

# *The Land Report*

*A publication of The Land Institute | Number 68 | Fall 2000*



**What Merry-Go-Rounds, Galileo's Problem with the Church,  
and Industrialized Agriculture Have in Common**

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Cover: Scott Bontz. *Land Institute* staff members Jackie Keller and Stan Cox view the merry-go-round differently than from a standstill. See Wes Jackson's essay about evolving perspectives on Page 10.

Back Cover: Christopher Picone. *fog on Land Institute prairie this fall*

Above: Christopher Picone. *perennial wheat sprouts at The Land Institute. See the report on Natural Systems Agriculture on Page 19.*



## Our Mission Statement

When people, land and community are as one, all three members prosper; when they relate not as members but as competing interests, all three are exploited. By consulting nature as the source and measure of that membership, The Land Institute seeks to develop an agriculture that will save soil from being lost or poisoned while promoting a community life at once prosperous and enduring.

The Land Report is published three times a year.

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ISSN 1093-1171



# Democracy Without Farmers

The family farm in America has all but vanished, and with it we are losing centuries of social and civic wisdom imparted by the agrarian life.

Victor Davis Hanson

The American is a new man, who acts upon new principles; he must therefore entertain new ideas and form new opinions. From involuntary idleness, servile dependence, penury, and useless labour, he has passed to toils of a very different nature rewarded by ample subsistence. This is an American.

— J. Hector Saint John de Crèvecoeur,  
*Letters from an American Farmer*

Farmers see things as others do not. Their age-old knowledge is more than the practical experience that comes from the art of growing food or the independence of rural living. It involves a radically different — often tragic — view of human nature itself that slowly grows through the difficult struggle to work and survive from the land. Destroyed by hail that most others ignore, praying for a rain that few will notice, increasingly foreclosed upon in a national sea of cash, smug in their ability to nourish thousands but bewildered that they cannot feed their family, apart from town but dependent on those who are not, still confused over how and why plants usually produce harvests but sometimes do not, the last generation of American farmers have become foreign to their compatriots, who were once as they.

The farmers' understanding of man and society in our present age is critical to the survival of democracy as we once knew it. Democracy at its inceptions, ancient and American, has always been the outgrowth of an agrarian society; but its old bones now have new and different flesh. Consensual government can continue in the vastly transformed conditions of great wealth, urbanism, and rapidly changing technology never foreseen by its originators; but whether democracy can still instill virtue among its citizens will be answered by the age that is upon us, which for the first time in the history of the civilization will see a democracy without farmers.

More than 200 years ago, J. Hector Saint John de Crèvecoeur (1735-1813) published *Letters from an*

*American Farmer* (1782), a collection of 12 essays on American culture and rural life. Crèvecoeur's letters are generally regarded as the beginning of American literature, inasmuch as they are the first formal expressions of what it was to be "American." The opening to homesteaders of new frontier lands across the eastern seaboard, the immigration and assimilation of a wide variety of Europeans, and the turmoil of the American Revolution convinced Crèvecoeur that he was witnessing at the end of the 18th century the birth of a unique nation and a singular man. In his view, freeholding yeomanry lay at the heart of this great experiment in creating a middling, rambunctious, democratic citizenry that could not be fooled, enticed, or enslaved.

In America, the European now feels himself a man because he is treated as such; the laws of his own country had overlooked him in his insignificance; the laws of this cover him with their mantle. Judge what an alteration there must arise in the mind and the thoughts of this man. He begins to forget his former servitude and dependence; his heart involuntarily swells and grows; this first swell inspires him with those new thoughts that constitute an American. What love can he entertain for a country where his existence was a burden to him? If he is a generous, good man, the love of this new adoptive parent will sink deep into his heart.

Part formal essays, part autobiographical memoir, part fictive sketches (on everything from the island of Nantucket to slavery to the American hummingbird), the letters of Crèvecoeur are rambling, confused, and at times almost unreadable. But they brilliantly use the landscape of contemporary 18th century agriculture to demonstrate how the natural bounty of America and the availability of vast expanses of farmland molded the European religious and political heritage into something far more dynamic — something never before seen or even imagined.

Crèvecoeur was a materialist. Where people live, what they do, and how they work determine how they think and who they are. He believed that the farmland of North America was everything, its rich abundance

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From *The Land Was Everything* by Victor Davis Hanson. Copyright 2000 by Victor Davis Hanson. Reprinted by permission of The Free Press, a division of Simon & Schuster Inc.

critical to fashioning a new culture. Crèvecoeur's American man, then, was surely different from any in Europe, because he had room and resources that could be freely exploited. The American was a wholly untraditional creature whose successful existence proved that free and "insignificant" men fleeing Europe could create a novel culture from an unforgiving nature.

This "new" man was, of course, a curmudgeon who would be very hard to deprive of his newfound liberty. Only with difficulty would he be coerced or uprooted, and he would not be fooled by the trend and jargon of the town. He was as rough and unromantic among his urban peers as he was in his mute fields — in other words, a new, hard-nosed, no-nonsense American.

Crèvecoeur wrote his *Letters* in the belief that the emergence of yeomen and free landowners in America meant the genesis of a new egalitarian American culture. Muscular labor, now autonomous and in the service of the individual, would create a self-confident, viable, and pragmatic citizen in place of the passive serf and ignorant day laborer of past nonegalitarian regimes of the European monarchies. Yet this new farmer-citizen was also at odds with the trader and near savage who left nothing in his wake, who was made brutish by North America's wild rather than tamed by it. Crèvecoeur's American agriculturists alone — who had created cultural order (homesteads, cultivated fields, bridges, small towns) out of natural chaos — had hit upon that rare middle ground: freeholding yeomen neither rich nor poor, wild nor pampered, brutes nor sophisticates, day laborers nor absentee lords. American democrats were not to be coffeehouse intellectuals or an envious and volatile mob eager for someone else's property and capital.

Crèvecoeur's powers of abstract observation and analysis derived from his own unique background. He was classically trained at a Jesuit college in France, and his Latin phrases frequently remain untranslated in the *Letters*. He traveled widely, held a variety of jobs, and emigrated to the northern English colonies in 1759 by way of Britain and Canada. He was married and raised three children on his New York farm until the tumult of the Revolutionary War forced him to flee America. Crèvecoeur farmed for less than a decade before his return to Europe, where he entered the diplomatic service and became a literary figure in his own right in revolutionary France. Though he was a genuine farmer, agriculture was but a parenthesis in his life, which was, ironically, spent largely in Europe writing about farming in America. His *Letters*, then — as generations of critics have pointed out — suffer from the paradox of an ex-farmer writing about what he will not or cannot any longer do.

Still, the *Letters* were an immediate success among Crèvecoeur's contemporaries for two reasons:

The largely European audience was curious about the creation of this new social paradigm in America, and it wanted to know the natural esoterica of a frontier and rural lifestyle pretty much unknown in Europe. The ostensibly fictional account is actually a firsthand look at life in rural New England and details the creation and management of a working farm.

But the book's real interest, past and present, arose from its literary exploration of a more important topic: What is an American, and is he really so new? What is the relationship between the cultivated landscape of America and the nature of its citizenry? What has American agrarianism done to improve upon the Western paradigm as practiced in Europe, and could the muscular and uncouth govern themselves without the guardianship of the academic and refined?

More than two centuries later, American citizens know less about farming than did Crèvecoeur's Europeans. This is a great tragedy, perhaps *the* tragedy of the last half-century. Americans have completely forgotten the original relationship between farming and democracy, which Crèvecoeur sought so carefully to explain. As a consequence, few Americans can define in the abstract what they were or who they are. Few of us work with our hands or become dirty from the soil, unless we are puttering in our gardens; those who do so for work more often wish that they did not. The labor of muscle, unless directed to the narcissistic obsession with the healthy body, is deemed unfortunate, whereas the work of the tongue alone is prized. That the two might be combined, and thus become greater than either, is ignored or forgotten. To Crèvecoeur, the dichotomy of the effete intellectual and brutish thug — so common in Europe — was resolved by the emergence in between of the independent American farmer who avoided through his autonomy, craft, and labor the pitfalls of both. And so it is: to walk into a room of farmers is to see some of the most rough-looking yet highly thoughtful citizens in America.

Just as Crèvecoeur held that the formation of freeholding yeomen created the American republican spirit, so now the decline of family farming in our own generation is symptomatic of the demise of his notion of what an American was. Just as Crèvecoeur saw unlimited land, small towns, multiethnicity, the growth of a middle class, self-reliance, and a common culture as essential to the creation of America and its democracy, so today the decline of family farming, the end of the egalitarian principle of farm ownership, the growth of urbanism, the assurance of material entitlement, and the virtual disappearance of a rural middle class ensure the demise of Crèvecoeur's American.

Crèvecoeur was neither naive nor entirely a utopian romantic: freedom, egalitarianism, and democracy were



possible because man in America had little leisure and less affluence, and found success or failure largely in his own efforts. Surfeit for the human species was as great a danger as poverty, sloth the more terrible peril than exhaustion. Education and contemplation without action — the near religious faith of today's intellectual class — meant not impotence, but moral vacuity itself. It was not merely democracy that was important, but the type of people who created democracy.

To Crèvecoeur, like Aristotle, man was tame only to the degree that he was occupied, independent only as long as he owned property. Only through agriculture was the citizen in constant observation of how terrible loomed the animal and human world about him: man realizes the dangers of his own natural savagery only through his attempt at physical mastery of the world.

Many men and women who undergo this experience provide a check on those who do not. Such farmers question authority and yet follow the law; they are

suspicious of the faddishly nontraditional, yet remain highly eccentric themselves; they vote and work for civic projects and group cohesion, and yet tend to be happiest when left alone, these who historically have been democracy's greatest supporters by not quite being convinced of the ultimate wisdom of democracy.

In contrast, Crèvecoeur's trappers and traders who live as natural men on the edge of the frontier are not romantic individualists, but more often beasts — without permanent residence, without responsibilities to others, without desire to clean and separate themselves from the foul world they must inhabit and have surrendered to. They and the refined urban merchant both dwell in antithesis to the farmer, who both

Above: Ted Sider.  
East Adair County,  
Iowa, 1999



conquers and lives with nature, who practices both a solitary and a communal existence, who is and is not one with the government at large. From that personal, strife-filled experience of working the soil, the yeoman-citizen alone, this muscled reader of books, this hardened lover of beauty, transfers his code of stewardship, reasoned exploitation, and independence to the wider society of his peers. That the balance and stability of agrarianism in themselves explain the health of a culture seems preposterous to us in the postindustrial age. But to Crèvecoeur, the connection was self-evident to the point of being unquestioned.

In the great American debate over ecology, development, and the use and abuse of nature, we have forgotten the central role of agriculture, which is more than just to keep us alive one more day. Farming alone reminds us of the now-lost balance between wilderness and pollution and inculcates in our youth the thought that true erudition is not the mastery of the specialist's esoterica but broad learning, checked and tried daily through the pragmatics of the arm and back. The more abstract, liberal, and utopian your cant, the more difficult it is to live what you profess. The farmer of a free society uniquely solved the age-old Western dilemma between reason and faith, the balance between the Enlightenment and medieval minds, by using his reason and intellect to husband and direct the mystical world of plants, even as he accepted the limits of reason by experiencing every day a process that was ultimately unfathomable. The land taught us that, and so it was the nursery, not merely the breadbasket, of our nation.

We are not starving in this country and need not worry about our food supply, even under corporate conglomerations to come. But we are parched and hungry in our quandary over how to be good citizens — whom the Greeks, the logical forefathers of modern democracy, said were ultimately the only real harvest of the soil.

Our new American is responsible for little property other than his mortgaged house and car; his neighbors and friends, indeed, his very community, are more ephemeral than they are traditional and rooted. Although not an aristocrat, he is esteemed by his peers to the degree that he is polished and secure and avoided once he is at odds with comfortable consensus. He depends on someone else for everything from his food to his safety. Lapses in his language and manners can end his livelihood; obsequiousness, rather than independence, is more likely to feed his family. Yes, America is more democratic and free, and perhaps a kinder and gentler nation than in the past; but political and economic advance came at a price. For a time we have become more humane collectively and in the abstract, but somehow far worse individually and in person.

We American agrarians of the latter 20th century fought a war for land that we did not even know we were in. Yet we apparently have lost it nonetheless. Family farmers as a species were mostly unknown fatalities in the new wave and final manifestation of market capitalism and entitlement democracy, the final stage of Western culture that is beyond good and evil. Ever more unchecked democracy and capitalism — because they alone succeed at achieving what they are designed for, and since there is no alternative to either — are now nearly global. In the next century, both practices will ensure to the billions of the world material prosperity, entertainment, and leisure undreamed of by any generation in the planet's history. Surely billions will prosper as princes where millions once lived as the dispossessed in squalor, disease, and filth. Even the exploiters of capital cannot siphon the sheer abundance of lucre from the mob.

Yet this remarkable success has brought us to the end of history as we have known it. The age-old Platonic antithesis between what we can do and what we should do has been settled in favor of the former. There is no political, no religious, no cultural idea left that stands in the way of bringing more things to more people at any cost, to dismantling every cultural, religious, and social impediment to self-expression and indulgence.

In the absence of an agrarian creed, no intellectual has stepped forward to craft a higher culture for the people that is beyond materialism and consumerism. No abstract thinker dares to advocate the love of soil, a legacy of hard work, loyalty to family, town, and country, or even fealty to a common culture. No one suggests an erudition that is harmonious with, rather than antithetical to, muscular labor. These are the glues that hold — and should hold — a people together, that make their day-to-day drudgery mean more than the gratification of desire. Say that, and one would be dubbed a crank, misfit, and worse — corny, naive, and silly for sure. And why not? Everything that we hold dear — our mass entertainment and advertising, cars, leisure, music, material wealth, easy jet transportation, health, and consumer democracy with its moral relativism, academic bromides, and cheap caring — are ours precisely and only because we have evolved away from the agrarian ideal and a vibrant countryside. The end of family farming gave us more food — you must confess it, agrarian romantics — more time, more money, and less shame. Indeed, maybe even more equality as well.

Our new age is akin to the period between A.D. 98 and 180, the era of the so-called Five Good Emperors in Rome, whose monotony and materialism Edward Gibbon called the most tranquil period of human

existence. Ours now is. “No other way of life remains,” wrote the contemporary Greek toady Aelius Aristides of a similar past epoch:

There is one pattern of society, embracing all.  
... Were there ever so many cities, inland and maritime? Were they ever so thoroughly modernized. ... Seashore and interior are filled with cities, some founded and others enlarged.  
... The whole world, as on a holiday, has changed its old costume ... and gone in for finery and for all amusements without restraint. All other animosities between cities have ceased, but a single rivalry obsesses every one of them — to show off a maximum of elegance and luxury.

Not just yeomanry, but even race, language, custom, and locale are falling before the onslaught of instant communications, advertising, unfettered speech, and material dynamism — before the idea that leisure and escape from muscular labor are the agreed-on prize. For the first time in civilization, real material overabundance, and at least the veneer of egalitarianism that it spawns, are upon us. The \$10 sneakers of the illegal alien look and feel hardly different from the \$200 designer brands of the corporate lawyer; the tap water of the welfare mom can be as clean as that of the exploiting blueblood; the video brings entertainment — any entertainment — as quickly, cheaply, and frequently to the illiterate as to the opera buff. Ease of consumption unites us more than race, gender, and class divide us. In short, for the first time in the history of civilization, the true age of democracy is at hand, encompassing not only the ideal of political equality but a real material kinship and shared vulgarity at last. There are no longer the age-old skeptics from the countryside to come into town and remind us that it is all but dross.

The agrarian life, which is neither materialist nor fair, is the most visible casualty of what we have become in this age of Pax Sumptuosa. And we all have on occasion become willing casualties in this Faustian tradeoff. It is baffling still to see one’s children emerge exhausted from a day’s hoeing of vineyard weeds with enough energy left to head right for their video game consoles. We poor farmers do not understand the present because we believe in ethical restraint on the economy. Yet at the same time, as American consumers we, too, want and expect what this efficient and amoral economy has to offer.

For most of my early adult life I was called a failure for farming; now I am dubbed a success for having failed at farming. Thus I can offer some insight into the consequences of the cultural demise of agrarianism

through my own inability to live an exclusively agrarian life: I can write well of what I do not like, because in some sense I have just about become exactly what I do not like.

The alternate Western — and agrarian — tradition of autarcheia, autonomy, localism, and shame, which was always at war with our urban genius for materialism, uniformity, and entitlement, now more or less has lost out as it has always lost out — just as the polis has always given way to the kingdom, republic to empire, culture to civilization in this endless cycle so inherent to our history. These voluntary checks on acquisition and consumption, on efficiency and bounty itself, put too much responsibility on us. The middling agrarian, whose age-old role was to preserve society from the dominion of the gifted but brutal renegade — Plato’s solitary superman who would live by natural law alone — now gives way to the contemporary man of desires. He is full of reason of sorts, but without spirit, and uses his knowledge mostly to seek complacency amid his bounty. This contemporary clerk, teacher, salesman, and bureaucrat is everything the farmer is not: mobile, material, careful, and timid; at peace with security, sameness, petty reputation, and complacency; glad for an endless existence of leisure and affluence without the interruption of strife or discord; nose always to the scent of cash and pleasure. He wants liberty, but too often liberty for indulgence alone, and then is surprised that when such commensurate license is extended to the less fortunate, they shoot and inject rather than show a taste for industry. Agrarianism was such a brief interlude between savagery and decadence; it was such a hard teacher of the human condition.

The old conception of an entire family — grandparents, parents, and children — living from nothing other than the fruits of their labor, raising (not surviving by selling) produce; passing on a successful livelihood to sons and granddaughters; conveying ideas of independence, shame, and skepticism; and criticizing both the bookish and weak, the robust and the ignorant, will disappear. Indeed, it already has. Was the agrarian tradition of Western culture, the sum total of millions of mostly unknown existences and personal tragedies, of lost crops and ruined lives, all for this? Was the agrarian character of Thomas Jefferson’s America to evolve only to give us the abundance, convenience, and freedom that we might become what we are? Was that what the family farming of Crèvecoeur’s age was for? Was Crèvecoeur’s yeoman to lead us to what we now are at the new millennium?

Other good souls still bravely resist. Their attempts to recreate rural farming communities, to share in neighborly agrarian enterprises, and to forge farm communalism indeed will be noble and needed

enterprises. Yet something will bother us about many of them. We will in secret confess that they are a bit scholastic. They are without the challenge and disaster of the past. This alternate agriculture of the organic gardener and suburban homesteader will be contrived by those whose daily survival and capital are really found elsewhere, rather than in the spontaneous enterprises of working farmers.

In the postagrarian era to come, we who were not part of the classical age will do all in our power to restore it — a doomed endeavor, whatever our noble intent. Many agrarian idealists and restorationists will seek solace in pockets of vitality such as the much-praised Amish, who can withstand the tide and hold to their way thanks only to a fiery and uncompromising God — and a surrounding unagrarian society that indirectly subsidizes them. They prove that the horse and plow, dinner at five, and asleep at nine are yet possible if one will just suffer enough. But in the end, even the most diehard farming reformers will not wish to be as the Amish are — and they will not know how to be like the Amish without being the Amish.

Their praiseworthy experience will emulate but not continue the agrarian idea, which grew out of a centuries-long tradition of families tied to particular farms of about the same size. At the end of agrarianism, when (as with autos or steel) there are but a score of megafarms, we will find the demise of real conservatism. When all the dour populists are gone, we will see that the market is not so conservative in its excess and the liberal not so tolerant in his utopian agenda for his peers. The second most bothersome Americans are globalist profiteers who justify every exploitation imaginable as the inevitable wages of their market-as-deity. Perhaps the most offensive are the very serious and usually affluent left-wing utopians, who foam and grimace from a distance in their elite white enclaves as they explain how we all must be forced to do this and that, here and now, to save some rare amphibian, a certain inert gas, someone's anonymous arteries or lungs, or an inner-city child's dreams — or else.

With the loss of this country's agrarian and conservative profile also goes a tradition of using agrarian life to critique contemporary culture, a tradition

of farming as moral touchstone of some 2,500 years' duration in the West, beginning with Hesiod, Xenophon, and Aristotle and ending with us. Agrarian wisdom — man using and fighting against nature to produce food that ensured that his family stayed on the land and his community remained safe — was never fair or nicely presented. Family farmers prefer to be at loggerheads with society, yet they are neither autocrats nor disillusioned Nietzschean demigods sneering at the growing mediocrity of the inferior in their midst.

As their doomed and near-extinct status illustrates, yeomen are rather different from the rest of us. These Ajax-like men and women oppose us but mean us no harm; they are more suicidal than homicidal. They bother us with their "judgments" and "absolutes" and "unnecessary" and "hurtful" assessments that derive from meeting and conquering real challenges. But they also bother us in order to save, not to destroy, us, by giving a paradigm of a different, older way that once was in all of us. They want us to slow down, not to implode, to find equilibrium between brutality and delicacy, as they themselves have with their orchards and vines. They want us to try something out ourselves before advocating it for others.

Family farming is gone, yet democracy and Western civilization remain, the creations of agrarianism. We Americans, now so rich, free, and at peace, can survive, thrive even, under the material conditions of the 21st century. But we will never be anything like what we were. The hardest task in America now is not to fall into defeatism — even if it means verging on idealism. And perhaps we might still learn from what we are losing.

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*Victor Davis Hanson, the author of a number of books, including *Fields without Dreams* (1996) and *The Soul of Battle* (1999), is a farmer and professor of classical studies at California State University at Fresno. This essay is adapted from the forthcoming book *The Land Was Everything: Letters from an American Farmer*.*



# Down to Earth: Why Soil — and Soil Science — Matter

Dan H. Yaalon

Many ancient religions recognized the importance of soils, and their customs evolved into a spiritual attachment to the life-giving Earth. But surprisingly, ancient and classical scholars did not study the nature of soil. Early scientists also ignored it. For instance, the famous naturalist Alexander von Humboldt (1769-1859), a founder of plant geography, never compared the soils of the several continents on which he studied the distribution of plant species. This attitude still crops up frequently. The *Fontana History of the Environmental Sciences* (1992) contains no mention of soils as a branch of environmental science, although other Earth sciences are included. Is soil just dirt, too commonplace for mention or study?

I am a pedologist — an Earth scientist focusing on the origin and distribution of soils in relation to the history of landscapes. We have much to learn about non-arable soils, and must try to integrate our knowledge into a holistic view of the Earth's dynamics and biogeochemical transformations. Soils are economically and socially important. They can even have beauty: The soil scientist Hans Jenny (1899-1992) was enchanted by the soils depicted in paintings. To paraphrase Leonardo da Vinci: Why do we know more about distant celestial objects than we do about the ground beneath our feet?

New ideas about the nature and origin of soils emerged only in the second half of the nineteenth century. V.V. Dokuchaev (1846-1903) and E.W. Hilgard (1833-1916), both mineralogists and chemists by training, recognized in their soil surveys that climate, vegetation and substrate were all important, and saw the importance of soil horizonation — the development of different layers of soil parallel to the surface — in representing and elucidating a landscape's history. Dokuchaev had imperial backing in Russia, and several distinguished followers. Hilgard, although a respected university professor in the United States, was not favored by the establishment. An opportunity to promote his ideas was lost when John Wesley Powell and he failed to establish a geological-agricultural (soil) survey in the U.S. Geological Survey. Language barriers hindered communication between soil scientists, and the spread of knowledge was painfully slow, even after the new Russian pedogenetic ideas were presented at world exhibitions and translated.

Gradually, topographical and biological effects, and the duration of soil-formation processes were all recognized as equally important factors in soil evolution.

It took more than one generation before C.F. Marbut (1863-1935) included the concepts of external and internal environmental effects on pedogenesis in the influential U.S. Department of Agriculture soil survey, established by Milton Whitney in 1899. When Jenny submitted his now-classic book on the “five soil-forming factors” and the quantitative approach to single-factor soil-forming functions, it was at first rejected for publication. It took five years before the book was eventually published in 1941.

The importance of soils as a life-support system and in the production of food and fiber was duly recognized. There were spectacular achievements, helping to feed the ever-growing population. Nowadays, most of the 50,000 soil scientists work in agronomic institutes, studying the composition and dynamics of soils in ever-greater detail. Yet less than 5 percent of the global agricultural research budget goes to soil research.

The use of soils in road building, construction, ceramics and the cement and aluminum industries is another area where a basic knowledge of soil and landscapes is important. Technological institutes promote this study, which is anchored in ancient practical applications.

Soils teem with life. The Nobel laureate Selman Waksman (1888-1973) isolated streptomycin from soil biota, and the preservation of pedodiversity and biodiversity may aid similar research in the future. Also, it seems plausible that biological evolution was influenced and constrained by the properties of the soil environment, an attractive field of unexplored research. For Earth scientists, ancient and buried soils are one of the better proxies for reconstructing past climate and the development of the landscape.

But it is as the transformer, regulator, buffer and filter of water, nutrients and other dissolved and dispersed compounds that soils are most important to humankind — a focal and connecting link between the biogeochemical cycles of the Earth and the dynamic atmospheric system. In the conceptual wiring diagram of the International Geosphere-Biosphere Program the soil system, especially its carbon dynamics, is the central link between the physical climate and biogeochemical systems. It is therefore a major route to understanding and predicting the effects of human actions on the Earth.

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# Merry-Go-Rounds, Galileo's Problem With the Church, and Industrialized Agriculture: What They Have in Common and More

Wes Jackson

My house sits 100 feet away from a steep cliff on a bluff of the Smoky Hill River looking mostly west. I have actually measured the distance. Facing the river on the right, between the front door and the cliff, is a sandbox and playhouse for the grandchildren, composting bins and a potting shed. On the left is a fenced garden, and beyond that, a merry-go-round. It is this merry-go-round that is essential to my subject here. It stands ready to be ridden at any moment, but it is there for more than fun. I want my grandchildren — and others — to experience an illusion. The design features a centerpiece with an offset pivot to which four rods are attached, rods which reach back to handles in front of each of the four seats. A rider (see photo), by moving the handle back and forth, can cause all four seats and any riders to move around and around until boredom or dizziness sets in.

But now I want to talk about a time some four centuries ago when Galileo lived. This extraordinary early scientist was much taken by an idea advanced by Copernicus. Both lived in a world in which the dominant idea was that the earth was at the center of everything and that the sun moved. This worldview was derivative of the thinking of Ptolemy, a geographer and astronomer from Alexandria who lived in the second century A.D. Mathematicians and other thoughtful people elaborated on what seemed obvious to all and formalized a way of looking at an earth-centered universe. Some mathematicians who built on Ptolemy's ideas were pretty good at predicting the position of the known planets on any particular day of the week in any year. In spite of such powerful prediction, and no matter that Dante had used Ptolemy's cosmology as a map for the paradise section of the *Divine Comedy*, both Copernicus and Galileo believed that the Ptolemaic worldview and the church were wrong.

Back to the merry-go-round. Anyone riding that plaything and looking to the center where the rods are attached will feel that the center and the attached offset pivot part are moving. The perception of movement will be retained in the rider's mind when stepping off. Anyone on the ground staring at the center and pivot will see that neither move.

Anyone sitting on one of those four seats is like a person riding on planet Earth who, when looking at the center — the sun in this analogy — will, like us looking

at the sun every day, perceive that the center is moving. The sun does not rise in the morning, the earth rotates.

Galileo was able with his mind to step outside the system. The power structure of the church refused to take this courageous mental step. Eventually, of course, others became convinced of the truth of his insight and a major tenet of science was born — *perception is not always reality*. This was one of the great moments in the early history of science. Unfortunately, we too often ignore or forget this lesson. If more agricultural scientists, for example, were really honest about the reality of industrial agriculture, they would repeatedly point out that the high bushels-per-acre output in industrial countries is an illusion.

Reports on the recent corn crop reveal a record year in production, around 141 bushels per acre. (In 1980 the yield was just over 100 bushels per acre for the 70 million acres devoted to corn.) Like riders on the merry-go-round, it is easy to believe that we are more agriculturally productive than we really are. If we were to step off the merry-go-round, remove ourselves beyond bushels-and-acres considerations — if we expanded our boundaries of consideration — we would immediately see that without fossil fuel and material subsidies from the extractive economy, yields would be seriously lower. In other words, were we to withdraw the non-renewable resources from production efforts — like natural gas serving as the feedstock for nitrogen fertilizer, herbicides, insecticides and more — and force ourselves to rely on the natural fertility of the soil and crop rotations featuring legumes for nitrogen fixation, fertility yields would plummet. The yields that dazzle us and make us boastful give us an illusion that we are sophisticated on the subject of agronomics.

We have had agriculture for approximately 100 centuries, 10,000 years. Yet it is only in the last century — the last one percent of our history with agriculture — that we have experienced such a major bump in food production. No comparable bump is likely to be available to us again, because of the degradation of the natural fertility of our soils, as well as the largely absorbed elasticity of the genetic potential of our major crops. According to devotees of the modern paradigm, it has been a great ride. But it is time for a reality check — a check that industrialized cultures seem to lack the courage to invite.



Scott Bontz. *From Land Institute development associate Jackie Keller's perspective, the merry-go-round's pivot appears to turn, but it is the rest of the apparatus that swings around it, as someone standing aside can tell.*



# The Changing Relationship Between the Tree of Knowledge and the Tree of Life

Wes Jackson

Over the last ten millennia or so the nature of the human condition has changed more in degree than in kind. The rich and many-layered early writings suggest that the dilemma imposed by the subject-object dualism had been addressed through myth in the oral tradition long before writing appeared.

I want to honor some of those ancients, both Greek and Hebrew, by using their myths. In Genesis we read the following:

## Chapter 2

<sup>8</sup>And the LORD God planted a garden in Eden, in the east; and there he put the man whom he had formed. <sup>9</sup>And out of the ground the LORD God made to grow every tree that is pleasant to the sight and good for food, the tree of life also in the midst of the garden, and the tree of the knowledge of good and evil.

<sup>16</sup>And the LORD God commanded the man, saying, “You may freely eat of every tree of the garden; <sup>17</sup>but of the tree of the knowledge of good and evil you shall not eat, for in the day that you eat of it you shall die.”

## Chapter 3

<sup>1</sup>Now the serpent was more subtle than any other wild creature that the LORD God had made. He said to the woman, “Did God say, ‘You shall not eat of any tree of the garden?’”

<sup>2</sup>And the woman said to the serpent, “We may eat of the fruit of the trees of the garden; <sup>3</sup>but God said, ‘You shall not eat of the fruit of the tree which is in the midst of the garden, neither shall you touch it, lest you die.’” <sup>4</sup>But the serpent said to the woman, “You will not die.

<sup>5</sup>For God knows that when you eat of it your eyes will be opened, and you will be like God, knowing good and evil.” <sup>6</sup>So when the woman saw that the tree was good for food, and that it was a delight to the eyes, and that the tree was to be desired to make one wise, she took of its fruit and ate; and she also gave some to her husband, and he ate.

<sup>17</sup> And to Adam he said, “Because you have listened to the voice of your wife, and have eaten of the tree of which I commanded you,

‘You shall not eat of it,’ cursed is the ground because of you; in toil you shall eat of it all the days of your life; <sup>18</sup>thorns and thistles it shall bring forth to you; and you shall eat the plants of the field. <sup>19</sup>In the sweat of your face you shall eat bread till you return to the ground, for out of it you were taken; you are dust, and to dust you shall return.”

<sup>22</sup>Then the LORD God said, “Behold, the man has become like one of us, knowing good and evil; and now, lest he put forth his hand and take also of the tree of life, and eat, and live forever” — <sup>23</sup>therefore the LORD God sent him forth from the garden of Eden, to till the ground from which he was taken. <sup>24</sup>He drove out the man; and at the east of the garden of Eden he placed the cherubim, and a flaming sword which turned every way, to guard the way to the tree of life.

For the ancient Hebrews, we estranged ourselves from the Creation by disobeying a direct order barring us from the Tree of Knowledge. It was also a theft.

For the ancient Greeks the split with Nature had its origins only in a theft. Prometheus stole fire from Nature’s gods, but there had been no warning. Even so, the penalty was pretty severe, for in Aeschylus’s tragedy, Prometheus was chained to rocks on nearby Mount Caucasus and an eagle daily ate from him. It was a jury of one, old Zeus himself, who levied the sentence.

Two thousands years later, during the Renaissance, both the Hebrew and the Promethean stories were still around, though mostly for reinterpretation. Some used the Promethean myth to validate defiance of the divine, while others saw it as a blow to the corrupt leaders. Around 1600 Francis Bacon and Rene Descartes helped launch the scientific revolution, followed by the Enlightenment. Prometheus was then a hero.

But humanity has never avoided being ambivalent about our alienation from Nature, and has not escaped the dilemma of how to reconcile it. We moderns are ambivalent about the employment of biotechnology, among other things. How are we going to satisfy our desire to sustain ourselves at whatever level without administering discomfort and pain to ourselves and the landscape? Something is wrong with our condition that other species seem to avoid. While too brief a summary, the extension of this reality is infinite.

The stalemate in our attitude toward Nature, at least when it comes to practice, traces back to the invention of agriculture. The metaphors of the ancient Greeks and Hebrews capture the enlarged social and cultural reality associated with taking up farming as a way of life. The Tree of Life had long supported gatherers and hunters. All life lived off the fruits of God's exclusive Creation. Suddenly, with agriculture, humanity became a participant in Creation. But to take such sweeping charge of our own food production was to bite off more than we could chew.

Practicing till agriculture requires the destruction of relationships embedded in the biological diversity that would otherwise cover the areas where we produce food. The various species of the wild ecosystem, interacting in relationships that save soil and minimize the consequences of imbalance — be it from microbes, big predators, invertebrates or aggressive colonizing species called weeds — are gone. Now humans must manage the new arrangement in order to eat. Areas that formerly sustained our small numbers without our intervention now rely on the Tree of Knowledge, sponsoring an expanding population at the expense of ecological capital.

The original split implicit in the mind of the ancient Hebrews was due to an act of disobedience and a theft. The penalty for asserting our independence was pain and sweat, thistles and thorns, and on balance over the centuries, it has been more than we can handle. That is the fall of the human.

A participant in the Creation must take on the role of husbandry of our primary sponsor, that non-renewable resource we call soil. Resources from the global commons — atmospheric nitrogen, carbon, oxygen, sulphur and water — have to be more aggressively managed. Resources from the local landscape — phosphorous, potassium, calcium, manganese, other trace minerals and more — now require our management. That we are ill-equipped is shown by the record. Soil management has mostly failed. Water management in numerous places has led to soil salting. In more recent times, in this century particularly, when we get involved in nitrogen management, usually by using fossil fuel as a feedstock for nitrogen fertilizer in the form of natural gas, we often pollute the groundwater.

In the early books of the Bible, much of the content has to do with the making of the Hebrew people. Abraham not killing his child Isaac marked the end of human sacrifice for the tribal peoples. Slavery imposed on the Israelites during their time in Egypt invalidated the idea of slavery as a practice to condone. The Exodus, their time on the desert and their settlement in Canaan shaped their culture. All of the lessons were not positive, from my point of view. Their journey out of Egypt into Canaan amounts to a kind of Manifest

Destiny, validating our own taking of this continent. Once settled, these Hebrews were often persuaded by their Canaanite neighbors to worship their farm gods called Baals. The local Canaan agriculturists were sort of agrarian pantheists whose agronomic achievements served them well. They also stood as a threat to a still emerging people. The environment might be less under siege had such pantheists prevailed. But it wasn't to be.

The Hebrews could have surrendered their belief that their success was embedded in one God, the God of the Mountain and Storm, not an array of gods that had been amalgamated. But they held out and it had a payoff. When their belief combined with those of the Greek philosophers who found their answers in reason from *within* the individual and thought we could improve on Nature, the potential for dominion of the earth increased. Historian Daniel Boorstin pointed out that Christians brought faith and reason together in the dogmas of the church and its communities, in monasteries and universities. St. Thomas Aquinas (c.1225-74) in *Summa Theologica* aimed to show that reason could operate within faith and yet according to its own laws. Now we live in what Boorstin calls the Age of Experience. Reason and faith seem to have become instruments.

Perhaps this recollection of ancient wisdom is too great a stretch for us modern readers. It is fair to ask: What does any of this history of assumptions and interpretations matter, given that our life-giving soil still erodes, and our soil and water still absorb alien chemicals? Modern science has told us not to rely on the authority of the ancients, but to learn our lessons from experience.

We do have new ways of asking questions, more fluid ways of thinking — but soil still erodes. The biblical Creation story with a fixed and recent date has been supplanted by growing evidence of a long geologic past, whose firm documentation began about 200 years ago. I am glad to know the new facts — but soil still erodes. In *Origin of Species*, Charles Darwin (1809-82) placed all life forms into a prehistorical context firmly locked in that geological record, and provided an explanation of how varying life forms came into existence. But what about soil erosion, chemical contamination and fossil fuel dependency? Edwin P. Hubble (1889-1953) expanded our concept of space when he found evidence that some nebulae are galaxies. Our place in the universe shrunk by orders of magnitude, our sense of awe about cosmic scale expanded — but what about the soil, the water and the air, now all polluted? Louis Pasteur (1822-95) revolutionized medicine, and physicists exploring the atom introduced a nuclear horror that only the Tree of Knowledge could have produced — and soil erosion continues and the chemical industry expands. We learn from the prehistorical and historical record the valuable

lesson that nothing in our world is really stable, all is fluid. The firmament isn't firm. Even continents drift. Fixed dogmas are gone. Science is now about process. I am glad to know all this — but soil erosion continues. New varieties of chemicals are introduced and fossil fuel dependency increases.

We keep reaching outward, paying too little attention to what supports us. In his book *Religion and Science*, Albert Einstein (1879-1955) wrote: "Individual existence impresses man as a sort of prison and he wants to experience the universe as a single significant whole." To Einstein this mysterious, "cosmic religious feeling" was "[t]he most beautiful experience we can have. ... It is the fundamental emotion which stands at the cradle of true art and true science." Maybe so, but again, neither the fruit of the Tree of Knowledge nor this fundamental emotion have stopped soil erosion or any of our other ecological problems.

In our long journey, with all of its successes, the plot remains constant. Wrinkles are added here and there, important wrinkles, but the most substantive reality of the human condition that worried the Greeks and ancient Hebrews remains constant.

Now in this new century, many of us ask what it will take to save the soil and contain our excesses, and not just those fueled by oil or uranium, but also those driven by our discoveries, insights and inventions. No excess is containable so long as we operate as though knowledge is adequate to run the world. To sustain ourselves, we pluck one fruit after another from the Tree of Knowledge and more or less ignore the Tree of Life. Maybe we ignore the Tree of Life because we think we lack access to it. Maybe we remember the Angel with the Flaming Sword and believe it is axiomatic that access is impossible.

Let's return to the historical chronology for a moment. The dating of the scientific revolution is often, if not usually, set at 1500 to 1700. The industrial revolution is often said to have begun 100 years later in 1800. These are very general dates with important notable exceptions lying outside them, but let's allow them. During the scientific revolution, most scientists simply tried to understand how the world *is*, exploring deeper into the nature of God's laws. It is easy to understand that the cognitive transition from how the world *is* to how the world *works* required a subtle but profound shift for the human mind. It then was made ready for the era of the inventor, who became increasingly present from 1700 to 1800. Practical utility became a force to deal with, science an instrument.

The distinction is still with us. Basic science has to do with how the world *is*, applied science with how the world *works*. The latter tends to be more narrowing of our imaginations.

The myth of the Tree of Knowledge is about *knowing the difference between good and evil*. The irony

is that this distinction cannot be known until evil has been discovered. To participate in the Creation, to take charge, is to undo the sustainable integrities with our limited perception. Evil is now loose in the world. I am reminded of a passage from a book by Dr. Roald Sagdeev, a plasma physicist who led the U.S.-Soviet Apollo-Soyuz mission, a former member of the USSR's Academy of Sciences and a man who played a major political role during the first five years of perestroika. He is now a professor of physics at the University of Maryland. In his book, *The Making of a Soviet Scientist*, he has this to say:

The development of a revolution in science is controlled by its own internal logic. To build a new, revolutionary concept, to make a breakthrough, requires a certain hidden incubation period, during which time there is the accumulation of experimental data, the painful assessment of difficulties, careful invention, and then the injection of new scenarios and explanations. Science and physics have always progressed in this way.

Somehow we, the nuclear physicists of the twentieth century, were spoiled by quick successes like the Manhattan project and, a few years later, a parallel breakthrough with a nuclear bomb on the Soviet side. Many of us, even ... wise and experienced leaders ... thought that if an appropriate budget were given it would almost guarantee immediate technical progress in resolving any problems nature presented us.

If we physicists had subconsciously become somewhat arrogant, our punishment was not long in coming. Controlled thermonuclear fusion, unlike the uncontrolled one with its apocalyptic hydrogen bomb explosion, was not an easy nut to crack.

As it turned out, the very nature of plasma — the hottest state of matter and at the same time the least controllable substance — destroyed the legend of Almighty Science versus Nature. What was originally perceived as a quick victory of the new, inexhaustible source of energy became a long, protracted war against plasma instabilities. It created almost a deadlock and proved to be a setback and a warning of even bigger future failures of humanism, which saw itself as the master of nature.

Here is a fruit that rotted early. But now the metaphor has the potential to fail us, for the valuable lesson learned over a few years by a few physicists in the Soviet Union could be dismissed as being from science at the edge of the envelope. Away from the



envelope's edge, where the legend of Almighty Science versus Nature still dominates in the scientific culture, the assumption remains: Knowledge *is* adequate to run the world. Those of us who embrace or look to Nature as a standard or measure are in a small minority. Scientists at work in the dominant paradigm either ignore Nature or seek to subdue Nature. But what if the dominant paradigm does not work or leaves unacceptable debris behind? Should we not hedge our bets?

The legend of Almighty Science versus Nature with the weight on science as the superior factor is unlikely to die very soon for most of us. It was short for those Soviet fusion scientists. It will be a bit longer for fission if we expand nuclear power after the portable liquid fossil fuel epoch. But if we embrace nuclear power, we must remember that no human technology is exempt from Murphy's Law.

Life would be easier if the implementation of a technology or practice allowed us to live or drop dead immediately. Smoke one cigarette and you die. Use methyl bromide on a crop one time and you die. Instead, we're faced with a world of uncertainty, and we have to call on fields like epidemiology and other sciences dependent upon statistics. Because we don't drop dead, we allow ourselves to draw our boundaries of consideration much narrower than the boundaries of causation. To put it another way, "Out of sight, out of mind." What is out of sight is the true, longer-term cause-effect relationships of our taken-for-granted lifestyles and fundamental assumptions. When we extend our vision, we come face to face with more of our ignorance, more of our ambiguity. Precaution becomes the watchword, but even that is not enough.

Most biologists, including many evolutionary biologists, are not what I would call Deep Darwinians. If they were, they would not stand by when dead sheep are fed to cattle — resulting in Mad Cow disease. Nor would they sit idle as huge cattle, hog and chicken confinement operations are put in place, operations which require heavy doses of antibiotics, which in turn breed resistance by disease-causing organisms. Some antibiotics are already useless in hospitals. Deep Darwinians would count any human-made chemical with which humans have not evolved as guilty until proven innocent.

Yes, we are highly adaptable. Our balance, vision, upright stance, much of which evolved east of the Rift in Africa, are such that we can ride bicycles. Yes, there are many technological activities we engage in with impunity to the ecosphere and ourselves. This reality and the need to wait into the long run for many effects to take hold masks, in the short run, whether we have got away with something or not.

By mentioning evolution, ecology and the molecular oneness of life at a basic level, I am advancing the

bedrock disciplines for an operating philosophy that, given enough standing, has the potential to offset the hold that Bacon (1561-1626) and Descartes (1596-1650) have on our modern minds, especially the minds of scientists. Bacon gave us the outline for the institutional requirements of practical knowledge in the midst of the period when scientists simply wanted to know how the world is. Biographer Perez Zagorin maintains that Bacon was the first to see science as "a public, collaborative, and progressive enterprise." Bacon was "a thinker about science: the conditions favorable to its growth; the changes and procedures required to insure its progress; its contribution to the inauguration of a new regime of knowledge." As early as 1592, at age 31, Bacon wrote in a letter that he was taking "all knowledge to be my province." Such a challenge helped lay the groundwork for the "knowledge as adequate" worldview that nearly all of us hold today.

Utilitarian science was also in the mind of Descartes. In his *Discourse on Method*, the 41-year-old mathematician who revolutionized algebra insisted that a combination of math and experimentation would provide us with "knowledge which is very useful in life." Had Descartes stopped there with the mere "usefulness" of knowledge, we might be able to forgive him for the excesses his ideas helped spawn. But surpassing usefulness, Descartes thought that through science we could (and should) "render ourselves the masters and possessors of nature."

Few of us in industrial society really want to do without science. I certainly don't. And so the question comes: What would 'doing science' look like in an *ignorance-based worldview*? Or, what would it look like if we truly employ the precautionary principle as a dominant way of operating in our science? In our daily lives?

The precautionary principle is not new, of course. In fact, it is widespread in our daily lives. The Oath of Hippocrates included the injunction "First, Do No Harm." Men get checked for the prevalence of the prostate-specific antigen in their blood. Scopes check our colon and intestines, and increasingly a cancer is caught in time.

Still, many problems build up before we catch them, too often when it is too late to reverse the consequences. Precaution is still not a sufficiently dominant way of being. And if it were, I doubt that it would be enough, because scale makes for differences. A new crop variety tested in the small plots of an experiment station for resistance to a pest, when planted over hundreds of thousands of acres, may become quickly susceptible, for it has increased the possibility of picking up a mutant resistant form of the pathogen.

My younger daughter and her husband, both high school teachers, a few years ago moved to a small Kansas town with their 3-year-old son. In a few months

this son, my grandson, would welcome his new baby brother. My older daughter, her husband and their then 3-year-old daughter paid them a visit. Four young adults, one of them pregnant, and two 3-year-olds did what Sunday visits often occasion. They went to the park, got hot and sweaty, and become thirsty. But in this town small children and pregnant women are warned by the city to not drink the water. When the younger daughter and her family moved in, a neighbor, noting my daughter was pregnant, handed her a letter warning them that the nitrate level was unsafe for children including those *in utero*. The letter also said that for one year, the family was entitled to free bottled water from the grocery store.

I know this is only one example in a list of ecological compromises that have been going on for a hundred years and more, but where is the outrage that would stop and reverse the problem? Where is the money required to remove the nitrate? The Des Moines River runs through Des Moines, Iowa. Nitrate pollution is a problem for that river. The city of Des Moines, however, is sufficiently rich that millions of dollars can adequately remove the toxic nitrates. Small Town, Kansas, cannot.

Who is to blame for the nitrate problem in the first place? The farmers who spread commercial fertilizer on the fields? Area feedlots? Eighty percent of the feedlot nitrogen becomes airborne to fall who knows where. The reality of non-point source pollution means that no one is to blame even though all are to blame. We all live in a fallen world.

Where does the precautionary principle fit here? It should be an *automatic* derivative of the evolutionary-ecological worldview, since high nitrate concentration runs beyond what *Homo sapiens* has historically experienced. The Tree of Knowledge is inadequate. Within the Baconian-Cartesian worldview, we learn precaution through experience. We learn to tread carefully only *after* we've tripped and fallen. This approach is increasingly perilous. Precaution informed by a deep sense of our evolutionary history, evolutionary mechanisms and ecological arrangements instructs us in the wisdom of treading carefully *before* we fall. Both worldviews call upon experience to teach us; the Deep Darwinian view simply draws from a much longer and larger range of experience. It extends our sight and thus broadens our minds. It gives tribute to the Tree of Life, and that is a healthy start.

Too much water has gone through the turbines for us to ignore the Tree of Knowledge. We need it in this world of more than 6 billion people. But more than the Tree of Knowledge, we need the Tree of Life. We cannot totally abandon the one, and yet we need the other because our long-term security on this beautiful planet will come not just by an acknowledgment of our

fallen condition but by embracing nature as our standard or measure — by embracing the Tree of Life.

Genesis Chapter 3, Verse 24, tells us, "So he drove out the man: and he placed at the east of the garden of Eden the Cherubims, and a flaming sword which turned every way, to keep the way of the tree of life." Does this mean that, because we have so long relied on the Tree of Knowledge, we no longer have *any* access to the Tree of Life? What if we were to try to strike a bargain with the cherubims, with Nature, with God? How would we prepare our part of the script?

It is always good when reading to keep in mind the author's intent. What was the intent of Moses, who is given credit for the first five books of the Bible? Better still, since most scholars contend that there were multiple authors, what was their intent? It seems clear that they were less interested in historical accuracy and more in recognizing certain truths of the human condition, the human dilemma and — perhaps most important — human relationships.

Karen Armstrong notes, in her book *In The Beginning*, how Genesis has a timeless quality, because the tales there "address those regions of the spirit that remain opaque to us and yet exert an irresistible fascination. A reading of Genesis suggests how it was that psychoanalysis began as a predominantly Jewish discipline. Long before Freud, the authors of ancient Israel had already begun to explore the uncharted realm of the human mind and heart. They saw this struggle with the emotions and with the past as the theater of the religious quest." The authors of Genesis are dealing with fundamental and difficult matters. Armstrong continues: "There are no glib or facile messages in Genesis. It is impossible to find a clear theology in its pages; the authors share no moral consensus. ... Even though Genesis has played so significant a role in shaping the Judeo-Christian tradition, *the book shows that it cannot adequately express the frequently baffling reality to which it directs our attention.*" (Emphasis added.)

Too much of human history has been built on the Tree of Knowledge for us to completely forsake it for the Tree of Life. Or, in terms of the Greek myth, it is safe to say that we are not going to quit using the fire we have stolen even though we recognize that the earth has been scorched by it, especially during these blazing 200 years of industrial revolution. There have been gains for humanity: in the arts, in science, in medicine, where knowledge has directed that flame to rid much of humanity from countless cruel anxieties and at the same time allow a wide array of artful expressions unavailable to the fire-free species of our planet.

And so the question is, do we dare approach the angel with the flaming sword turning in all directions? I think the answer is "yes." How do we do it? We approach with humility and with a promise, the promise

that the Tree of Knowledge will remain subordinate to the Tree of Life. We promise that we will look to Nature's patterns where agriculture has not invaded or dominated. We will look to alpine meadows, to tropical rain forests, to deciduous forests, to unplowed native prairie, and we will elect to use them as our standard or measure. For fisheries we will look to parts of the ocean where fishing's effects have been minimal. In a professional sense, this means that ecologists and evolutionary biologists must have veto power over the biotechnologists and even the plant breeders. We will say that those who have studied original relationships, who have been descriptive — ecologists and evolutionary biologists — have a primary say over those who have had the burden of being *prescriptive*. At the end of our speech we will request that the flaming sword be sheathed so that we can gain access to the insights sustaining the Tree of Life. We will promise that every effort will be made to reduce the Tree of

Knowledge to a vine supported by the Tree of Life, not to strangle it, but to depend upon it. And in our everyday thoughts, the world of Bacon, Descartes and Newton will decline in size, while that of Darwin and those steeped in natural history will increase in scale. Both trees will remain, both kinds of scientists remain, but the Tree of Life will have the dominant standing.

With the vine dependent on the tree for support, perhaps the subject-object dualism that goes back at least to the ancient Greeks and Hebrews can diminish. Soil health and human health can become one subject and paradox the crucible for creative work of a different and higher order.

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# Developing Perennial Chickpeas, Which Might be a Rediscovery

Scott A. Yates

The search for crops that can be planted once and grown and harvested for several years is not limited to wheat and The Land Institute's efforts with sorghum and sunflowers.

In the Northwest, Fred Muehlbauer, a geneticist with the Agricultural Research Service of the U.S. Department of Agriculture, has been working with a perennial chickpea for several years. This involves a wild species found in Turkey and the Himalayas.

It might be wild, that is. There are theories to suggest that some past civilization cultivated it. Several species are not prone to shatter, and some lines have a white flower.

The white flower is significant, Muehlbauer said, because thousands of years ago, when plants were starting to be domesticated, most had colored flowers, particularly food legumes. The white flower is desired because the pigment that is removed brings a bitter taste.

Most wild legumes also have pods that shatter and can throw seeds several yards. Although the trait is desired as nature's planting system, it makes things difficult for humans who want to collect the seed and use it for food. The perennial chickpeas, however, tend to hold seeds.

That, combined with the white flower, made Muehlbauer wonder if the plants escaped domestication and established themselves in the wild.

He initially became interested in the wild perennial chickpea because the various types are virtually immune from all important diseases found in the Palouse area of western Washington. He hoped to use them as a source of resistance for commercial material.

Muehlbauer had been growing lines of perennials at the Spillman Research Farm since 1992. His thinking took a turn when Steven Jones and Tim Murray, at Washington State University, began investigating the feasibility of perennial wheat. Muehlbauer wondered about the possibility of developing a perennial chickpea line.

The advantages would be the same as for perennial wheat. Planting perennials on clay knobs and other sites farmers do not want to plow would reduce erosion.

"Maybe you wouldn't harvest as much, but you wouldn't have as much cost involved, either," Muehlbauer said.

Although the chickpeas produced by the perennial lines are not the kind found at salad bars, different

markets desire different sizes and shapes, and a home might be found for them. Muehlbauer suggested a perennial line of chickpeas could be available in seven to 10 years, perhaps sooner.

At The Land Institute, a meeting was recently held to discuss the promises and pitfalls that can be expected in perennializing the major crops. Although institute founder Wes Jackson has been talking about perennial crops for 20 years, the Washington State scientists are the acknowledged leaders in the field.

David Van Tassel, a plant scientist at the institute, believes what the WSU team is doing with wheat is feasible for many crops. There's already a sorghum-like perennial developed from a cross with its close relative, Johnson grass.

There are also wild perennial versions of sunflowers. The question is whether to develop the wild types into commercial varieties or transfer the perennial habit from them into annual commercial varieties.

Even corn has a perennial wild relative. Although its ears are extremely small and wouldn't be recognized as corn, the Mexican species is thought to be the origin of our modern corn.

"Corn is a big mystery. No one can quite explain how you get the plant with the big ears from this small wild thing," Van Tassel said.

Nevertheless, he believes it would only take a few genetic mutations to achieve a perennial corn with normal sized ears.

The first step toward that and other perennializing goals is to galvanize interest among scientists at major universities. To that end, The Land Institute and a group of scientists including Jones are involved in developing a paper for *Science* or *Nature* magazine that will address specific scientific questions regarding the perennial habit.

*Reprinted from the April 15 issue of Capital Press, Agricultural Weekly, in the Northwest. Scott A. Yates is a staff writer.*

## Natural Systems Agriculture (NSA)

### Perennials and Intermediate Cropping

To get an evolving Natural Systems Agriculture into the field, Chris Picone, David Van Tassel and Stan Cox are embarking on two connected research programs. Simultaneously, these programs will develop and study intermediate cropping systems — perennial or perennial-annual plant combinations and methodologies we might call On the Way to NSA — along with the perennial grain crops on which NSA will be based.

Interim cropping systems may be less perennial and less diverse than the full domestic prairie that we envision. But now is the time to begin studying these systems, because it may take many years to breed the full suite of perennial crops necessary for a domestic prairie. We plan to create systems that begin to perennialize the landscape, even if not all the crops involved are perennials. The immediate value of such systems would be the conservation of soil and water. We will also get valuable experience with the planting, harvesting and maintenance of perennial systems. The role of perennial legumes is particularly interesting now.

We are planting annual wheat in conventional monocultures between strips of the perennial legume alfalfa and directly interseeded in alfalfa. Alfalfa reduces erosion and provides nitrogen fertility. The experiment looks at how cereals and perennial legumes grow together and whether some version of this arrangement could be a practical cropping system. Over the next few years, we will try variations on this theme, substituting, for example, a native perennial legume for alfalfa or perennial wheat for annual wheat.

Another type of interim system might use existing prairie grass mixtures as hedges between strips of conventional annual crops, mixtures of annual crops or new perennial grain crops. The prairie strips trap runoff and diversify species, providing benefits such as refuge for predatory insects. In our research, we will study the benefits of adding perennials to cropping and find the optimum width of grass hedges.

Perennializing crops to be grown in NSA will require breeding programs involving several species. As *Land Report* readers know, there have always been two approaches to developing perennial grain crops:

1) Domesticate wild perennial species such as Illinois bundleflower and Eastern gamagrass, and 2) transfer genes for perenniality into annual crops such as

sorghum and wheat. Our new breeding philosophy will combine these two approaches by using genes from annual crop species to improve the productivity of related perennial species.

Perenniality is not the result of a single gene, and it is not even very useful to think of it as a single trait. To the plant, perenniality is a way of life encompassing many traits governed by many genes. Our plan is to retain as much of the perennial plant structure as is needed for the plant to be a good perennial and improve it for cropping given that structure. This is an intermediate strategy. It lies between introducing genes for perenniality from related species into an annual, and domesticating wild perennials.

In practice, the philosophy will lead to the following:

- We will continue the Land's long-term perennial sorghum project. It is partly because of this project that we are adopting the new philosophy. It becomes apparent that perennial sorghums may inevitably be more highly tillering with more open panicles than grain sorghum — i.e., intermediate between sorghum and Johnson grass — but that there is much room for improvement of productivity within the boundaries of this plant type.
- We will expand the perennial sunflower project, obtaining more hybrids between wild annual, perennial and cultivated annual sunflowers, with the goal of increasing seed size and yield of the perennial.
- We will initiate a perennial rye breeding program, with parentage from high-yielding annual rye cultivars, the wild perennial *Secale montanum* and the few perennial rye cultivars already developed from crosses that others have made between the species.
- Our wheat work will follow two complementary paths. Our postdoctoral Fellow Doug Lammer is working on perennializing wheat at Washington State University, as described in the previous *Land Report*. At the Land, we will begin work on improving yield and crop suitability of perennial grasses in the genera *Thinopyrum* and *Leymus*, using natural variation within the species as well as genetic input from wheat. We expect synergy with the two projects.
- We will produce and grow much larger populations than previously, especially in the sorghum and rye projects. Results of efforts with sunflowers and

wheat relatives will be much longer in coming and require intensive initial genetic work.

Meanwhile, we will focus efforts to domesticate perennial species outright, primarily with Illinois bundleflower.

Also, in the short term, we aim to produce prototypes of perennial grains to be used in our experiments on perennializing the landscape. We will develop perennial versions of sorghum and rye and select among perennial cool-season grasses to provide components of an NSA-in-the-making.

In this way, the crops and the system evolve in parallel. All of this work will require increased funding — which we are now seeking — and extensive cooperation with other research groups.

## NSA Graduate Research Fellowship Program

### Annual Workshop

The Land Institute held its annual workshop of graduate fellows in Matfield Green, Kansas, during the last week in July.

Our workshop has several goals. First, we teach new fellows about Natural Systems Agriculture. The students are interested in this new paradigm but often do not have much background in it. Second, we provide an experience unique to many graduate students: a chance to combine agricultural and ecological themes. The students come from traditional programs in agriculture or ecology, and most have found little cross-pollination in their home institutions. Finally, we demonstrate the breadth of fields involved in NSA through The Land Institute.

Workshop sessions included the history of agriculture, alternative approaches to science, the U.S. Department of Agriculture's relationship to farmers and the role of genetic engineering.

The four new fellows (see last issue of *The Land Report*) came during the first few days for lectures and discussions led by staff. We were fortunate to have presentations by our former ecologist Jon Piper, in biology at Bethel College in Kansas; by board member Chuck Francis, in agronomy at the University of Nebraska; by three NSA advisors, Tim Cruz, in agro-ecology at Prescott College, Arizona, Ted Lefroy, of the University of Western Australia, and Ray Dean, professor emeritus in engineering at the University of Kansas; by Cindy Cox, in plant pathology at Washington State University; and by Doug Lammer, a Washington State postdoctoral geneticist sponsored by The Land Institute.

Later in the week, all 14 fellows came together for a tour of the long-term experimental plots at Konza

Prairie led by NSA advisor John Blair, in soil science at Kansas State University. This trip was followed by presentations from Karen Garrett, a Kansas State plant pathologist, Kansas State historian Bonnie Lynn-Sherow, David Huggins, in crop and soil sciences at Washington State, and Martin Teitel, of the Council for Responsible Genetics.

The fellows then presented progress reports to the group. We closed the workshop with a keynote address by Harold Morowitz of George Mason University titled "Citric Acid and the Holy Ghost: Twenty-eight Steps from Matter to the Human Spirit."

## Sunshine Farm

### Dryness, Heat and Harvest

Despite no rain during August and most of September and a near-record 23 days of temperatures over 100 degrees in August — the record is 26 days in the Dust Bowl year of 1936 — we harvested soybeans, milo and sunflowers, while many neighboring soybean crops failed.

Our organic crop yields during 1993-99 have been comparable to Saline County average dry-land yields except for milo and sunflowers, the former hindered by competition from weeds and the latter reduced by fall-migrating blackbirds. Annual soil testing during 1993-2000 has shown no consistent trend in the levels of nitrogen, phosphorus, potassium or organic matter, but there has been a slow increase in cation exchange capacity, a measure of the soil's ability to supply nutrients such as potassium, calcium, and magnesium.

### Advisors Tour

Sunshine Farm director Marty Bender convened the Scientific and Farmer Advisory Committees of the Sunshine Farm Project during August, including five agricultural researchers from Kansas State University. They toured the crops on our farm and also on some of the 2,000 acres farmed by our contract farmer, Charlie Melander.

Charlie and Dave Regehr, who specializes in weed management at Kansas State, discussed the advantages and disadvantages of various crop sequences in his rotations. Of particular interest at both places was the minimum tillage that Charlie practices with a no-till drill and a rotary hoe, including herbicides on about 10 percent of his fields and none on the Sunshine Farm. By minimizing the amount of soil disturbance, minimum tillage reduces soil erosion and should improve some soil properties.

Even though the rotary hoe has existed for half a century, so few farmers have tried it that Charlie has been forced to learn on his own during the past ten



years. He explained that the rotary hoe has not been improved in the past 50 years and that adding hydraulics to it would make it much easier for him to control weeds without herbicides. Agricultural engineers should accomplish this so that agronomists could conduct long-term comparisons of improved rotary hoes and regular field cultivators — part of conventional tillage — for crop yields, weed control and soil conservation. This would help determine whether minimum tillage would be a substantial improvement over conventional tillage in terms of farming without herbicides.

## Rural Community Studies — Education

Rural Schools and Community Trust renewed our grant for the second of a three-year commitment.

### Student Water Monitoring

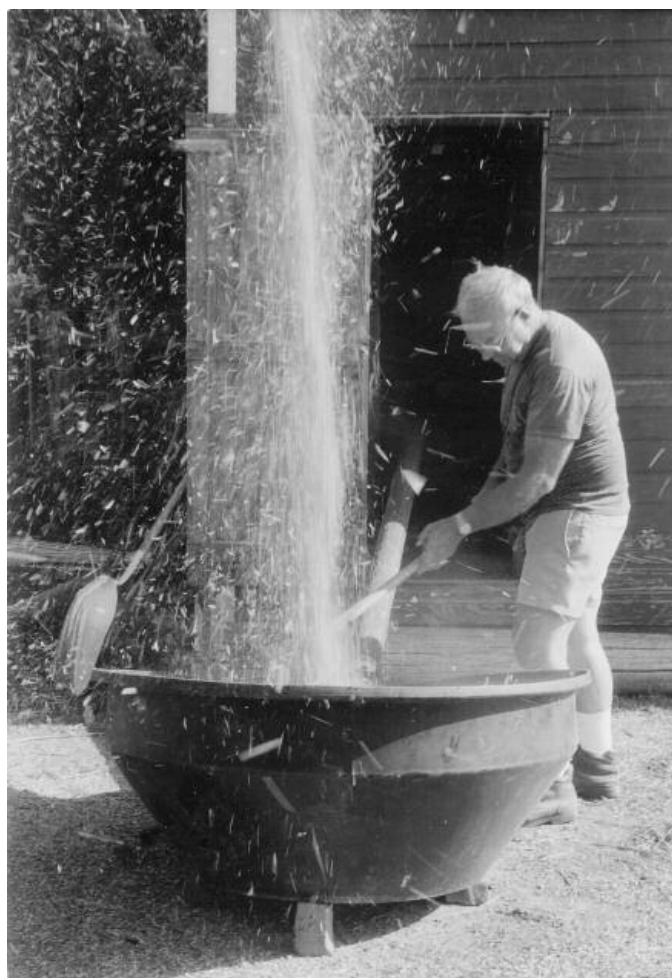
Students monitor local rivers and streams. This fall and next spring, chemical assessments, species head counts, and environmental observations will help students understand forces in their waterways.

The student program StreamLink was initially devised to recognize the volunteer water quality monitoring efforts of schools in the Kansas River Valley. Now led by the non-profit Kaw Valley Heritage Alliance, the program provides training to teachers and other youth leaders and runs a website that tracks the data collected by students. The activities have spread to other communities along the Kansas River.

Our Education Director Bev Worster arranged to extend this training to teachers who participated in The Land Institute's summer workshop, bringing stream monitoring to waterways south and west of the Kansas River. The aim is to extend the program to young people across the state and to collect data over many years.

Students in The Land Institute's Consortium of public schools — Baldwin, Flinthills, and Chase County school districts — monitor at last one stream site twice each year beginning this fall. All will use the StreamLink protocols. This ensures that data are collected in the same manner so students can compare them.

Developing water resource literacy is fun for students from the elementary grades through high school. It helps them understand the relationships between water and the land and builds a sense of stewardship. For more information about StreamLink, see the website at [www.streamlink.org](http://www.streamlink.org).



## New Staff

**Stan Cox** joined us in July as senior research scientist to coordinate our research in Salina and with cooperators around the country. He is a plant geneticist, and his research will be breeding a range of perennial crops in the *Triticeae* — wheat, rye and their relatives — and with sorghum, eastern gamagrass, sunflower and others. His undergraduate degree is in agronomy and his doctorate is in plant breeding. He worked as a wheat geneticist in the Agricultural Research Service of the U.S. Department of Agriculture in Manhattan, Kansas, 1984-96, and taught in Hyderabad, India, from 1996 until he joined The Land Institute.

**Jackie Keller** joined us in October to help increase our development activity. She is a Kansan who just returned after eight years in San Francisco, where she earned a master's degree in international relations and

Above: Scott Bontz.  
Bob Pinkall helps  
auger oats pouring  
from a combine into a  
Sunshine Farm granary,  
2000.

wrote her thesis on sustainable agriculture. During those years she worked on pesticide reduction for the city of San Francisco. We are glad to welcome her back to her home state.

## Public Notices

### Right Livelihood Award

Land Institute President Wes Jackson, along with scientists and activists from Ethiopia, Indonesia, Turkey and the United States, was named to share the 2000 Right Livelihood Award. At the start of a new millennium, the Award's international jury has sought to highlight four key issues that will determine whether there is a civilization to celebrate at the end of it. Jackson was selected "for his single-minded commitment over more than two decades to developing an agriculture based on perennial crops that is both highly productive and truly ecologically sustainable." The \$50,000 award will further the work of The Land Institute.

The awards are presented annually in the Swedish Parliament and are usually referred to as "alternative Nobel Prizes." They were introduced to honor and support "those offering practical and exemplary answers to the most urgent challenges facing us today." The founder, Jakob von Uexkull, felt that the Nobel Prizes today ignore much work and knowledge vital for our future.

### Presentations

We made presentations at Allegheny College, Oberlin College, Michigan State University, Evergreen State University, Drew University, the Agricultural College at Rutgers University and several conferences. We were interviewed for National Public Radio and

Public Broadcasting System shows. A presentation to the Environmental Protection Agency regional staff spawned a return to speak at an EPA national staff meeting.

### In the News

Our agricultural ideas were featured on the Voice of America radio program broadcast abroad. Several articles and Op-Ed pieces appeared in the *Salina Journal* and *Kansas City Star*.

### Website

If you have not already found our website, [www.landinstitute.org](http://www.landinstitute.org), we invite you to visit. September is the end of our first year on the Internet. We went from less than 200 visitors last October to more than 900 this September. In the next few months, look for more and more of our articles available in our website's archive — they will be searchable by date, author, title, and keywords.

## About the Photographers in This Issue

Ted Sidey was born in Washington, D.C., but spent the past two years as editor of the Adair County Free Press in Greenfield, Iowa. The newspaper has been in the family for more than 100 years. He is working on a book of short stories as writer in residence for the Henry A. Wallace Country Life Center, at the birthplace of the former vice president and agriculture secretary in Orient, Iowa. Christopher Picone is a Land Institute scientist. Scott Bontz is an institute volunteer.

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