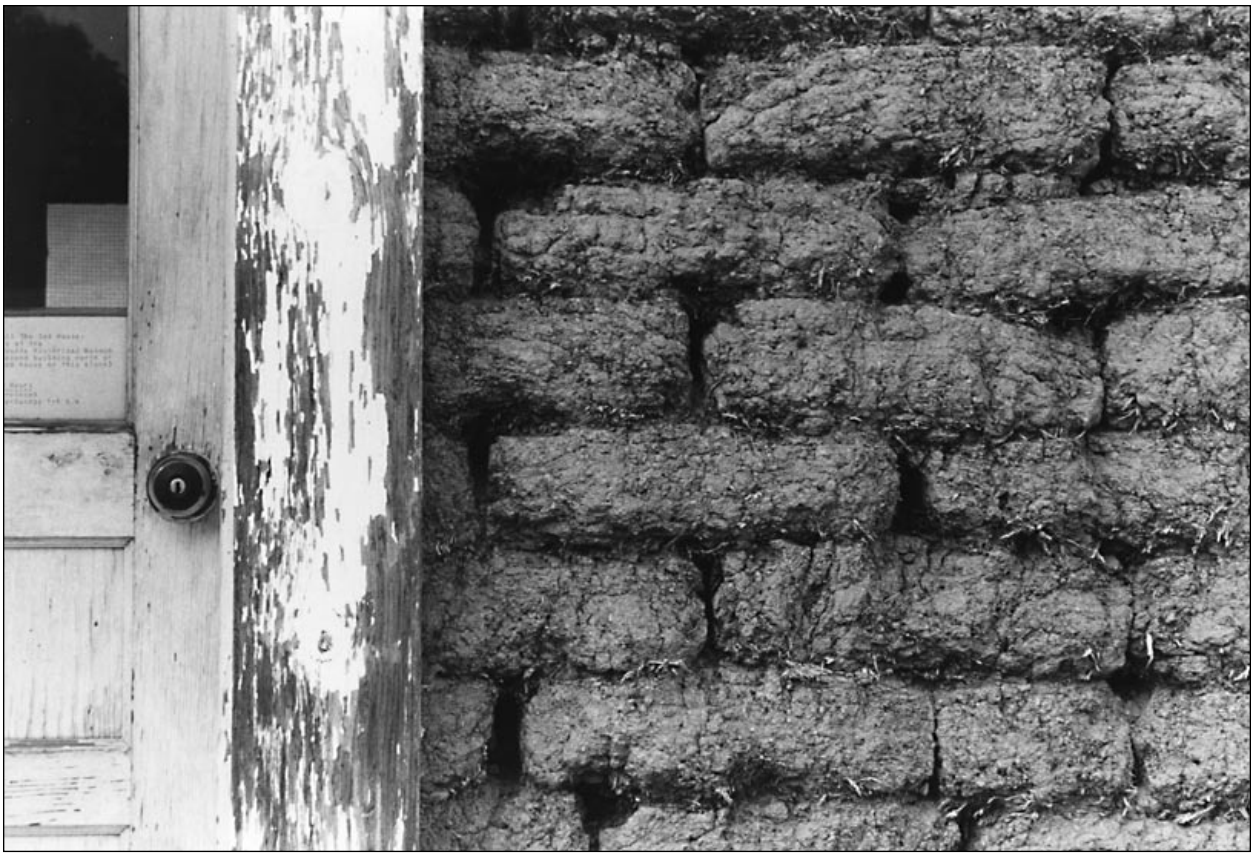
The Land Report

A publication of The Land Institute / Number 87 / Spring 2007



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Cover: Lane County, Kansas, by Jon T. O'Neal.

The Land Institute 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.

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ISSN 1093-1171

The Land Report is published three times a year.
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At the Land

Perennial Grain Breeding

The work to develop perennial grains will spread to the far side of the world: Scientists in Australia have secured funding to breed perennial wheat. We'll share with them seed from our own effort.

Len Wade, chair of crop agronomy at The University of Western Australia, said money from a consortium of government organizations and grower levies has the program set for seven years beginning in July 2008. Until then, the Australian scientists will accumulate a variety of seed for the effort.

Wade visited in 2005 to learn about our work.

Cropping with annuals in Western Australia has made soils salty. Annuals' shallow, seasonal roots let salty groundwater rise. Perennials' deeper and more efficient roots help prevent this.

In Kansas, excellent weather meant good plantings of wheat, wheatgrass and other fall-sown species.

Wheat: Our greenhouse again filled for winter breeding with wheat and perennial relatives. We succeeded in getting a large number of perennials to grow vigorously and produce lots of pollen and heads this year.

So far our wheat breeding has focused on backcrossing wheat-by-wheatgrass hybrids to wheat, in an effort to maximize yield and quality. Because the plants produced by this strategy have lacked the ability to persist, we are now crossing these very wheatlike plants to wheatgrass. We expect to obtain plants that are more wild in their appearance but also long-lived.

Intermediate wheatgrass: The 4,000 plants we transplanted to the field are doing well for another cycle of direct domestication with this perennial.

Sorghum: We learned a way to help predict which hybrid plants won't survive winter, and this will aid breeding this grain crop to be a perennial. Among hybrids that lived through winter 2005-6, the large majority had begun growing the underground stems called rhizomes and the green shoots called ramets that sprout from them—structures that help many perennial species survive and spread. The number of ramets ranged as high as more than 50 for some plants. But none with more than 20 survived winter—apparently they burned out. We know to favor plants that grow some ramets, but not too many.

We also learned that sorghum hybrid families with at least some winter-hardy siblings had averaged higher grain yield than those with no survivors. But families with the most winter-hardy plants produced less grain than did families with only one to three survivors. So, again, in plant breeding, moderation is often best.

The size of individual grains fell steadily with increasing winter-hardiness. But the correlation likely isn't genetically simple, and diligent plant breeding has long been able to turn what appeared a tradeoff into two gains.

Commercial, annual sorghum has been bred to be short, which avoids waste of energy on competitive height and eases harvest. It also is bred for compact heads of seed. Our hybrids still tower and have wilder, more open heads. We planted a block of those expected to be relatively short. Many didn't turn out so, but our combine handled them all well. Taller plants with wilder heads tended to make more ramets in fall, indicating more perennial potential. But their grain yields almost matched shorter plants with more compact heads.

Those grain yields are encouraging, because they suggest that we can develop higher-yielding perennials, though we'll have to keep pressing for shortness and compact heads.

Maximilian sunflower: We put seeds in 4,000 small pots for transplanting to the field this spring. The seeds were from 20 of the most promising plants seen in the last cycle of domesticating this native prairie perennial.

The pots sat outside to expose the seeds to cycles of freezing and thawing. This greatly improves the percent and uniformity of germination. However, we also have found that some Maximilian seeds don't need "stratification." And in addition to improved seed size and yield, we're selecting for the farm-friendly trait of ready-to-go seed. Screening raised the occurrence of it from 10 percent of the population one year to 70 percent the next. It appears that this will be an easy trait to "fix" in the population.

Kansas rosinseed (*Silphium integrifolium*): In effort to domesticate this wild perennial of the sunflower family, we harvested heads from about 50 plants with minimal shattering—dumping of seed before it can be uniformly harvested. The vast majority of plants had shattered. We picked 200 others plants for different reasons, such as shortness, number of seeds per head and number of heads per plant. We stratified 10 seeds from each select plant, for a total of 2,500. They'll go into the field this spring for another cycle of study and selection.

Lewis blue flax: This perennial that we're studying for possible grain production included about 20 individuals that re-flowered in fall. Most of the rest among hundreds in our field flowered only in spring. Fall flowering could increase chances of winter kill by depleting reserves. And fall flowers would be more susceptible to early frosts. But this species seems quite tolerant. And a double-harvest—

Land Institute plant breeder David Van Tassel is working to domesticate from the sunflower family a plant he calls Kansas rosinseed, Silphium integrifolium*. This winter he seeded in pots, from 250 select plants, 2,500 seeds for transplanting to field in spring. Similar efforts were made with other species as our breeding of perennial grain crops advances. Scott Bontz photo.*

spring and fall—crop could have the advantage of buffered yields. In years with a dry spring, low yields could be compensated for by a second harvest if the summer or fall was wet.

Agroecology

In 2004 we began comparing five native tallgrass prairie remnants, used exclusively for hay removal, with adjacent annual crop fields primarily used for wheat. The croplands have received fertilizers for decades. Despite lacking these artificial subsidies, the unfertilized prairies continue to export in hay as much or nearly as much nitrogen as the wheatfields, while keeping soil carbon and nitrogen significantly higher.

We don't know what the prairie soil nitrogen levels were at the onset of haying years ago. But long-term wild hay yield data for the five site counties show that yields can be maintained for long stretches—soil fertility apparently has not declined.

As we continue over the next few years to compare the prairie and longstanding cropland for production and soil quality, we can't say how much the differences are because of annual farming per se, and how much because of former practices such as moldboard plowing and use of low-yielding varieties. So we recently have also converted small blocks within the prairies to annual cropping under modern no-till management.

What we find from all this should help us learn how to grow our perennial grain crops together in ecosystems that maintain soil fertility and soil health in a way that annual monoculture crops cannot.

Presentations Made

Land Institute President Wes Jackson talked about biofuels at the Humans and Nature meeting in Chicago on November 9.

Beginning in mid-November, he campaigned against building three coal-fired power plants in western Kansas. He spoke in Salina, Lawrence and Topeka, the capital. There he testified to legislators for a moratorium bill, and talked twice with the governor and lieutenant governor about canceling the plants and leading a Plains states effort to build wind turbines instead. The moratorium bill failed. Decision on the plants is pending. We have funding to begin organizing the Plains wind effort, which Jackson talked about March 2-4 at a climate change meeting of the World Future Council in Kalamazoo, Michigan.

He described civilization's history of mining pools of carbon—trees, grassland, coal, oil and natural gas—to the New School in New York on November 28, and for a Rivers Institute conference in Indianapolis on November 29.

His topic December 4 at the University of Kansas was prairie as a model for agriculture. On January 11 in Charleston, South Carolina, it was climate change, and January 30 at Winona State University in Minnesota the talk was "Replacing the Industrial Mind."

Managing Director Ken Warren spoke February 2 in Kansas City, Missouri, for Coming Home to Eat, a conference to promote eating locally grown food. He said our agriculture and economy are going through soil, water and oil at a pace that cannot last, and that local-food proponents can join those with shared concerns, such as water conservationists, to anticipate the economy playing into their hands.

The Land Institute sponsored February 10 in Salina a discussion of how irrigation, more than what was perceived as drought, has cut stream flow in recent decades and brought a water shortage on the city last summer. A follow-up meeting March 11 addressed hydrology, water rights, the effects of farm policy, and the city government perspective.

Jackson spoke on agriculture, energy and rapid climate change February 17 for the 40th anniversary of Prescott College in Arizona, where he received the school's Environmental Award.

Presentations Scheduled

March 21, Independence, Missouri.
May 24, Manhattan, Kansas.
July 24, Topeka, Kansas.

Wes Jackson will speak at the Aspen Ideas Festival in Aspen, Colorado, July 2-8, but the event has sold out.

For more, call or see www.landinstitute.org.

Weekend Course on Our Work

Our annual weekend course in natural systems agriculture will be May 25-27 at Salina. There is no tuition, but students are responsible for their travel and accommodations. Maximum enrollment will be 25. Preference will go to applicants with backgrounds in areas related to agricultural or environmental sciences and career interests that match the course. Application deadline: April 15. For more, call, write or see www.landinstitute.org.

Prairie Writers Circle

We send op-ed essays to about 500 newspapers around the country. Recent topics: farm policy, the payoff from snow, population outstripping resources, evolution in public schools (see page 16). All of the essays are at www.landinstitute.org under Publications. They are free for use with credit to us.

Tours

We would enjoy meeting you, telling our story and hearing yours. Please call ahead. We give guided tours only with advanced arrangement, from 8 a.m. to 5 p.m. weekdays. See Visit at www.landinstitute.org or call 785-823-5376.

Farming Pioneers to Pioneer Factory Farmers

Thomas Rowe Mastick

Great, great grandfather Squire Washington Rowe and his wife, Dolly Castle Rowe, ventured up the Erie Canal and across Lake Erie in 1835. They homesteaded in Michigan, which became a state two years later.

They chose West Highland, an area of "oak openings," as natural meadows in the white oak forest were called. They built a log cabin and cleared more land to farm.

They labored for decades to clear the farm of stones and boulders left by glaciers. The stones were piled next to the fences bordering each field, a testament to determination. In 1855 a stone farmhouse replaced the log cabin.

Dad and I started working the farm in 1948. Each spring we pulled out the stoneboat and followed Squire Rowe's ritual, only with an Allis-Chalmers WD tractor instead of oxen. Each year frost heaved up more rocks. We said that we grew them.

"More boys left the farm over clearing stones than any other reason," Dad said. But I did not want to leave the farm. Through my teen-age years, I came to love the land and respect the settlers' works.

Scattered in the fields were apple trees where grazing livestock or a team and driver could rest in the shade. Black walnut trees lined the farm drive. There were apple and peach orchards, a vineyard, stone smokehouse, asparagus bed and 12-acre woodlot for fuel. The stone basement of the barn dug into an east-facing slope gave shelter from winter winds. The front yard was planted with sugar maple trees for syrup. All this was meant to sustain generations of farm families.

Dad and I raised Angus breeding stock. The cattle were purebred, generating enough income to compensate for our relatively small farm of 120 acres. But it could not support two families. I planned to work off the farm until we could find some way to increase productivity.

In 1962 Ralston Purina and Reynolds Aluminum Supply Co. had a new concept in egg production—the egg factory. Charlie, from Purina, used their pilot factory to show us the reward of this modern agricultural method: a "labor profit" of more than $7,000 per year for the smallest unit—3,312 birds, two per cage. It was the answer we were looking for.

The factory came in a package: aluminum building, cages hung from roof trusses, feed and water troughs in front of sloped cages. You only had to walk along to pick up the eggs that rolled down. You drove an automatic feed dispensing cart down concrete aisles. A feed bin outside augered feed through the wall into the cart. The lights were timed. A walk-in cooler refrigerated the eggs waiting for weekly pickup by the packer.

This innovative plan stocked the factory yearly with 20-week-old pullets raised elsewhere, ready to start laying. These were not ordinary hens, either—not Rhode Island Reds or White Leghorns. These were egg-laying machines called K-27s, developed by agriculture scientists at a land grant university. The birds were designed to have the highest "feed conversion ratio" and thrive in cages. Ralston Purina's feed scientists had developed a feed formula to maximize K-27 productivity.

Dad and I went to the bank. A contractor put up the building, the K-27s were stocked, and we were pioneer factory farmers.

We had a few problems that first winter. The air was so filled with ammonia from the manure, we had to open vents. Then the continuous running water in the troughs froze, overflowing into the feed. We had to keep the vents closed and accept bad air.

A month later the K-27s developed a respiratory illness. They stopped laying and started dying.

Charlie called it "morbidity." He said Purina had used an antibiotic. We set up a system to drip this into the water, never suspecting it would continue through the hens and into the eggs.

Eventually the birds recovered to lay well. We knew better weather was coming. But egg prices were low, as conventional flocks swung into production. Our egg checks barely covered expenses.

When a bird died, we put her cage mate into a cage with another survivor. Each cage developed a dominant and submissive hen. The dominant spent all her time standing on the submissive, eventually wearing the feathers off its back. When you put two dominants together, there would be an extended fight, with the winner climbing on the loser's back. When you put two submissives together, they would lie side-by-side for a day. The second day, one would stand up and climb on the other's back.

As days grew warmer, we opened the vents and doors to fresh air. Sparrows flew in to eat the feed, infecting the K-27s with mites. The caged birds could not fight this with dust baths. Productivity dropped. We used Charlie's special chemical dust to deal with mites and built chicken-wire doors to exclude the wild birds.

At times of high productivity K-27s could lay four or five eggs every five days. This high output plus the strain of caging produced what Charlie called "blowouts." The chickens' entrails fatally blew out the vent.

We could not keep the flies out of the manure. They laid eggs in the manure pits and made writhing masses of maggots. This manure was unlike any we had handled. It was so wet when we shoveled it into the spreader, it just ran

out the back. We learned to make a straw containment dam in the rear of the spreader.

The flies got worse. A Purina poultry specialist recommended a revolutionary new insecticide—malathion. Used in high concentrations, he said, it could eliminate any insect problem. It did.

Egg prices continued to fall. There was no "labor profit." We struggled to cover expenses. After two years, we realized Purina and Reynolds had sold thousands of egg factories across the nation. There was an egg glut. The new Purina feed dealer in our area went bankrupt, as many other new egg operations could not pay their bills.

We bought an egg grader. We washed, graded and packed the eggs ourselves. We delivered directly to grocers. The extra effort didn't pay.

Each year the old hens were picked up, slammed into a large truck and delivered for Campbell's soups. New pullets arrived, and the cycle renewed.

We changed feed suppliers, to one who offered a contract guaranteeing one dollar per bird per year profit. This was less than half of Purina's projections. But by now it sounded good to us. The new supplier's poultry expert told us we had the best-managed operation of all his producers.

After two years, this supplier went bankrupt. One dollar per hen per year was more than the depressed egg market could support.

After six years of operation, I was supplementing the expenses out of my earnings off the farm. Clearly it was better to close down and make the bank payment out of my own pocket.

Dad said, "There is more money in farming farmers than in farming." We had been farmed. My dreams of continuing the family farm made me a willing dupe of agribusiness in collusion with agricultural universities.

Factory farms violate every decency of animal husbandry. When I recall my role as a player in that inhumane system, I'm embarrassed after 40 years. Beyond this embarrassment, in nationwide travels I see old farms with derelict Reynolds Aluminum buildings. They represent the final effort of thousands of families to retain a way of life.

Our farm is now rural sprawl, commuters' homes scattered on the pastures. We sold it off piecemeal to pay for our aging parents' care.

Today factory farming continues to destroy the family farm with confined livestock operations that pollute the environment and torture animals. It produces inferior food at absurd low prices.

Agricultural universities and farm support industries need to realize that creatures we use for food cannot be forced into the production line model. In the big view, healthier animals make food more healthful.

Will the schools, agribusiness and the consumer wake up? Growth of organic food production gives hope.

Pelicans

Robinson Jeffers

Four pelicans went over the house,
Sculled their worn oars over the courtyard: I saw that ungainliness
Magnifies the idea of strength.
A lifting gale of sea-gulls followed them; slim yachts of the element,
Natural growths of the sky, no wonder
Light wings to leave sea; but those grave weights toil, and are powerful,
And the wings torn with old storms remember
The cone that the oldest redwood dropped from, the tilting of continents,
The dinosaur's day, the lift of new sea-lines.
The omnisecular spirit keeps the old with the new also.
Nothing at all has suffered erasure.
There is life not of our time. He calls ungainly bodies
As beautiful as the grace of horses.
He is weary of nothing; he watches air-planes; he watches pelicans.

From The Collected Poetry of Robinson Jeffers, Volume 1*, edited by Tim Hunt*

The Historical Roots of Our Ecologic Crisis

Lynn White Jr.

All forms of life modify their contexts. The most spectacular and benign instance is doubtless the coral polyp. By serving its own ends, it has created a vast undersea world favorable to thousands of other kinds of animals and plants. Ever since man became a numerous species he has affected his environment notably. For six millennia at least, the banks of the lower Nile have been a human artifact rather than the swampy African jungle that nature, apart from man, would have made it. In many regions terracing or irrigation, overgrazing and the cutting of forests, by Romans to build ships to fight Carthaginians or by Crusaders to solve the logistics problems of their expeditions, have profoundly changed ecologies. Observation that the French landscape falls into two basic types, the open fields of the north and the *bocage* of the south and west, inspired Marc Bloch to undertake his classic study of medieval agricultural methods.

Today, the impact of our race upon the environment has so increased in force that it has changed in essence. When the first cannons were fired, in the early 14th century, they affected ecology by sending workers scrambling to the forests and mountains for more potash, sulfur, iron ore and charcoal, with some resulting erosion and deforestation. Hydrogen bombs are of a different order: A war fought with them might alter the genetics of all life on this planet. By 1285 London had a smog problem arising from the burning of soft coal, but our present combustion of fossil fuels threatens to change the chemistry of the globe's atmosphere as a whole, with consequences that we are only beginning to guess. With the population explosion, the carcinoma of planless urbanism, the now geological deposits of sewage and garbage, surely no creature other than man has ever managed to foul its nest in such short order.

What shall we do? Unless we think about fundamentals, our specific measures may produce new backlashes more serious than those they are designed to remedy.

As a beginning we should try to clarify our thinking by looking at the presuppositions that underlie modern technology and science. Science was traditionally aristocratic, speculative, intellectual in intent; technology was lower-class, empirical, action-oriented. The quite sudden fusion of these two toward the middle of the 19th century is surely related to the slightly prior and contemporary democratic revolutions that, by reducing social barriers, tended to assert a functional unity of brain and hand. Our ecologic crisis is the product of an emerging, entirely novel, democratic culture. The issue is whether a democratized world can survive its own implications. Presumably we cannot unless we rethink our axioms.

The leadership of the West, both in technology and in science, is far older than the so-called Scientific Revolution of the 17th century or the so-called Industrial Revolution of the 18th century. These terms are in fact outmoded and obscure the true nature of what they try to describe—significant stages in two long and separate developments. By A. D. 1000 at the latest—and perhaps, feebly, as much as 200 years earlier—the West began to apply water power to industrial processes other than milling grain. This was followed in the late 12th century by the harnessing of wind power. From simple beginnings, but with remarkable consistency of style, the West rapidly expanded its skills in the development of power machinery, labor-saving devices, and automation. Not in craftsmanship but in basic technological capacity, the Latin West of the later Middle Ages far outstripped its elaborate, sophisticated and aesthetically magnificent sister cultures, Byzantium and Islam. In 1444 a great Greek ecclesiastic, Bessarion, who had gone to Italy, wrote a letter to a prince in Greece. He is amazed by the superiority of Western ships, arms, textiles, glass. But above all he is astonished by the spectacle of water wheels sawing timbers and pumping the bellows of blast furnaces. Clearly, he had seen nothing of the sort in the Near East.

By the end of the 15th century the technological superiority of Europe was such that its small, mutually hostile nations could spill out over all the rest of the world, conquering, looting and colonizing. The symbol of this technological superiority is the fact that Portugal, one of the weakest states of the Occident, was able to become, and to remain for a century, mistress of the East Indies. And we must remember that the technology of Vasco da Gama and Albuquerque was built by pure empiricism, drawing remarkably little support or inspiration from science.

In the present-day vernacular understanding, modern science is supposed to have begun in 1543, when both Copernicus and Vesalius published their great works. It is no derogation of their accomplishments, however, to point out that such structures do not appear overnight. The distinctive Western tradition of science, in fact, began in the late 11th century with a massive movement of translation of Arabic and Greek scientific works into Latin. Within less than 200 years effectively the entire corpus of Greek and Muslim science was available in Latin, and was being eagerly read and criticized in the new European universities. Out of criticism arose new observation, speculation and increasing distrust of ancient authorities. By the late 13th century Europe had seized global scientific leadership from the faltering hands of Islam.

Since both our technological and our scientific move-

ments got their start, acquired their character and achieved world dominance in the Middle Ages, it would seem that we cannot understand their nature or their present impact upon ecology without examining fundamental medieval assumptions and developments.

Until recently, agriculture has been the chief occupation even in "advanced" societies; hence, any change in methods of tillage has much importance. Early plows, drawn by two oxen, did not normally turn the sod but merely scratched it. Thus, cross-plowing was needed, and fields tended to be squarish. In the fairly light soils and semiarid climates of the Near East and Mediterranean, this worked well. But such a plow was inappropriate to the wet climate and often sticky soils of Northern Europe. By the latter part of the seventh century, however, following obscure beginnings, certain Northern peasants were using an entirely new kind of plow, equipped with a vertical knife to cut the line of the furrow, a horizontal share to slice under the sod, and a moldboard to turn it over. The friction of this plow with the soil was so great that it normally required not two but eight oxen. It attacked the land with such violence that cross-plowing was not needed, and fields tended to be shaped in long strips.

In the days of the scratch plow, fields were distributed generally in units capable of supporting a single family. Subsistence farming was the presupposition. But no peasant owned eight oxen: To use the new and more efficient plow, peasants pooled their oxen to form large plow teams, originally receiving, it would appear, plowed strips in proportion to their contribution. Thus, distribution of land was based no longer on the needs of a family but, rather, on the capacity of a power machine to till the earth. Man's relation to the soil was profoundly changed. Formerly man had been part of nature; now he was the exploiter of nature. Nowhere else in the world did farmers develop any analogous agricultural implement. Is it coincidence that modern technology, with its ruthlessness toward nature, has so largely been produced by descendants of these peasants of Northern Europe?

What people do about their ecology depends on what they think about themselves in relation to things around them. Human ecology is deeply conditioned by beliefs about our nature and destiny—that is, by religion. To Western eyes this is very evident in, say, India or Ceylon. It is equally true of ourselves and of our medieval ancestors.

The victory of Christianity over paganism was the greatest psychic revolution in the history of our culture. It has become fashionable today to say that for better or worse we live in "the post-Christian age." Certainly the forms of our thinking and language have largely ceased to be Christian, but to my eye the substance often remains amazingly akin to that of the past. Our daily habits of action, for example, are dominated by an implicit faith in perpetual progress which was unknown either to Greco-Roman antiquity or to the Orient. It is rooted in, and is indefensible apart from, Judeo-Christian teleology. The fact that Communists share it merely helps to show what can be demonstrated on many other grounds: That Marxism, like Islam, is a Judeo-Christian heresy. We continue today to live, as we have lived for about 1,700 years, very largely in a context of Christian axioms.

What did Christianity tell people about their relations with the environment?

While many of the world's mythologies provide stories of creation, Greco-Roman mythology was singularly incoherent in this respect. Like Aristotle, the intellectuals of the ancient West denied that the visible world had had a beginning. Indeed, the idea of a beginning was impossible in the framework of their cyclical notion of time. In sharp contrast, Christianity inherited from Judaism not only a concept of time as nonrepetitive and linear but also a striking story of creation. God planned all of this explicitly for man's benefit and rule: No item in the physical creation had any purpose save to serve man's purposes. And, although man's body is made of clay, he is not simply part of nature: He is made in God's image.

Especially in its Western form, Christianity is the most anthropocentric religion the world has seen. As early as the second century both Tertullian and St. Irenaeus of Lyons were insisting that when God shaped Adam he was foreshadowing the image of the incarnate Christ, the Second Adam. Man shares, in great measure, God's transcendence of nature. Christianity, in absolute contrast to ancient paganism and Asia's religions (except, perhaps, Zoroastrianism), not only established a dualism of man and nature but also insisted that it is God's will that man exploit nature for his proper ends.

At the level of the common people this worked out in an interesting way. In antiquity every tree, every spring, every stream, every hill had its own *genius loci,* its guardian spirit. These spirits were accessible to men, but were very unlike men; centaurs, fauns and mermaids show their ambivalence. Before one cut a tree, mined a mountain or dammed a brook, it was important to placate the spirit in charge of that particular situation, and to keep it placated. By destroying pagan animism, Christianity made it possible to exploit nature in a mood of indifference to the feelings of natural objects.

When one speaks in such sweeping terms, a note of caution is in order. Christianity is a complex faith, and its consequences differ in differing contexts. What I have said may well apply to the medieval West, where technology made spectacular advances. But the Greek East, a highly civilized realm of equal Christian devotion, seems to have produced no marked technological innovation after the late seventh century, when Greek fire was invented. The key to the contrast may perhaps be found in a difference in the tonality of piety and thought which students of comparative theology find between the Greek and the Latin Churches. The Greeks believed that sin was intellectual blindness, and

that salvation was found in illumination, orthodoxy—that is, clear thinking. The Latins, on the other hand, felt that sin was moral evil, and that salvation was to be found in right conduct. Eastern theology has been intellectualist. Western theology has been voluntarist. The Greek saint contemplates; the Western saint acts. The implications of Christianity for the conquest of nature would emerge more easily in the Western atmosphere.

The Christian dogma of creation has another meaning for our comprehension of today's ecologic crisis. By revelation, God had given man the Bible. But since God had made nature, nature also must reveal the divine mentality. The religious study of nature for the better understanding of God was known as natural theology. In the early Church, and always in the Greek East, nature was conceived primarily as a symbolic system through which God speaks to men: The ant is a sermon to sluggards; rising flames are the symbol of the soul's aspiration. This view of nature was essentially artistic rather than scientific. While Byzantium preserved and copied great numbers of ancient Greek scientific texts, science as we conceive it could scarcely flourish in such an ambience.

However, in the Latin West by the early 13th century natural theology was following a very different bent. It was ceasing to be the decoding of the physical symbols of God's communication with man and was becoming the effort to understand God's mind by discovering how his creation operates. The rainbow was no longer simply a symbol of hope first sent to Noah after the Deluge. From the 13th century onward into the 18th, every major scientist, in effect, explained his motivations in religious terms. Indeed, if Galileo had not been so expert an amateur theologian he would have got into far less trouble: The professionals resented his intrusion. It was not until the late 18th century that the hypothesis of God became unnecessary to many scientists.

It is often hard for the historian to judge, when men explain why they are doing what they want to do, whether

Leavenworth County, Kansas. Jon T. O'Neal photo.

they are offering real reasons or merely culturally acceptable reasons. The consistency with which scientists during the long formative centuries of Western science said that the task and the reward of the scientist were "to think God's thoughts after him" leads one to believe that this was their real motivation. If so, then modern Western science was cast in a matrix of Christian theology. The dynamism of religious devotion, shaped by the Judeo-Christian dogma of creation, gave it impetus.

We would seem to be headed toward conclusions unpalatable to many Christians. Since both *science* and *technology* are blessed words in our contemporary vocabulary, some may be happy at the notions, first, that, viewed historically, modern science is an extrapolation of natural theology and, second, that modern technology is at least partly to be explained as an Occidental, voluntarist realization of the Christian dogma of man's transcendence of, and rightful mastery over, nature. But, as we now recognize, over a century ago science and technology, hitherto quite separate activities, joined to give mankind powers which, to judge by many of the ecologic effects, are out of control. If so, Christianity bears a huge burden of guilt.

I personally doubt that disastrous ecologic backlash can be avoided simply by applying to our problems more science and more technology. Our science and technology have grown out of Christian attitudes toward man's relation to nature that are almost universally held not only by Christians and neo-Christians but also by those who fondly regard themselves as post-Christians. Despite Copernicus, all the cosmos rotates around our little globe. Despite Darwin, we are *not,* in our hearts, part of the natural process. We are superior to nature, contemptuous of it, willing to use it for our slightest whim. A governor of California, like myself a churchman but less troubled than I, spoke for the Christian tradition when he said (as is alleged), "When you've seen one redwood tree, you've seen them all." To a Christian a tree can be no more than a physical fact. The whole concept of the sacred grove is alien to Christianity and to the ethos of the West. For nearly two millennia Christian missionaries have been chopping down sacred groves, which are idolatrous because they assume spirit in nature.

What we do about ecology depends on our ideas of the man-nature relationship. More science and more technology are not going to get us out of the present ecologic crisis until we find a new religion, or rethink our old one.

Possibly we should ponder the greatest radical in Christian history since Christ: St. Francis of Assisi. The prime miracle of St. Francis is the fact that he did not end at the stake, as many of his left-wing followers did. He was so clearly heretical that a general of the Franciscan Order, St. Bonaventura, a great and perceptive Christian, tried to suppress the early accounts of Franciscanism. The key to an understanding of Francis is his belief in the virtue of humility, not merely for the individual but for man as a species. Francis tried to depose man from his monarchy over creation and set up a democracy of all God's creatures. With him the ant is no longer simply a homily for the lazy, flames a sign of the thrust of the soul toward union with God; now they are Brother Ant and Sister Fire, praising the Creator in their own ways as Brother Man does in his.

What Steven Runciman calls "the Franciscan doctrine of the animal soul" was quickly stamped out. Quite possibly it was in part inspired, consciously or unconsciously, by the belief in reincarnation held by the Cathar heretics who at that time teemed in Italy and southern France, and who presumably had got it originally from India. It is significant that at just the same moment, about 1200, traces of metempsychosis are found also in Western Judaism, in the Provencal *Cabbala.* But Francis held neither to transmigration of souls nor to pantheism. His view of nature and of man rested on a unique sort of pan-psychism of all things animate and inanimate, designed for the glorification of their transcendent Creator, who, in the ultimate gesture of cosmic humility, assumed flesh, lay helpless in a manger and hung dying on a scaffold.

I am not suggesting that many contemporary Americans who are concerned about our ecologic crisis will be either able or willing to counsel with wolves or exhort birds. However, the present increasing disruption of the global environment is the product of a dynamic technology and science that were originating in the Western medieval world and against which St. Francis was rebelling in so original a way. Their growth cannot be understood historically apart from distinctive attitudes toward nature that are deeply grounded in Christian dogma. The fact that most people do not think of these attitudes as Christian is irrelevant. No new set of basic values has been accepted in our society to displace those of Christianity. Hence we shall continue to have a worsening ecologic crisis until we reject the Christian axiom that nature has no reason for existence save to serve man.

The greatest spiritual revolutionary in Western history, St. Francis, proposed what he thought was an alternative Christian view of nature and man's relation to it: He tried to substitute the idea of the equality of all creatures, including man, for the idea of man's limitless rule of creation. He failed. Both our present science and our present technology are so tinctured with orthodox Christian arrogance toward nature that no solution for our ecologic crisis can be expected from them alone. Since the roots of our trouble are so largely religious, the remedy must also be essentially religious, whether we call it that or not. We must rethink and refeel our nature and destiny. The profoundly religious, but heretical, sense of the primitive Franciscans for the spiritual autonomy of all parts of nature may point a direction. I propose Francis as a patron saint for ecologists.

Adapted from the author's book Dynamo and Virgin Reconsidered, *originally published as* Machina ex Deo, *in 1968, by The MIT Press. The essay first appeared in the journal* Science, *in 1967.*

The Gospel of Green

Will evangelicals help save the earth?

Bill McKibben

First came the mighty winds, blowing across the gulf with unprecedented fury, leveling cities and towns, washing away the houses built on sand. Toss in record flooding across the Northeast, and one of the warmest winters humans have known on this continent, and a prolonged and deepening drought in the desert West. For Americans, the year that began with the hurricanes of 2005 was the year the earth turned biblical. Pharaoh may have faced plagues and frogs and darkness; we got Katrina and Rita and Wilma.

But it was also the year the environmental movement turned biblical—the year when people of faith began in large numbers to join the first rank of those trying to protect creation. The key symbolic moment came in February, when 86 of the country's leading evangelical scholars and pastors signed on to the Evangelical Climate Initiative, a document that may turn out to be as important in the fight against global warming as any stack of studies and computer models. It made clear, among other things, that even in the evangelical community, "right wing" and "Christian" are not synonyms, and in so doing it may have opened the door to a deeper and more interesting politics than we've experienced in the past decade of fierce ideological divide.

That document seemed, to many newspaper readers, to come out of nowhere. But, of course, it was the result of long and patient groundwork from a small corps of people. Understanding that history helps illuminate what the future might hold for this effort. And given that 85 percent of Americans identify themselves as Christian, and that we manage to emit 25 percent of the world's carbon dioxide—well, the future of Christian environmentalism may have something significant to do with the future of the planet.

In the beginning—say, The Reagan Era—all was darkness. To liberal American Christians, the environment was largely a luxury item, well down on the list below war and poverty. "I remember one Catholic bishop asking me, 'How come there aren't any people on those Sierra Club calendars?'" says one of the few religious conservationists of that era. To conservative Christians, *environmentalism* was a dirty word—it stank of paganism, of interference with the free market, of the '60s. Meanwhile, many environmentalists were more secular than the American norm, and often infected with the notion spread by the historian Lynn White in his famous 1967 essay, *The Historical Roots of Our Ecologic Crisis*, that Christianity lay at the root of ecological devastation. Everyone, in short, was scared of everyone else.

But there were a few lights starting to shine in that gloom. Calvin DeWitt carried one lantern. A mild-mannered Midwesterner with a Ph.D. in zoology, he helped in 1979 to found the Au Sable Institute in northern Michigan. The institute devotes itself to organizing field courses and conferences that teach ecology, always stressing the Christian notion of stewardship, the idea that, as it says in Genesis, we are to "dress and keep" the fertile earth. To understand what a religious environmental worldview might look like, consider this from one of DeWitt's early statements: "Creation itself is a complex functioning whole of people, plants, animals, natural systems, physical processes, social structures and more, all of which are sustained by God's love and ordered by God's wisdom. Thus, Au Sable brings together the full range of disciplines—from chemistry to economics to marine biology to theology—that we need if we are to be good stewards of God's household." That doesn't sound too frightening, right?

In DeWitt's Reformed Church tradition, God has left us two books to read. First, the book of creation, "in which each creature is as a letter of text leading us to know God's divinity and everlasting power." And second, the Bible. It's easy to see how environmentalism connects with the first of these, but it's taken longer to understand its relevance to the second.

"When we started, for the first two or three or four years almost everything we were dealing with was an Old Testament text, from the Hebrew Bible," says DeWitt. That makes sense. Since the Old Testament starts at the beginning, it has to deal with questions about the relationship between people and land. There's Noah, the first radical green, saving a breeding pair of everything; there are the Jewish laws mandating a Sabbath for the land every seventh year; there's the soliloquy at the end of the book of Job, which is both God's longest speech in the whole Bible and the first and best piece of nature writing in the Western tradition.

But the sparer, more compressed text of the Gospels and Epistles had never been read with an eye to its ecological meaning—in large part because it wasn't necessary. Medieval Christians, say, weren't living in a time of planetary peril. But now that we were, people started finding passages like this from Colossians: Jesus "is the image of the invisible God, the first-born of all creation; for in him all things were created, in heaven and on earth ... all things were created before him and through him." It may not sound exactly like an Audubon Society mailer, but the insistence on this world as well as the next was important in helping many pastors open up to environmental thinking. Or this, from Revelation, describing the final judgment, when the time

would come for rewarding the servants and prophets and "for destroying the destroyers of the earth." (That's a little scarier to secular ears, but if you've ever sung Handel's *Messiah*, the "trumpet shall sound" stuff echoes the same passage.) The point is, once people started looking, the Scriptures started speaking.

Something else happened too: the emergence of climate change as the key question for the environmental movement. On the one hand, confronting global warming made everything harder—environmental groups suddenly found themselves contending with the main engine of our economy. But for many religious environmentalists, heightening the stakes may have made progress easier—this was a cosmological question, one about the ultimate fate of our species, our planet, God's creation. Unlike, say, clean drinking water, where simple, practical wisdom was enough to offer you an answer, global warming almost demanded a theological response. In that sense, it was like the dawn of the nuclear age. "The magnitude, the comprehensiveness, the totality of the challenge it represents to God's creation on earth, the profoundly intergenerational nature of the damage that was being done—it became the central axis," says Paul Gorman.

Gorman is a story in himself. A former speechwriter for Eugene McCarthy, in 1993 he co-founded the National Religious Partnership for the Environment, which, with generous amounts of foundation money, set out to build environmental support among American Jews, Catholics, mainline Protestants and evangelical Christians. Crucially, it was willing to go slowly enough to build a solid foundation. "It's not going to be the environmental movement at prayer," says Gorman, "not about providing more shock troops for the embattled American greens. We have to see the inescapable, thrilling, renewing religious dimension of this challenge." A thousand Sunday school curriculums and special liturgies and summer camps later, Gorman's effort is bearing real fruit. In 2001, for instance, America's Catholic bishops issued a pastoral statement on the environment, one that fits the question into their longstanding theology of "prudence" and relates it to their centuries of work against hunger and poverty around the world. "If you measure [the change] against the speed with which religious life integrates fundamental new perspectives, then historically it's been kind of brisk," says Gorman.

On occasion, the religious environmental movement flared into public view. At the turn of the century, for instance, while spending a year as a fellow at Harvard Divinity School, I helped organize a series of demonstrations outside SUV dealerships in Boston. Before one demonstration with a bunch of mainline clerics, Dan Smith, then the associate pastor of the Hancock United Church of Christ in Lexington, Massachusetts, where I'd grown up, and I painted a banner that said "WWJD: What Would Jesus Drive?" The initials were borrowed from evangelical circles, where they stood for What Would Jesus Do and usually referred to questions of sex or drugs. But we liked the emphasis on personal responsibility—and we guessed that the newspapers might like it too. Guessed correctly, as it turned out, for the sign was splashed across the front pages and Web sites the next day. Within a matter of months, it wound up back in more conservative circles, where the Evangelical Environmental Network, of which DeWitt was a founder, used the slogan as part of a multistate advertising campaign.

Most of the time, though, the progress has been slower, steadier and less visible. The Evangelical Climate Initiative document, for instance, grew out of a very private retreat for select leaders at a Christian conference center on the Maryland shore, a gathering that included many of the evangelical movement's luminaries, most of whom had not been deeply involved in environmental issues. The opening remarks came from John Houghton, an English physicist and climate expert who had served as chairman of the scientific assessment team for the Intergovernmental Panel on Climate Change, the group that definitively broke the news that humans were indeed heating the planet. Houghton was also a lifelong British evangelical—on a continent where Christians are less politically polarized—and a friend of John Stott, another Brit and a beloved elder statesman in evangelical circles. Houghton also could point to his collaborations with business leaders in Europe, like John Brown, chairman of British Petroleum, who were far more open to acknowledging global warming than were their American counterparts at companies like Exxon.

"When John Houghton speaks, he speaks with both biblical authority and scientific authority," says DeWitt. "The critic, the detractor, the naysayer has to deal with a person who is both the scientist and the evangelical scholar in one and the same person. As an evangelical, Bible-believing, God-fearing Christian as well as a scientist, he'd made sure that the IPCC reports were absolutely the best and most truthfully stated documents ever produced in science." And, he adds, "it helps that he's got a British accent."

By the conference's close, the participants had made a covenant to address the issue, and then spent months gathering signatures. When it was eventually released, some leaders of the Christian right, like Jerry Falwell, Pat Robertson and James Dobson, demanded that it be retracted. Climate science was unsettled, they said. Speaking anonymously, one conservative Christian lobbyist scoffed to a reporter, "Is God really going to let the earth burn up?" The National Association of Evangelicals, the umbrella group for the entire movement, feared a split and stayed officially neutral. But the bulk of the 86 signers—who included seminary presidents, charity directors and prominent pastors like Rick Warren, author of *The Purpose-Driven Life*—held strong, some of them quietly relishing the chance to say that their movement was larger than high-profile televangelists and not necessarily a steady date of the GOP. "The grace of it!" says Gorman. "I think you could say this is

one of the first significant events of the post-Bush era."

It's had legs, too. Last spring the *New Republic* reported that in Pennsylvania the incumbent Republican senator Rick Santorum had come under religious fire for his stand on climate change. At a panel on the subject, a biology professor at Messiah College in Grantham, Pennsylvania, "tore into the senator, accusing him of selling out the environment to business interests," one reporter said. In the words of Richard Cizik, the chief lobbyist for evangelical causes in Washington, "there's going to be a lot of political reconsideration on this in the coming year. The old fault lines are no more."

Other evangelicals are less political, but at least as subversive. A former emergency room doctor named Matthew Sleeth, for instance, quit his job to preach the green gospel and says the reaction has been far greater than he could have guessed. His book *Serve God, Save the Planet* was published last spring, and he has been traveling to churches ever since. Everywhere his message is the same: God asks us to surrender some of our earth-wrecking wealth. "Bible-believing Christians have confused the kingdom of heaven with capitalism and consumerism," Sleeth says. He's not attracted to electoral politics. Instead he's been downsizing his life—putting up the clothesline, selling his stuff, buying a Prius. (He writes his books on a lifetime supply of old computer paper he rescued from a Dumpster.)

The ecological battles ahead of us compare to the greatest battles in American history, he says, and his models include people like the abolitionist John Brown, who practiced exactly what he preached, sharing his farm with freed slaves. "There's a longing for a spiritual life in this country," he says, over and over. "A great hunger for something more than capitalism."

It's far from clear, however, that faith communities will take this fight as far as it needs to go. Simply breaking ranks with the Bush administration on this issue took enormous courage for evangelical leaders. So if some legislator offers any kind of deal to "fix" the problem of global warming, it may win all-too-easy endorsement. Some kind of Kyoto-lite measure, like the one proposed by Senators John McCain and Joe Lieberman, might pass the Congress in the next few years. If it does, the bar has been set so low that environmentalists of all stripes, but especially those out on a limb like the evangelicals, might well sign on, even though the steadily worsening scientific findings make it very clear that bold and rapid action is required. Here's John Houghton, speaking hard words to Americans: "You've got to cut your own greenhouse gas emissions, on the fastest time scale you can possibly do. You've got to help China and India develop in ways that are environmentally friendly and don't emit too much, but allow them to develop at the same time." Those are precisely the fights—

Smith County, Kansas. Jon T. O'Neal photo.

over scale, speed and international equity—that will bedevil whatever steps we take to fight global warming, and it's not clear that the faithful are really girded for the fight. "Will this groundswell have the real moral edge to keep the pressure on over the long haul?" asks Gorman, and he doesn't answer his own question.

If the answer is going to be yes, a couple of things may need to happen. One, the mainline Protestant denominations will have to step up to the plate. They long ago passed all the proper resolutions decrying the destruction of creation, and certain congregations have launched interesting initiatives. (An upstart group called Episcopal Power and Light, for instance, pioneered the practice of supplying congregations with green power.) But not many mainline Protestants have stepped far outside their comfort zones—in part because the denominations themselves are dwindling in number and beset by internal divisions over questions like the ordination of gay clergy. Still, there are increasing hints of future activism: Planning for possible widespread nonviolent civil disobedience to draw attention to global warming, for instance, was widely discussed at a recent National Council of Churches meeting in storm-wrecked New Orleans. Protests at Ford headquarters? Blocking the entrance to the EPA? Sitting on the tracks of coal trains? Whatever the strategy, it will play better on TV if there are some clerical collars near the front.

The critique from all quarters will need to get sharper too. Calvin DeWitt pulls no punches: "We've spiritualized the devil," he says. "But when Exxon is funding think tanks to basically confuse the lessons that we're getting from this great book of creation, that's devilish work. We find ourselves praying to God to protect us from the wiles of the devil, but we can't see him when he's staring us in the face."

Much of the uncertainty about the future of such efforts stems from this: Christianity in America has grown very comfortable with the hyperindividualism of our consumer lives. In one recent poll, three-quarters of Christians said they thought the phrase "God helps those who help themselves" came from the Bible, when in fact it derives from Aesop via Ben Franklin and expresses almost the exact opposite of the Gospel injunction to "love your neighbor as yourself." Says DeWitt, "By accommodating to a new philosophy about how society works, we've flipped Matthew 6:33 on its head. Instead of 'Seek ye first the kingdom of God and all the rest shall be added unto you,' we're looking out for number one." Which makes it a lot harder for politicians to start talking about carbon taxes or other measures that might actually start to bring our emissions under control.

Still, there are continuing signs of progress—what Christians might call evidence of the Holy Spirit at work. In August, after the hottest early summer on record in the United States, even Pat Robertson announced his conversion—people were heating the planet, he said, and something needed to be done. In the end, it's clear that this battle is not only for the preservation of creation. In certain ways, it offers the chance for American Christianity to rescue itself from the smothering embrace of a culture fixated on economic growth, on individual abundance. A new chance to emerge as the countercultural force that the Gospels clearly envisioned. And also a chance to heal at least a few of the splits in American Christianity. Fighting over creation versus evolution, for instance, seems a little less crucial in an era when de-creation has become the real challenge.

Appeared first in OnEarth*, magazine of the Natural Resources Defense Council.*

The human consciousness may have begun to leap and boil some sunny day in the Pleistocene, but the race by and large has retained the essence of its animal sense of time. People think in five generations—two ahead, two behind—with heavy concentration on the one in the middle. … Geologists, dealing always with deep time, find that it seeps into their beings and affects them in various ways. They see the unbelievable swiftness with which one evolving species on the earth has learned to reach into the dirt of some tropical island and fling 747s into the sky. They see the thin band in which are the all but indiscernible stratifications of Cro-Magnon, Moses, Leonardo, and now. —John McPhee, *Basin and Range*

The Missing Link: Compromise

David Van Tassel

Recent court and ballot box decisions have turned back the teaching of creationism in public schools. Now the temptation for evolutionists like me is to legally enshrine Darwinism as orthodoxy. We should reconsider.

First, we need to guard against a spirit of triumphalism that can undermine the scientific culture of debate and freethinking. Let's not become Inquisitors for Science.

Second, it would be a tactical mistake. It would fuel the creationists' sense of being a persecuted minority, further energizing their insurgency, which is sophisticated, passionate and resilient. In my home state of Kansas, school science standards have been rewritten four times since 1998. Now that the state school board has shifted back to evolutionists, the fight is sure to surge anew.

Third, it is unnecessary. Most people don't need evolution to cope in the world. Most Americans either don't believe or misunderstand the theory, yet technology and science flourish. Glimpsing the scope and logic of evolution is like learning to appreciate great literature or wine: Our world is forever expanded and enriched. But we must admit that there are plenty of professionals who don't appreciate literature or wine or evolution, yet are competent and successful.

Let's not get sidetracked by the old "slippery slope" argument. I know many creationists, and none of them wants witch hunts. Warning of a slippery slope is a discredited scare tactic used with equal relish to predict that Darwinism leads to cannibalism.

And let's not equate scientific Darwinism with political progressivism or confuse "correct" science with virtue. There are creationists—and probably flat-earthers—who protect wildlife, conserve resources, feed the hungry and support civil liberties. And evolutionists who don't.

Fourth, it is impractical. The world faces urgent technical problems: rapid climate change, the prospect of global food and water shortages, the rise of drug-resistant diseases and pests. The practical response is to agree to confine our disagreements to certain times and places, and to work on common problems in harmony.

Maybe the taxpayer-funded K-12 school can be our mutual peace offering. Defer the debate to college, where biology students will more likely have the science and math background to meaningfully evaluate competing, technical claims about evolution. In the public schools we could:

■ Rigorously teach about genetic changes within species. This is observable, repeatable, vitally practical science. Epidemiologists, medical geneticists, crop breeders and wildlife biologists all use it. Creationists call this "microevolution," and they have no problem with it. Increasing the number of graduates literate in basic molecular and population genetics would be a triumph for all of us.

■ Move both Genesis and "molecules-to-man" Darwinism to history or philosophy classes. Our children should understand these ideas and how they have informed our culture, but we can reach a grand compromise by teaching neither as science. Creationists win because their children are no longer "indoctrinated" with "macroevolution" taught as fact. Evolutionists win because "creation science" claims that have not withstood scientific scrutiny are excluded from science classes.

My hesitancy to proselytize for Darwin doesn't mean I have no faith in evolution. I have faith that most people who love living things and take the time to get a solid biology background will find Darwin's model convincing. Supporting evidence still accumulates after almost 150 years. Information about evolution is easy to find in books, universities and on the Internet. This idea is too powerful to vanish from science or even popular culture. Its survival doesn't require imposing it on children.

I have faith that biologically minded children will connect the dots if they are effectively taught basic math, science and "microevolution." Those who seek will find.

I should know. I was a creationist kid. I absorbed their literature. I flummoxed my high school biology teachers with trick creationist questions that exposed the shallowness of their understanding of evolution.

But I also had a lifelong passion for biology, and in my senior year at a college where many teachers were creationists, the explanatory power of Darwin's theory finally won me over. I remember the feeling of liberation and murmuring Jesus' words: "The truth shall set you free."

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Winding Our Way Back to the Future

Jake Vail

I first came to Kansas to learn some basic lessons about how what we eat connects to how it is grown—how food connects to agriculture. And one can't learn much about that without also learning how agriculture connects to energy. These are the same lessons that the first immigrants learned when they came to this land in the mid-1800s.

Kansas was settled east to west, from wetter lands to drier lands, with a civil war neatly dividing two waves of immigration right at the line where trees give way to grass—not very far west of Kansas City. The pioneers' agriculture was the one that they brought with them from the humid woods of the eastern United States. It took some time before they realized that it didn't fit very well on the comparatively dry and windy prairie.

In a time before tractors, when "horsepower" had real meaning—though oxen were frequently the beasts of burden, tilled fields were small and plantings were diverse. Foodstuffs of every kind were tried in the unfamiliar lands of the Kansas Territory. Flax, cotton, and hemp were planted for fiber. Orchards went in, especially when new railroads could ship young trees. New England sugar maples were even planted for syrup. The wheat that Kansas would become famous for was a different sort then—spring wheat. It would take over 20 years more for hard winter wheat to make its way from Russia and remake the agricultural landscape.

Corn was King. An important part of eastern agriculture that fueled both people and livestock, it also fueled a brisk alcohol trade, a potent version of which is growing today—about which more later. And of course the pioneers brought their livestock, not only cattle but pigs and sheep. In Douglas County in eastern Kansas there were as many cows as residents in 1860, and even more pigs.

When the Massachusetts Emigrant Aid Company arrived to found Lawrence in 1854, what would come to be the Wheat State was still the Sunflower State—though Kansas wasn't yet a state, and had no such slogan, but you get the point. It wasn't at all obvious where power and heat would come from, for the trees that the New Englanders knew were few, growing almost exclusively in the bottomlands. As was the case until the heyday of the railroads, settlement followed waterways, for rivers provided energy and transportation routes.

On those rivers, staples like flour came from points east. Steam-powered mills also came to Kansas, shipped down the Ohio River and over to Kansas City. Most operated as combination mills, grinding grain but also sawing lumber, turning lathes, riving shingles, spinning wool, and ginning cotton. Steam mills, of course, require water and fuel for the fire, and so were built in or near the woods on the banks of the rivers.

The very first bolted (sifted) flour milled in Kansas was ground in 1857 at a steam mill on the Wakarusa River, southeast of Lawrence. The Rev. James Wesley Willey settled on the western edge of the Shawnee Reservation, between the Wakarusa and the Oregon Trail. He had a mill shipped from Indiana to Kansas City, and hauled it home on the wagon trail with his oxen. Using it to saw his own oak lumber, he and his son built a sturdy combination mill.

In addition to steam power, another source of energy became obvious in Kansas' early years: wind. The Junction City Union wrote, "If Kansas … does not utilize this wealth, it is entirely the fault of its own stupidity." That was 138 years ago. As is still true, windmills were commonly used to pump water for cattle grazing on the prairie uplands. It took a Swede though, not a New Englander, to build the first wind*mill*, to grind grain.

In 1858, Kansas' second gristmill was built, a few miles upriver from Willey's. Like Willey's, Henry Hiatt's was a steam mill, though he advertised a windmill, too, which apparently never was constructed. But he had planted the seed of an idea. A young man named Anders Palmquist worked at Hiatt's mill, and it was Palmquist who, with John Wilder, built one of Kansas' early landmarks. Their "genuine Holland windmill," sailing some 80 feet tall, stood on a hill above Lawrence for over 40 years.

Palmquist, who changed his name to Andrew Palm, was raised in the south of Sweden, where windmills were as much a part of the landscape as trees were to the New Englanders. After teaming up with Wilder, Palm journeyed back to Sweden to gather plans and carpenters. Mill construction began in May of 1863. The limestone foundation was quarried on site, and the mill itself was oak cut from the banks of the Kansas River, shingled in walnut. The massive gears that transferred wind energy to turning millstones were made of oak.

Construction, which fortunately hadn't gotten too far, was interrupted on the morning of August 21, when William Quantrill and his band of pro-slavery raiders rode in from Missouri and burned Lawrence down. Palm's Swedish workers hid in a nearby basement, but Josiah Trask, who it seems was a partner with Wilder and Palm, was killed. Nevertheless, by the next spring the first wind-driven mill in Kansas was completed. The Kansas State Journal said, "It runs all the while, eats no wood, consumes no water, and asks absolutely nothing of its proprietors … but that they shall spread its sails... ."

Small-scale grain milling boomed briefly in eastern

Kansas after the Civil War. But soon came railroads, more settlers and new technology. Grain production moved to the center of the state, a drier land where much less corn and much more wheat was planted, where the Mennonite colonies were finding great success with winter wheat from their homelands. Large mills followed the farmers west. Lawrence's famous windmill turned mostly to manufacturing farm equipment.

Kansas agriculture professor E. M. Shelton wrote in 1877, "No eastern farmer can live in Kansas a couple years without learning a good deal; but what he learns is as nothing compared to what he unlearns." Now facing an uncertain future of expensive fuel, climate change, water shortages and volatile international markets, agriculture and energy in many ways are becoming new again, and Kansans must brace for a new round of unlearning.

Oddly, Wheat State agriculture is spiraling back to the mid-1800s. Since 1982, acres planted in wheat have steadily decreased. Over the same years, corn acreage has more than doubled. This growing interest in corn, especially recently for ethanol distillation, confounds balances of agriculture and energy. Like the hydraulic mining of the gold rush, the corn surge is water intensive—far more than growing wheat is. The necessary water comes from deep aquifers, pumped out with fossil fuels. Corn's cultivation and fertilization require yet more petrochemicals. The effects on the land and on our real source of energy—food—remain to be seen.

From the start, Kansas farmers have borrowed pieces of centuries-old agricultures from around the world. Livestock from Europe. Windmills from Sweden. Winter wheat from Russia. Native Americans, of course, taught us about corn. We have yet to learn the lessons of our new home, the grassy land that is named for the south wind.

Adapted from a version in The Lawrencian.

Cheyenne County, Kansas. Jon T. O'Neal photo.

With All Its Outbuildings

William Paul Winchester

With all its outbuildings the farm is like a settlement, a colony with each of us having our own shelter. Dog, cow, weaned calf, poultry, bees and myself. What began as a house standing solitary in a weedy field became in time a farm, but not overnight. A farm grows by accretion, piece by piece, not by plan so much as by necessity, evolving in ways a biologist would understand better than an architect or builder.

There is always some construction going on of a screen porch on the house, a shed for the tractor, a fence around the peach orchard, a pasture gate, a chicken brooder, a flail. No work on the farm is more pleasurable than this. It combines the fascination of solving a puzzle with the delight of making something. Driven indoors by a rain, I've spent the happiest of afternoons with tablet and pencil and square, laying out yet another project.

For some things there are plans in books or even the finished article on a store shelf. But usually not—because they won't do the job, or because they cost too much, or because you've got materials lying about to find some use for, or because you can make something better, which you usually can.

The work is not exacting. Yoll change it as you go along, or later. The result is a little makeshift, a little rough—although just because the wood has a nice grain you may find yourself putting a hand-rubbed finish on a milk stool that will spend its working life in a cow shed, flyspecked and spattered with manure. The important thing is it works well enough, it does the job. And even if it did't there's no one looking over your shoulder, no next door neighbor to object. Budding inspectors and zoning boards aren't interested as long as it isn't an eyesore or a hazard to public safety—which milk stools, like most of the things you make, aren't. You have only yourself to please.

And I have taken the greatest delight in those things I have built for my own use. Shortly after the house was finished—at least for the time being—I began work on a barn of the same stuccoed concrete block construction. Fourteen and a half feet by 36, the building would house my bee equipment at one end (extracting tanks, hive budding materials, and all the other paraphernalia of the honey trade), gardening tools in a center room, and, at the far end, on the other side of a concrete block partition, the cow. The proportions of this long, low building with its hip roof turned out to be so mysteriously pleasing that there must be an explanation somewhere in the canons of architecture.

The roof structure was so light and airy that I decided to leave the framing exposed. The rafters radiate from a point of the ridge board in a way that suggests the veins of a leaf or the spreading branches of a tree, an impression carried out by chance in the floor. There falling mulberry leaves left their imprint, a fossil from that autumn afternoon when the concrete slab was poured.

In the country the outside is always coming in. Large, burnt orange paper wasps winter under my porch and emerge on the first warm days of April to be trapped inside the screen until I let them out. The porch itself, nine and a half feet by 20, I added some years after the house was built—enjoying the construction so much that I hurried through my gardening to get back to it and worked as long as there was light.

It's furnished with a table and two chairs and a porch swing, all of peeled white cedar. When the weather is warm I have my meals out there, the raised porch overlooking the farm. And on summer nights I spread my bedroll on the porch floor, where I can watch the prairie moon rise above the eastern horizon—and then the morning sun.

Everywhere I look I see things a professional carpenter or mason or architect would have done differently, and yet I had my reasons. It was with the occasional violent winds of the Southern Plains in mind that I decided to do away with any projecting eaves. The modified hip roof looked so French that when the natural stucco began to streak from weathering I decided to paint it in the manner of small houses in Provence—rosy terra-cotta walls with white corner detail, white borders around each of the windows, and Mediterranean blue shutters and door.

The crawl space under my house is deeper than usual, making it easier for an amateur to work on plumbing and wiring. And entry is by a largish trapdoor in the floor of my pantry rather than the usual cramped opening in the foundation wall. The house may be structurally stronger for it—and replacing the elbow joints in my plumbing, a fault of the manufacturer, took only an afternoon. In construction at least, what is done for a practical reason usually turns out for the best.

In both the short run and the long, economy is also a consideration. The large windows, high ceilings, cool masonry walls and screen porch enable me to live without air conditioning. A fruit press was too expensive, so I made one. A small threshing machine, one that will winnow the chaff from the grain, is simply not available. And that is my next project.

There is almost nothing an amateur working alone cannot do, from building a house or a barn or a shed to stretching fence and hanging gates. And pitted against his constructive and orderly efforts are the familiar antagonists

of a small farm—age, weathering, hard use by animals and the consequences of altering a landscape.

A small farm is nooks and crannies, a toehold for rank nature. Trees take root, fencelines grow up in brush, the whole climate changes. Never before a problem in a dry land, rot takes hold of a shed's foundation and a trumpet vine lifts the roof off. Iron either rusts and flakes away in the hand or else takes on the patina of an ancient relic. Wood crumbles with rot or turns to brittle amber. Plants that before couldn't have been coaxed to grow on the prairie upland appear out of nowhere, take root and go on a rampage.

In the shadow of even the neatest farm there is hint of disorder and creeping dilapidation. And the farmer himself—in his patience with inconvenience, readiness to make do and reluctance to throw anything away—can easily fall under its spell. But that is not the same as "makeshift," which is one of the necessary arts. Making do with what is on hand.

The large basket I use for firewood, stacking the logs on end, has been reinforced so many times with sticks and wire that a visitor asked if it was "an antique withy basket." The chick brooder I made from an old metal garden cart. Discarded beehives (lids, bottom boards, hive boxes) are surprisingly useful around the place. If too rotted for anything else, hive boxes serve as rabbit guards for sapling fruit trees. An old mop handle I use to steer my chickens in at night. Two broomsticks I joined with a section of plastic pipe to make a long arm for my fruit picker.

Old boots are a handy source for a piece of leather or rubber, a hinge or a bumper. An old pump house cover I was about to haul off shelters a pair of 5-foot constrictors (corn snakes, useful predators in the garden). A section of hollow sycamore by the barn hydrant (once housing a colony of wild bees discovered when a neighbor was clearing up after a storm) is a perfect work bench for cleaning gardening tools. There are even notches to brace the tools, a hollow to stash my "clettering stick," and a place to drape rags. I couldn't have designed anything better.

No dimension lumber ever gets thrown away. Every scrap of the original 5-by-5-foot covered porch went into something—the new screen porch, a shed for the weaned calf, shelving in the tractor shed, and the last of it into the woodstove as kindling.

In the extremes of makeshift, however, there is sometimes a surrealistic quality. Three or four miles from me is a pig farm. The tenant must at one time have had something to do with appliances, for he's made a windbreak of old refrigerators, washing machines, kitchen stoves. And he feeds his pigs on stale bread, truck loads of it, the loaves still in their wrappers, which the pigs and the wind scatter to catch in the fence—along with the feathers of peacocks. For strutting about with the pigs, in the spring spreading their shimmering fans, are a dozen or so peacocks. A mile beyond this pig and peacock farm is a housing addition, "Dover Pond," very grand and exclusive. I have not been down to see how the two are getting on.

In every small farm there is some degree of higgledy-piggledy. When I look around at Southwind—at the house and outbuildings and pens and fences and gates and beehives and all the rest—I'm surprised there isn't more disorder. I'm also astonished that it has been done so quickly and has given such pleasure in the doing. Having built the farm and its appurtenances, most of them, with my own hands has given me a heady sense of possession and permanence. It's hard to remember that all this was once an empty field, just as it's hard to believe that having been set in motion it won't go on being a farm forever.

In one field, where a lighter type of cultivator was being towed and the tractor could move pretty fast, a dog was trotting up and own with the machine. He had no doubt been accustomed to follow a team of horses at a walk; but the mechanisation of farming had forced him to quicken his pace. —Margaret Leigh, who in *My Kingdom for a Horse* describes riding the length of England in 1938.

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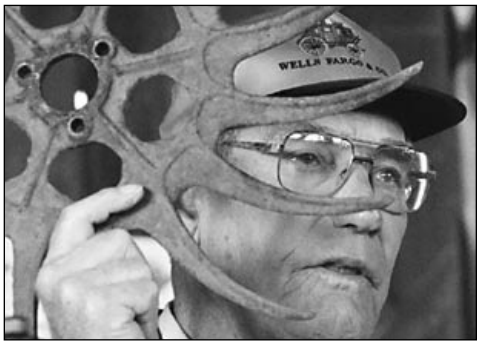
Your IRA as Tax-free Gift

Once you are 70½ years old, you might want to take advantage of a new provision for charitable Individual Retirement Account rollovers.

Our longtime friend, Thomas Brown, a farmer in Nebraska, visits our Prairie Festival most years. If you have attended, you have likely shaken his hand, or you saw him honor Land Institute President Wes Jackson in 2004 with a beautiful agricultural artifact. This year he took advantage of the IRA rollover provision to make a very generous gift to The Land Institute, and urged us to tell about it and inspire others to do the same. If you are interested in discussing an IRA rollover gift, please phone Joan Jackson at 785-823-5376.



Tom Brown gave Wes Jackson an old rotary hoe wheel in 2004. This year he gave us funding from his IRA.

Here is how it works: *For 2006 and 2007 only*, you may make tax-free lifetime transfers from your qualified traditional IRA or Roth IRA for "qualified charitable distributions."

The new law provides:

■ Exclusion from gross income of otherwise taxable IRA distributions (up to $100,000 per year) by plan owners who are 70½ by the date of distribution. Each person in a married couple can give to that maximum.

■ This distribution can be applied to satisfy a plan owner's distribution requirements for the year. The entire amount of your minimum distribution requirement can be directed to charity.

■ The distribution check must be payable directly to the charity from the plan administrator. To receive a proper receipt, the donor should inform the recipient charity to expect the check, identifying the account owner as the donor.

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The Writers and Artists

Jon T. O'Neal is a physician and screenwriter west of Lawrence, Kansas. On trips to see his parents in Colorado while in medical school at the University of Kansas, he drove across each tier of Kansas counties, making photographs of all 105. The photos, made in 1983, are at the Birger Sandzen Memorial Gallery in Lindsborg, Kansas.

Thomas Mastick is a building contractor in northern Michigan. He had a dozen "real" chickens called the Grasshopper Patrol—Rhode Island Reds, Barred Rocks and Golden Comets. This small flock was a more pleasant than the factory farm.

Robinson Jeffers (1887-1962), son of a Presbyterian minister, was trained in classics and science, and wrote poetry with an affinity for nature and critical of what he considered civilization's self-absorption. He lived in Carmel, California.

Lynn White Jr. (1907-87) was a professor of medieval history at Princeton, Stanford and the University of California, Los Angeles.

Bill McKibben is a former writer for *The New Yorker*, a contributor to magazines including *Harper's*, *The Atlantic Monthly* and *Mother Jones*, and author of books including *The End of Nature* and, new, *Deep Economy: The Wealth of Communities and the Durable Future*. He founded stepitup07.org, which is organizing rallies across the nation April 14 for legislative curbs on carbon emissions.

David Van Tassel is a Land Institute plant breeder.

Jake Vail is a writer and librarian in Lawrence, Kansas.

William Paul Winchester farms 20 acres at Collinsville, Oklahoma. The essay here is from his book *A Very Small Farm*, published in 1996 and recently re-released. His essays also have appeared in *Country Journal*, *Oklahoma Today* and the book *Buying America Back.*

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Lincoln County, Kansas. Jon T. O'Neal photo.

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