals. Livestock perform **services** - directly for crop production but indirectly for overall farm sustainability - which are largely lost in today's specialized farming. Crops likewise perform services, both to livestock and to other crops. A few examples will suffice to make the point.

Joel Salatin. Many will be familiar with this master of enterprise stacking, where more than one enterprise - broilers, cow/calf, pigs etc. - is produced from a given field, pole barn, or other facility. In just one example, following rotationally grazing cattle with a portable layer house uses the layers to control flies and reduce intestinal worms in a beef pasture. The natural tendency of the layers to scratch apart cow pies is entrained to mutual benefit. In return for pest control for the beef herd, the truly free range layers get the freedom of doing what they do best, while producing a second source of income from the same land.

Fred Reid. This innovative organic egg man likewise uses layers, but to benefit a commercial organic raspberry crop. The 9000 layers on his home farm are kept in a layer barn at night. They are let out each day at about 11AM, to rotationally graze through fenced raspberry paddocks, having first laid their eggs in the barn. The layers preferentially scratch out weeds at the base of the raspberries, eliminating the need for manual weeding, meanwhile rejoicing in their innate chicken-ness, in the free choice dust bathing, and in bug and weed consumption - while also generating a second income stream from the same land.

Polly and Jay Armour. Hort crops and livestock are well integrated on this complex organic farm. One novel application is placing raw manure, covered by mature compost, in trough-like cement structures that extend the length of their passive solar greenhouse. Heat and carbon dioxide emitted by the decomposing raw manure keep the greenhouse warm enough for starting vegetable transplants in the winter/spring, while stimulating luxuriant tomatoes, peppers, and eggplant in the summer months.

Tony and Fran McQuail. Another masterful integration of crop and livestock on this organic CSA farm involves harnessing the natural behaviors of earthworms and sheep for pest control in apples. Livestock compost was first applied to stimulate earthworm populations under each tree. Earthworms consume fallen apple leaves under the snow overwinter, reducing next year's inoculum source for apple scab. The grass stimulated by the compost is strip grazed off by sheep. The sheep - while providing a second income from the same landbase - not only graze off the habitat for overwintering field mice, which would otherwise girdle the trees, but also consume downed apples - next year's inoculum for codling moth.

Johann and Maggie Kleinsasser. This biodynamic farm turns vegetable leftovers or seconds from their CSA garden into winter feed for their pigs. A traditional rationale for keeping livestock was to consume unsaleable products, to recover at least some benefit from hail-damaged grain or immature corn frost-damaged in the fall or perishable vegetables produced in excess of demand.

In each of these cases, farmers have evolved ways to combining enterprises on the farm to do what they would otherwise have to buy from off the farm, and further, to internalize costs they would otherwise impose on the environment or neighbors. When fossil fuel energy was cheap,

these gifts were undervalued. When fuel is no longer cheap, these are example of the kinds of designs we will all be depending upon, to sustain and stabilize yield without external inputs.

## **SUMMARY**

If we are going to avoid joining the ranks of the obliterated, livestock need to be seen in a very different light. The 'place' of livestock must not be a life of misery in factory farms, nor as the source of unthinkable concentrations of waste, pathogens, and risk. It is equally blinding if we view livestock as the primary *raison d'etat* for the equally tragic fate of untold millions of acres, sentenced to growing nothing but corn and beans in perpetuity.

Instead, let us remove the blinkers and see livestock for what they really are - the lock that seals the connection between sustainable resource management and human food production. Perennial grass swards channel to human service many of the processes that sustain Nature. Livestock, in turn, convert this pivotal but inedible grass into human-usable food. Effectively re-integrating crops and livestock to achieve the synergies that sustain Nature - a goal of increasing necessity in the post-oil era - means learning, or re-learning to think in whole farm systems rather than in individual enterprises.

This is a challenge, but it is not an insurmountable challenge. The transformative process is already underway, as shown with real world examples from innovative farmers. It has been said that the toughest change is what goes on between the ears, and not just of farmers but of academics, policymakers, and elected leaders. It is not too late.