Land Report

Number 116, *Fall* 2016 · *The Land Institute*

About 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.

OUR WORK

Thousands of new perennial grain plants live year-round at The Land Institute, prototypes we developed in pursuit of a new agriculture that mimics natural ecosystems. Grown in polycultures, perennial crops require less fertilizer, herbicide and pesticide. Their root systems are massive. They manage water better, exchange nutrients more efficiently and hold soil against the erosion of water and wind. This strengthens the plants' resilience to weather extremes, and restores the soil's capacity to hold carbon. Our aim is to make conservation a consequence, not a casualty, of agricultural production.

LAND REPORT

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ELECTRONIC MEDIA

For e-mail news about The Land Institute, write to Carrie Carpenter at carpenter@landinstitute.org, or call. Web site: landinstitute.org.

SUPPORT

To help The Land Institute, see the contribution form on page 30, or go to landinstitute.org. Contributors receive the Land Report.

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Silphium dries before it is weighed as part of developing the perennial as an oilseed crop. For the story of hunting and gathering diverse silphium genomes along thousands of miles of two-lane roads, see page 4. Scott Bontz photo.

John Holmquist bags seed from a wild silphium plant northwest of The Land Institute. He also has collected hundreds of miles to the east, to amass a variety of traits to select from in making a perennial oilseed plant. This is to supplant annual sunflower and check the erosion that goes with annual cropping. Scott Bontz photo.

Prospecting in highway ditches

Gene wealth shelters just off road shoulders from Kansas to Mississippi

SCOTT BONTZ

John Holmquist presents an open cardboard box with his tools: a map of Kansas, pen and notebook, a smartphone that shows latitude and longitude, and manila envelopes in two sizes. He needs two sizes because the number of seed heads on silphium plants varies widely. He needs the other gear for notes about the seed and where he bagged it. From late summer to early fall he has searched and collected along 6,000 miles of road from northern Nebraska to eastern Mississippi. Today, October 5, might be his last expedition of the year. Wild silphium is dropping the seed that he and birds don't find first.

The road to silphium, of the sunflower family, in the sunflower state.

Come spring the seeds collected from these various plants will be grown together at The Land Institute in Kansas, and compared. How differently will they build stems and leaves that evolved in different temperatures, rainfalls, and soils? Will the plants from the humid South better resist fungi attacks? What else in genes sampled from across a good share of continent will help turn wild, perennial silphium into a domestic crop? Help replace annual sunflower and avert the soil and nutrient loss that goes with growing annuals?

Holmquist takes Interstate 135 quickly to the exit for Lindsborg, "Little Sweden USA," then tracks westward on two-lane Highway 4, past signs that put the black number on a yellow, stylized sunflower head. After the town of Marquette, home of the Kansas Motorcycle Museum, the land begins to roll, and fields of annual cropping give way to grass.

When he began collecting in August the silphium plants were blooming and easy to spot among the grasses. But Holmquist says, "In a strange way it's a distinctive plant even when it's mature, when it's dried up and brown." He mostly wants *S. integrifolium*, known by various popular names that include the word rosinweed. There is also prairie dock, *S. terebinthinaceum*; cup plant, *S. perfoliatum*; and compass plant, *S. laciniatum*.

Silphium stands out *if* is still standing. Aldo Leopold noted that cattle ate silphium first. Holmquist and Land Institute plant breeder David Van Tassel speculate that after grazing or haying the grasses rebound faster. But they aren't sure if that's the only reason silphium, a plant whose demise Leopold said would signal end of the prairie epoch, now appears so atomized.

At highway speed Holmquist scans ditches left and right. Swaths unmowed and undisturbed usually harbor native grasses.

Here also would be silphium. “I used to go about 50, 55,” Holmquist says. “Now I can go 60, 65, even 70, and still see it.” Past Highway 141, the way to the Army Corps of Engineers construction called Kanopolis Lake, he turns head and slows for a plant, but is quickly back to speed. “I think it was ironweed or lespedeza.” Another trickster is milkweed.

Holmquist grew up on a cattle and grain farm less than six miles by crow from The Land Institute. His mother teaches education at Bethany College and his father history and agriculture at Smoky Valley High School, both in Lindsborg. He is 25, the youngest of three siblings. He likes modern glass architecture like Dallas, not old brick like Omaha. He likes Steinbeck.

Silphium resulting from work toward domestication in Land Institute fields. The bag prevents random pollination by insects until researchers can intentionally cross it with another select plant. Scott Bontz photo.

He knows rangeland management and began college as a Kansas State animal science major, but switched to finance. "I wasn't really enjoying studying science – chemistry – but I was really enjoying agricultural economics." He finished at Bethany College and earned a master's degree in business administration from Rockhurst University, in Kansas City, Missouri. He joined a Kansas City investment banker, and says, "I was working in a cube farm." All day at a computer, punching buttons. Van Tassel wanted someone to help him domesticate silphium, and through his wife, who also teaches at Bethany, he found Holmquist. When Holmquist saw a modern research building, scientists, and the fields they managed, he says, "It made me realize The Land Institute was running breeding programs just like a land grant university."

Since August he has driven to collect silphium seed in Oklahoma and Texas, in Mississippi, in Arkansas and Missouri, and in Nebraska and Iowa, a range of 1,100 miles. Today for the first time during this quest he goes west, toward a sun descending clouded. He is in Ellsworth County, which a US Department of Agriculture map shows as the edge of silphium's habitat. But he says, "I've found it in places that weren't on that map." Highway 4 bends south-southwest for two miles, then pegs west again. Here another plant flags Holmquist. He turns around and drives back. It is *Helianthus pauciflorus*, a perennial sunflower, but not a silphium.

Then comes the town of Geneseo. A sign for Janssen Red Angus cattle. Highway 14. Coal cars on a railroad siding. The country now is less hilly but not entirely flat. Fields are rusty with ripe sorghum. The sky has turned partly sunny. A hawk grasps a low juniper – Kansas cedar. At the edge of the land miles away the road appears to run into a slim grain elevator.

Holmquist enjoys collection trips. Away from home he sees different country, different ecology. He prefers two-lane roads. He drove Interstate 135 in Oklahoma, but it took longer to slow down for a plant, and he couldn't turn around, had to walk back. The two-lane route is also more scenic.

On each trip he usually meets at least one person who wants to know what he's doing. In Oklahoma, with a flat tire and no spare, he called a tow truck. On the way to town he told the driver about his work, and about turning wild perennials into grain crops. The man said he saw the sense in this. He was especially intrigued by perennials' long roots. "Most people don't realize that most of the biomass of these plants is belowground rather than aboveground," Holmquist says. He also talked to a curious state trooper. "He had no idea there were so many species of sunflower." Holmquist asked the tow truck driver about roads that might prove fertile to his search. In Nebraska he asked a fellow sitting by him at dinner. Entering new states, he asks at visitor centers. He wants two lanes with prairie and sunflowers.

Highway 4 finds the elevator at Frederick, where, running north-south, are these three streets: State, First, and Second. The highway shifts just enough to miss the prairie skyscraper, then springs back. Then the mirror shows receding road again commanded by the monument to grain.

A sign for Green Garden Angus. The ground is nearly level. There are few homes, but as common as trees edging the section line roads around the grain fields are power lines. This netting pulls to a town of shining pipes and towers, signed Oneok Hydrocarbon and Northern Natural Gas – natural gas, the fossil feedstock for synthe-

sizing nitrogen to feed the world from soils exhausted by annuals.

The land rolls gently to Bushton, "The geographic center of Kansas," at the north edge of Rice County. The town originally was named for another annual grass crop, Sorghum, but was soon retitled, in 1887, for bushes.

"Here's some," Holmquist says, braking and turning at 2nd Road. On second look he can't identify the species. It is a plant standing alone. Usually silphium grows in groups. Nearby are tanks filled by pumpjacks, nodding donkeys, and the air reeks of oil.

Barton County. Highway 156. The town of Claflin. A brilliantly colored billboard of a bearded and white-robed man with raised hand and the caption "Jesus, I trust in you." Redwing.

In a day of driving Holmquist usually makes five or six collections. But if the first doesn't come soon, he worries. "Usually I start every trip thinking, 'My god, I'm not going to find anything,'" he says. He fears Van Tassel will think he was goofing off.

To search in Oklahoma and Mississippi he consulted herbarium records. Their directions might say no more about where plants were found than "outside" a town, or in a county. Or they might be more precise, but date to the 1930s. Then the plants are often gone. Still, the records point Holmquist to good geography for silphium. "Usually I just find it in the ditch," he says.

Hoisington, where in 2001 a tornado three-eighths of a mile wide destroyed 200 houses. The city rebuilt, but from the air the path still shows for lack of trees. Past the town are scattered power lines and tree clusters, but westward these have dwindled along with rainfall and population. The land is barer. Most of the fields are sorghum, a drought-tolerant grain. Some have been cut, some haven't.

Holmquist turns right and north on US 281 into steep hills. Up draws baring limestone climb what appear from afar like gravestones, sparse but militarily regular. They are fence posts cut from that native rock. For a while all of the pumpjacks are blue. Then they enter a black phase with a peppering of red. The road drops onto a plain, ducks under Interstate 70 and into Russell, childhood home of Bob Dole, and north of town returns to hilly grassland.

Wild annual sunflowers fringe plowed fields. Their place at the edge of soil disturbance, and their splayed branches with dozens of heads, easily distinguish *H. annuus* from silphium species. Sorghum sprouts along the road, apparently from seed blown out of grain trucks. In Oklahoma Holmquist found a ditch dominated by silphium and johnsongrass, the weed being crossed with sorghum for a perennial grain.

Holmquist turns east on another route of sunflower signs, state Highway 18. The road descends from grassy heights to Waldo and gentle rolls of soil bare and light brown, or littered with tan crop stubble. The only perennial plants are in the ditches.

The town of Luray, then Lucas, home of the Garden of Eden, a house entwined with Civil War veteran Samuel P. Dinsmoor's biblical and political concrete sculptures, and with his corpse behind glass in an aboveground concrete coffin. Leaving town the highway points at a cemetery thick with white flagpoles, on this day bare. Then it curves toward a leagues-distant picket of turbines with giant arms circle-signaling conversion of sunlight to wind to electricity.

By e-mail Van Tassel invited Land Institute supporters to send silphium seed and coordinates. The first of a half-dozen contributions was from a ratibida plant:

right family, right tribe, wrong genus. Other contributions have been silphium, though the seeds don't clearly spell out the species, and those from Pennsylvania and New Jersey are suspect, beyond silphium's known natural range. Holmquist has gathered seed from more than 50 locations, for a total of about 150 plants. About 80 percent of them are rosinweed. He tends to make most of his finds from mid-morning to mid-afternoon, especially in late morning.

Now it is late afternoon. At Meitler Cattle Company little statues of bulls, one red, one black, stand as tandem totems. Holmquist's family raises cattle and grows sorghum, soybeans, and wheat on almost 4,000 acres. They once devoted 1,000 acres to wheat, but prices dropping to levels of the mid-1990s have brought them to cut wheat acreage to 300.

A little before 6 p.m. Holmquist spots compass plant near the intersection with Highway 181 to Sylvan Grove. He wades through Indiangrass to the silphium. Normally he wouldn't collect compass plant, which Van Tassel considered before moving on to better candidates, but there have been no other finds today. It might be used in crossing with rosinweed. He pulls seed heads into envelopes, one envelope for each plant, and writes on them location and plant numbers. With left hand he holds out the envelopes and with right uses the smartphone to photograph them and mark the location by satellite positioning. "Half the battle is just finding where it is, because you can always go back and collect if you need to," he says.

"Lincoln Welcomes You" proclaim letters cut, along with stylized grass seed heads, in limestone blocks. Holmquist takes Highway 14 through town, past a suspended filling station sign that retains the shape of a badge shared with federal highway symbols, but is emptied of the red, white, and black Phillips 66 logo, instead framing only the sky. It is partly cloudy. Out of town come the wind turbines, and their blade shadows sweeping the road.

Holmquist finds no more silphium. He ramps up to Interstate 70 for The Land Institute. Today has been odd, a near bust. "Usually I have really good luck," he says. "I never collect everything that I see." Each stop takes 10 to 15 minutes; tending every population spotted along the road would not allow him to fully survey the species' geography and genetics.

A few days later Holmquist shows with pleasure one plump envelope of rosinweed heads. He hadn't been on a collection trip, didn't have his regular envelope supply, but between US 24 and Union Pacific tracks east of Manhattan, home of the Kansas agricultural university, he spotted silphium.

Next year he wants to search Louisiana and southeast Texas, and push farther south in Mississippi, to wetlands, different ecosystems. "It would give a much greater genetic variation from what's here," he says.

All this diversity, but now in fragments. A successful plant, if treated right. Leopold wrote, "What a thousand acres of silphiums looked like when they tickled the bellies of the buffalo is a question never again to be answered, and perhaps not even asked." But that was in the first half of the 20th century, before knowledge of DNA and the tools of gene markers and computers. Perhaps today Leopold would be inspired not just to ask that question, but join Holmquist and go collecting to achieve its answer.

To fill out the plate

The Land Institute hires a legume breeder

SCOTT BONTZ

In September Brandon Schlautman joined The Land Institute to fill a crucial, missing piece of how to farm herbaceous perennials in species mixtures for human food: enlisting a legume to fix nitrogen and fertilize the soil.

Schlautman, who turns 27 in November, came fresh from university studies devoted to perennial species and genetic tools that give unprecedented speed and precision to plant breeding. In his first week on the job he visited fields of perennial rice in China and discussed breeding with Land Institute collaborator Hu Fengyi. Back in Kansas Schlautman began reading science papers. He wants to learn from the institute's hits and misses, and to think through the challenges of domesticating a legume species directly versus hybridizing it with a current legume crop. He is also exploring how much the legume can be expected to both feed people with seed and neighbor plants with nitrogen. "It would be nice if the legume overlapped a bit," he said.

Schlautman

Another institute researcher, David Van Tassel, worked a decade ago with the prairie legume Illinois bundleflower. That species' shortcomings and Van Tassel's subsequent focus on making an oilseed crop from the sunflower family stalled legume development until after The Land Institute hired Tim Crews to study ecologically and economically mixing perennial grain species, and acquired more funding.

Schlautman grew up outside Lincoln, Nebraska, on acreage that in summer was pasture to his grandfather's dairy farm heifers. He and his brother caught fish, frogs, and insects, and built rafts to float on the family property's creek. On weekends his family traveled to help milk the cows. "I think agriculture was important for me for a long time," he said. "I loved the county fair and 4-H, and in addition to showing dairy cattle, I would try to grow, build, and bake as many things as I could to enter into the 4-H competitions."

At Nebraska Wesleyan University in Lincoln he earned a bachelor's degree in biology, with minors in chemistry and Spanish. Formative were a course called "The Necessity of Wilderness," which in-

On facing page, life-size, seeds and pods of legumes, some of them perennials that might feed us with beans, and a few annuals that they might be bred with or complement perennial grains by moving nitrogen to the soil. From left to right, top to bottom: alborea, a cross of alfalfa and a relative; the annual tarwi; partridge pea; hedgehog medick; Platte lupine; Illinois bundleflower; Russell lupine; narrowleaf lupine; barrelclover. Scott Bontz photos.

cluded a rugged canoe trip in Minnesota's Boundary Waters, and the writings of Aldo Leopold and Edward Abbey. He learned about sustainable agriculture and ecology, and saw how plant breeding could help. He also wanted to sustain rural cultures, "By giving farmers something new."

As a senior he collaborated with University of Wisconsin scientist Juan Zalapa to show how Siberian elm crossed with other elm species for diversity that might make it such a successful invader. He briefly worked both for an organic farm and for Neogen GeneSeek, analyzing the genomes of dogs, chickens, salmon, sheep, and dairy cattle, whose industry has quickly built immense data files for pedigree, performance, and breeding. Then as a doctoral student he joined Zalapa to understand the collection of genes that make the cranberry plant, and so improve its breeding.

One path to the missing legume might be the queen of the forage crops, alfalfa. Alfalfa can produce up to 1,000 pounds of seed per acre, but the seed is very small. Could selection and breeding change that, for both profitable grain and hay? The Land Institute and collaborators across the country are working to make intermediate wheatgrass such a dual-purpose crop.

But much of the nitrogen fixed by grain legumes such as soybean is removed from the field in the seed. So Schlautman might instead pursue a companion plant that keeps the nitrogen in its roots, stems and leaves.

Legumes number about 750 genera and more than 20,000 species. They include clovers, vetch, and lupine, whose annual form has become an important nitrogen fixer in Australia's crop rotations. A wild perennial soybean species in Australia might be crossed with annual soybean. Tropical legumes including pigeon pea, scarlet runner bean, and lablab bean might be bred to withstand temperate winters. The Land Institute is already doing this with sorghum. Bundleflower might be revived by improvement in seed flavor and elimination of a regulated hallucinogen from its roots.

Whichever species he chooses, Schlautman wants to keep trait selection narrow – to get the traits that make a good crop, such as seed size and production, but also preserve wild traits such as disease resistance and high protein. "Every time you make a selection, you reduce diversity," he said. And for 10,000 years of seeking better yields, agriculture has innocently but crudely chipped away from populations their diversity and other strengths. Recent progress in genetics allows breeders to select much more precisely, and to see much faster improvement over generations of their plants.

Though Schlautman wants to start from a diverse base, wants much to pick from, his work might include arranging a genetic bottleneck to help reveal hidden recessive traits and purge them.

His biggest challenge with a companion legume might be in releasing the nitrogen that has been fixed with the help of microbes at root nodules, so it can be used by neighboring grasses and oilseed plants. Legumes don't share well unless stressed by something like grazing. Schlautman might select types with lower thresholds to stresses such as shading or competition from neighboring plants.

He is game. In his application letter to The Land Institute he said that cranberry's demands of innovative strategy – "because it is a perennial, because it lacks sufficient genomic tools, and because it is understudied and underfunded" – had given him "countless hours of fun."

Schlautman lives in Lindsborg, southwest of The Land Institute, with his wife and their two girls, ages 1 and 3.

Land Institute shorts

A first perennial grain product

The outfitter Patagonia on October 3 released the first large-scale product using a perennial grain from The Land Institute. Long Root Ale appeared in several online media sources, including The Washington Post. Kernza is added to beer's usual barley. Long Root was made at Hopworks Urban Brewery in Portland, Oregon, and is being sold in Whole Foods stores in northern and central California. Kernza is a trademark registered by The Land Institute for food products made with intermediate wheatgrass grain.

General Mills visits

Six representatives from food giant General Mills visited October 13 to learn about The Land Institute and its development of intermediate wheatgrass as a perennial grain crop. The company is already running tests. Visitors included grain buyers from General Mills and staff members of subsidiaries Annie's and Cascadian Farm.

Encouraging wheatgrass data

Intermediate wheatgrass breeder Lee DeHaan thinks the same gene or genes keep plants from dropping seed before harvest and allow it to be easily threshed free of hulls – a convenient connection. Wild plants tend to "shatter" and lose ripe seed, and some grains, including oat and barley, have tenacious hulls that demand extra time and cost to remove after harvest. DeHaan found the connection in data, and is still studying the genes. Measurements also showed that whether a wheatgrass plant's stems grow straight up or splay depends highly on genes, not just on proximity to other plants, and that the growth angle was not connected with high seed yield. So DeHaan can mate productive plants with those that grow most erect, and possibly reduce lodging – flattening by wind or rain.

A US Department of Agriculture lab in Fargo, North Dakota, has developed a way to cheaply examine as few as five seeds from a plant to predict dough mixing quality. The lab is testing hundreds of DeHaan's plants.

Management changes

Scott Seirer retired October 1 after serving for five years as managing director of The Land Institute. Rachel Stroer now leads the institute's day-to-day work outside of research, with a different title, chief operating officer. Seirer's departure coincides with Wes Jackson's resignation of the institute's

presidency. Jackson's replacement is Fred Iutzi, a former graduate school fellow of the institute who had been helping rural co-operatives at Western Illinois University. Seirer had left as executive editor of the local daily newspaper, the Salina Journal, before the institute drew him out of retirement. He said he was retiring again to pursue other passions. He began in newspapers as a photographer and wants more time for camerawork, to bicycle, and to visit his son and grandchildren in New York City, his daughter in San Francisco, and his parents in Arizona. While growing up in Salina, Stroer helped her father restore prairie north of town. She earned a bachelor's degree combining biology and performance at New York University, and a master's degree in business administration from the University of Missouri. Between schooling, while with an architectural firm she advised cities on planning for sustainable development, and for an energy asset management company she handled communications and investor relations.

Seirer

Stroer

New board members

Along with The Land Institute's new president, Fred Iutzi, Nancy Jackson and Jim Haines joined its Board of Directors. Jackson is assistant vice president for strategic development at University of Kansas Endowment, and daughter-in-law of former Land Institute President Wes Jackson. She led the Climate + Energy Project, begun by The Land Institute to promote energy efficiency and renewable energy. Haines is the retired chief executive officer of the utility Westar Energy. In 2014 he and his wife donated to The Land Institute a house and 230 acres near the University of Kansas. The institute sold the property with an option to buy it back, and continues research there. Haines also served as assistant attorney general for Missouri. Wes Jackson left the board as well as the institute's presidency, but remains an employee, focused on writing and education. Other departing board members are Conn Nugent, a former chairman, and Leigh Merinoff.

Jackson

Haines

Publications and presentations

In the International Journal of Plant Breeding, researchers Pheonah Nabukalu and Stan Cox described their development of perennial grain sorghum. Staff members made presentations in China, Florida, Connecticut, Missouri, Massachusetts, New Mexico, California, Iowa, and Illinois. The Land Institute plans to help organize a perennial grains meeting next year in Kunming, China.

Correction

Page 15 of the summer Land Report erred about where Laura Jackson is a biology professor. She teaches at the University of Northern Iowa.

Extracts

SOME PEOPLE SPECULATE about how much time is required "to build an inch of soil material." The answer could well be, "somewhere between 10 minutes and 10 million years." – Charles E. Kellogg

THERE IS A COHERENT PLAN to the universe, though I don't know what it's a plan for. – Fred Hoyle

YOU CAN SEE THIS GREAT THING coming over the horizon. You don't feel there's anything you can do about it. … But you have to live through it. – Paul Kingsnorth, in The Wall Street Journal, about his novel "The Wake"

LANDSCAPES LIKE OURS were created by and survive through the efforts of nobodies. … The real history of our landscape should be the history of nobodies. – James Rebanks, "The Shepherd's Life"

THIS CULTURE'S ADDICTION to progress runs far deeper than any individual's chemical addiction. It is more powerful than many people's desire for a living planet. – Derrick Jensen

THE DILEMMA is that without the context of a higher good, freedom for people leads to the enslavement of nature. – J. Stan Rowe, "Home Place"

AND IT NEVER FAILED that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way. – John Steinbeck, "East of Eden"

IF ONE WANTS to know what the environment of an organism is, one must ask the organism. – Richard Lewontin, "The Triple Helix"

THE FARM is the portrait of the farmer. – Paul Johnson

MAN GOES TO MAN at the last, though the jungle does not cast him out. – Rudyard Kipling, "The Jungle Books"

IT SEEMS AS IF the day was not wholly profane, in which we have given heed to some natural object. – Ralph Waldo Emerson, "Nature"

WALKING IS A GREAT EQUALIZER, democracies' greatest act, more primordial than the vote. – Shiv Visvanathan, in The Hindu newspaper

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 down with the machine. He had no doubt been accustomed to follow a team of horses at a walk; but the mechanization of farming had forced him to quicken his pace. – Margaret Leigh, "My Kingdom for a Horse"

THOSE WHO CONTEMPLATE the beauty of earth will find reserves of strength that will endure as long as life lasts. – Rachel Carson

A SUBDIVIDED, overspecialized psyche seldom knows plain ecstasy. – Stephanie Mills, "Epicurean Simplicity"

Establish the work of our hands

FRED IUTZI

Adapted from a talk at the 2016 Prairie Festival.

On the morning of May 13, 1922, a line of automobiles arrived at the Millard G. and Sadie Lambert farm north of Adrian, Illinois, carrying Professor W. F. Handschin and 75 University of Illinois undergraduates who were capping off a semester of studies in Farm Management 1 with a "field inspection trip" to see emerging scientific principles of agriculture in action. The party was slated to spend an hour on this site before departing for the next farm on the itinerary. Incidentally, I too have some experience departing this farmstead – my great-grandfather Millard Lambert was the second generation of my family to reside there, and until this summer my children were the sixth generation. Five hours and four farms later, the line of Model Ts and REOs arrived at the last stop of the day, the Dana and Laura Stevenson farm west of Elvaston. Incidentally, I have some experience arriving on this site also, having first done so when I was roughly four days old. In 1915 my great-grandfather Stevenson moved one mile to start farming there with his new bride, and in 2016 this quarter section is still the centerpiece of my parents' 1,000-acre cash grain operation.

History does not record whether by 4 p.m. May 13, 1922, the students were dusty or muddy, but it would have surely been one or the other. They would also have had an eyeful. M. G. Lambert would have described his attention to soil fertility, his management and allocation of horse labor, and his work to organize farmer cooperatives. Both of my great-grandfathers would also have shown off their system of "swine sanitation" aimed at reducing parasite loads, one of the first truly ecological farming practices of the 20th century, as well as the farm financial accounting records project that they had each been participating in for nearly 10 years. And Dana Stevenson would have walked the students through his intricate system of crop sequences and field borders designed to maximize field efficiency, allow for long rotations including sod, minimize soil erosion, and maximize soil fertility. With only half an hour allocated on the agenda for this, presumably the students relied not on actually walking the farm but on a packet of 10 meticulously drafted farm maps documenting my great-grandfather's plan to gradually reorganize and restore his quarter-section over a decade.

Great intellectual and physical labor was expended at the close of the 19th and the opening of the 20th centuries to establish a public agricultural research and extension capacity – and the fruit of this labor was expected to be an agriculture that was not only efficient, but an agriculture that was *permanent*. Great-grandfather Stevenson was a sophomore at the University of Illinois when Professor Cyril G. Hopkins published "Soil Fertility and Permanent Agriculture," anchoring what would be known as the Illinois System of Permanent Agricul-

ture. Cyril Hopkins is known firstly for his foundational contributions to soil science and agronomy, and secondly for being epically testy and acerbic – he must have been a beauty in class. His 1910 volume starts, "It is the purpose of this book to teach the science of soil fertility and permanent agriculture, chiefly by reporting facts rather than by offering theories; and any one of common sense who reads the English language, and who can understand the common school arithmetic, can understand this book *if he will study it*. (The fact may well be recognized that some who have ample time for study, though physically industrious, are mentally lazy.)" He has a footnote connected to the word "lazy" to lay into the concept a little further. But over the next 700 or so pages, Hopkins expounds many of the very same tools in the current sustainable-agriculture toolbox, including the superiority of green manure crops to commercial fertilizers as

Marty Christians and other Land Institute workers this fall planted 6,400 seedlings from selection and breeding of intermediate wheatgrass, a perennial, to make grain for an agriculture that is more permanent. Scott Bontz photo.

a source of nitrogen, and the need to carefully steward nutrient and carbon cycles among crop and livestock enterprises. He even questions the fundamental soundness of feeding grain crops to livestock when the same grain could feed many more people directly. Hopkins and F. H. King were correspondents, and Hopkins likely considered himself to be providing a comparable message to King's "Farmers of Forty Centuries," but derived directly from and aimed directly at agriculture in the Midwest. The challenge he issued was for Americans to win in the New World the race against soil degradation that had been lost in the Old, and avoid the accompanying misery and toppled civilizations.

Cyril Hopkins's sense of "permanent agriculture" revolved almost entirely around soil fertility, but others were already filling out the concept. By 1920, Eugene Davenport, dean of the University of Illinois College of Agriculture and one of the prickly Hopkins's principal handlers, was declaring victory and looking ahead to a future that sounds even closer to today's farm and food system discourses: "The idea of a permanent agriculture is definitely fixed in the minds of nearly all of the progressive farmers of Illinois, whereby the fertility of the lands shall be maintained and not mined out as the generations pass. To that determination we are now beginning to add the idea of a finished agriculture, by which is meant not necessarily intensive farming but rather systems of farming which shall be more diversified than heretofore and which shall recognize more completely the peculiar demands of the consuming public and the particular resources of the various localities." In 1929, writing on the eve of the Depression, then-Cornell University Professor Rexford Tugwell talked about "moving toward the cereal reduction and grass increase stage." "First of all," he wrote, "there would be less cultivation. Crops which called for extensive baring of the soil would be greatly reduced."

So it's not even 1930 yet, and we've got it all figured out – right? Let's go back to that day in May 1922. Arguably, the bulk of the fundamental principles we associate with today's sustainable agriculture movement were already in place: closely managed nutrient cycling, ecologically based pest management, diversified crop rotations including perennials, etc. A national conversation was under way on institutionalizing these practices, and bringing about a *permanent* agriculture. But instead of being permanent, 1922 effectively represented the point of "peak farmer" for the US – by 1930 the number of farms had already started its slump from nearly 6.5 million, toward about 2.5 million now. Average acreage per farm has more than tripled. My parent's farm, for example, is larger than the Stevenson and Lambert farms put together – in part because it includes the Stevenson and Lambert farms, put together.

Meanwhile, in 1922, Great-grandfather Stevenson's meticulous bar charts plotting horse labor needs each month of the year and Great-grandfather Lambert's big teams were already under pressure by the march to mechanization. The old paper ledger book of the John Deere dealership records the men buying Model A tractors within two days of each other in time for 1937 spring tillage. Fewer equine mouths to feed knocked years out of the carefully plotted five-year crop rotations, and the move to bigger implements steadily knocked field borders out of the Stevenson farm's intricate crop map. Despite Cyril Hopkins's lectures about using legumes to get no-cost nitrogen out of the air, American farmers had doubled their 1920 commercial fertilizer use by 1950, and doubled it again by the mid-1960s. These

increases, combined with concentration of livestock production and the accompanying manure, as well as indiscriminate tile drainage management, introduced a new suite of surface water quality effects.

Now for the big problems. We're still losing soil. We are also losing the ability of the atmosphere to support stable weather year-to-year, and agriculture is in the sorry position of being a net contributor to the problem when it should be a net solution. And still too often the products of our agricultural systems are going to enrich the already rich and neocolonize the already colonized.

There are things that have been achieved in agriculture over the last 30 or 50 or 100 years of which we can be proud. No-till and reduced-tillage systems have cut soil erosion substantially from that seen under plow tillage without appropriate crop rotations to cover and regenerate the soil. We have backed down significantly on the toxicity of many pesticides. Many of the agricultural cooperatives founded in the early 20th century continue to help independent farmers make their way in the marketplace, and in my previous work I have witnessed them helping start a new generation of local-foods farmer co-ops. As the father of a daughter, I am very pleased that we've made progress in easing rigid gender roles in agriculture, although plenty more work remains. And for all the pervasiveness of the industrial ag matrix in which farming is embedded, we have a notably large number of intact family and cultural lineages among the farming operations that remain. I grew up on a farm of a thousand acres, but I was constantly taught the importance of knowing every single one of those acres. I knew where many of Great-grandfather Stevenson's conservation structures were located before I knew what conservation was. And my father, who is possibly the least angry man I know, taught me to feel anger at when I see unchecked soil erosion. We have permission to feel proud of the things we've done right in agriculture.

But then again, The Land Institute's argument has never been based on the idea that agriculture is incapable of doing anything right. It is based on the on the idea that conventional agriculture and the alternatives proposed to date do not provide a *system* for getting things right, a system in which soil, farm, and community can all simultaneously prosper. It's based on the observation that many of our successes have been the whack-a-mole type: trade reduced soil erosion under no-till for increased herbicide load. Trade reduced herbicide use for increased tillage. Improve drainage but increase nutrient loss. Reduce nitrogen loss, but do it by adding an additional biocide to the environment in the form of a nitrification inhibitor. Raise record-breaking yields, and still see rural communities slipping away. We at The Land Institute argue that there is life beyond whack-a-mole. That it is time to stop fighting ecosystem processes and instead start learning from ecosystems and mimicking their processes.

Now, to the title of this essay. Psalm 90, Verse 17. "Establish the work of our hands." The Land Institute has never been stronger, and the Natural Systems Agriculture vision has never been in sharper focus. Our intermediate wheatgrass has responded strongly to selection, and is undergoing genome sequencing. Our perennial wheat candidates yield more like a crop than a wild species. Our sorghum has travelled to Africa and East Asia for evaluation. Our silphium shows increasing promise as a perennial oilseed adapted both to regions with dependable rainfall and prone to drought.

We have a legume breeder newly on board. Crucial agroecological research is under way for combining these crops into polycultures that sponsor their own soil fertility and resist pests and diseases. We are rapidly increasing the number of research collaborations with partners around the world. We expect the perennial crops we're developing here in Salina ultimately to drastically reduce soil erosion, to both mitigate future climate change and to be more stable amidst the climate change already under way, to improve water quality, and to generally make agricultural ecosystems start pulling their own weight in the ecosphere.

So we've got tremendous research momentum and have cast a bold vision. But there has been a lot of momentum and vision casting over the last century, and I'm a little haunted by that. Some of the failures are a little easier to analyze than others. Cyril Hopkins cast an impressive vision for the future of agriculture. But his vision for the *science* was excessively narrow. As Eugene Davenport summarized it, "[T]he basis of the Illinois System of Permanent Agriculture is the addition to the land of somewhat larger amounts of fertility than are removed by cropping and by natural causes; and the recognition of the economic necessity of employing for this purpose the cheapest available materials, attention being confined for the most part to the limiting element in the particular soil in question." Plants cannot grow without plant essential elements – this is a pretty key piece of insight for growing plants, and this is the historical moment in which it was discovered. It was a necessary discovery for laying the foundation for sustainable soil management, but we now of course recognize it was anything but a *sufficient* discovery. There were many more factors waiting to be understood, but they had found their killer app and were going to go to press with it. I hope this speaks a little to you about why The Land Institute has a culture of letting its research results reach full fruition before release.

Another key reason for the impermanence of permanent agriculture was its failure to consider context. As I mentioned, Hopkins was strident about the importance of cropping systems sponsoring their own nitrogen fertility, through intensive use of legume crops as green manures and meticulous accounting for livestock manure. He argued for this because commercial fertilizer was expensive. Hopkins laid out this case in a publication called "The Farm That Won't Wear Out," in 1913. This was also the year that saw the start of commercial production of ammonia. Commercial fertilizer was, to put it mildly, not destined to stay expensive indefinitely. I hope this speaks to you about why we are prone to talk about the type of economic embeddedness we expect our perennial grain crops will have, and not just the agronomic characteristics.

In 1919 Cyril Hopkins was returning to the US from a study trip on degraded soils of Greece, when, as eulogized in the journal Science, he was struck down "at the zenith of his powers." The results of the trip were nevertheless compiled from notes and published in a 1922 pamphlet titled "How Greece Can Produce More Food." Hopkins writes, in a section titled "God's Commandment Disobeyed," "The great agricultural problem of Greece is to enrich the soil. This is a duty which has long been neglected, and even against the commandment of God, for in the first chapter of the Holy Scriptures we read: 'And God said unto them, Be fruitful and multiply, and replenish the earth and subdue it.' The first part of this commandment has been obeyed, for the people have multiplied, but the second part has been

disobeyed, for they have taken from the soil and have not replenished it. Instead of subduing the earth and having dominion over it and making it produce larger crops, the people of Greece have abandoned vast areas of land once cultivated." So, after wearing a soil down to a nub over centuries of intensive cropping, the diagnosis is "insufficient domination of the earth."

I go through this for you not to torment the ghosts of old soil scientists, but to suggest that researching new agricultural techniques and bringing them into practical use has a mixed track record. We need to reduce the frequency of dumb mistakes in an era when mistakes are increasingly likely to be fatal. We need to cultivate a greater aptitude in future scientists, future farmers, and all of the rest of us for situating that which we have contrived – including every aspect of our agriculture and our economy – in context of that which is real: the ecosphere we are part of.

This is the work that The Land Institute's ecospheric studies initiative is now embarked on. It is noteworthy to me that the great work and success of The Land Institute's flagship research program in plant breeding and agroecology grew from what was originally founded as an educational institution. And so we look forward to seeing where this new education initiative will lead. The process organizational theorist Robert Chia writes that, "each organizational outcome always already incorporates the weight of its genealogical past, which, in turn, creates potentialities for the future. The past is immanent in the present. …This objectivity of the past in the subjective present means that contemporary fact is always loaded with possibilities and can be continually enriched with newer and novel understandings and application." Chia then quotes Alfred North Whitehead, who wrote, simply, "The future is there in the present." So we can see now a compounding effect of the legacy of program work that has been done here at The Land Institute.

Now let me give you the full verse of Psalm 90, Verse 17: "Let the beauty of the Lord our God be upon us, and establish the work of our hands." I fall into the demographic of liberal Christianity, and so in a typical week I get most of my exercise by squirming uncomfortably about God-language. But I'm going to let myself off the hook, because the truth for us today in Psalm 90 is not a transcendent truth. It is an immanent truth – that is to say, a truth that is in-dwelling, in us and in everything around us.

And so the critical wording is not, "the Lord our God," the critical wording is "beauty." Over 40 years, over 100 years, over 10,000 years, we have seen the folly of working without a big idea. We have also seen the pitfalls of trusting our big, human ideas too much. We are embarked on work that we expect will give us the crops to make our agroecosystems more whole, the ecological groundedness to make our minds more whole, and through all of you, our supporters and allies, many other initiatives to make our society more whole. But beyond what our big brains expect, we know that ultimately our north star must be beauty – the beauty and symmetry of the ecosphere.

Today is graduation day for The Land Institute. What started as the vision of Wes Jackson has grown into a movement. What started as a seed has grown into a plant. What started with recognition of our radical disconnectedness has grown into a sense of deep and abiding ecological interconnectedness. We've got work to do. "Let beauty be upon us, and establish the work of our hands."

What is the world? Who are we? What are we going to do about it?

ROBERT JENSEN

Adapted from a sermon delivered July 17 at St. Andrew's Presbyterian Church in Austin, Texas.

What are the big questions that religion answers? I know what you are thinking, this being St. Andrew's, and St. Andrew's being a good liberal church: "Bob, it's not about answers but about living the questions." We say that, yet we do need answers. Questions are fine in church, but we live day-to-day by answers, no matter how tentative and incomplete they may have to be. Whether or not there are any definitive ones to be found, we're all hunting for answers.

One traditional formulation of the questions that various religions seek to answer is: Where did we come from? What happens to us when we die? How are we to live? Modern science gives us partial answers to where we came from – the big bang and evolution by natural selection. For me, the second question was never very interesting. I have always assumed that when my body stops functioning I stop functioning, and I "live" only in the memory of those who knew me. Other than that, when we die, we're dead, full stop. How are we to live? That's the tough one. Physics, biology, and history give us clues, which we do our best to misinterpret, which produces drama and comedy, which distract us from our inevitable failures to figure it out. I want to offer a different trio of questions to guide our stumbling through the tentative and incomplete answers, questions that I think are a little less self-centered and are made more relevant by the multiple, cascading ecological crises of this moment in history: What is the world? Who are we? What are we going to do about it?

What is the world? I believe that we live in God's Creation, though I don't believe in God. I believe in Creation without a Creator. I believe we all live as part of a glorious Creation, so grand that it must be the work of a Creator that I don't believe exists. Why do I hold onto the term "Creation" if I'm not looking for a Creator? Because the word conveys the reverence appropriate for the complexity of a living world that is beyond our ability to fully understand. While our future – if there is to be a decent human future, maybe any human future – depends on our ability to understand as much as we can, we should act on that partial understanding cautiously. Speaking of Creation encourages humility, reminding us of humans' relatively small, albeit disproportionately destructive, place in that larger world.

The first step toward that understanding is to realize the arbitrariness of the distinction we make between the living and the

dead. Like any organism, we focus on our own survival and the lives of those closest to us, kin and clan. The expansion of the moral realm has led us to recognize that all human life comes into the world with the same claim to dignity. From there, we realize that we depend on other living things, whose place alongside us in the world we must respect. So, I think first of my own existence, but I realize that my life is empty without friends and family, and that those people so dear to me are no different than billions of other humans, and that we best understand that all life has value.

From there, one more move remains, to recognize the slippery nature of the line we draw between living and dead. Don't worry, this is not the start of a seance, but rather the next step in developing a seriously ecological worldview, in going ecospheric. We move from being self-centered to human-centered to life-centered to eco-centered. We recognize the centrality and supremacy of Creation, or what we can the ecosphere: "atmosphere, hydrosphere, lithosphere, biosphere – connected in a living planetary 'cell,'" as ecologist Stan Rowe put it.

Stuck on Earth's skin, we call most of that around us "dead," but it is no more so than are the many parts of a living cell. This image itself is a compilation, by scientists and artists, of data from various satellites.

To challenge the living/dead dichotomy is not to suggest that water has consciousness or that rocks have the same moral status as humans, just as the suggestion that all life is precious doesn't mean we assign the same value to the lives of mosquitos and our children. Rather it is a different way of thinking about how to use the term "life." Rowe argues that instead of "organism = life" (the idea that life is a property of an organism) we should revive the more ancient idea that "Earth = Life" (life is a property of the ecosphere). We can do that by going beyond our limited viewpoint from the "inside," as a small component of the world, and moving to an "outside view," imagining how the world looks from afar.

Here's how Rowe explains it: "Looked at from the outside the cell is seen as a unit whose parts are the watery cytoplasm, the vacuoles, inclusions such as starch grains, the nucleus and various other organelles. Seeing the whole, the viewer accepts at once that all the constituents are related components of a living cell. Now suppose the viewer is reduced to micro-size and placed inside the same cell with a pair of binoculars. Looking out and around s/he will apparently see the same cell components but now as separate things. The slow flowing cytoplasm, the vacuoles and starch grains, will appear 'dead' while the more active, dividing organelles will be identified as 'alive.' From the outside all the components

participate in and express the life of the cell. From the inside only certain parts appear to be animated. Just so, people immersed in Earth's surface – deep-air animals – have mis-classified most of what lies around them as 'dead'."

What difference will this view from outside have? Realizing that life is a property of the ecosphere should make us more reverent, more respectful of the whole. When we label some things living and other things dead, it gives us license to be cavalier about the non-living. Think of soil. Especially for those of us in cities, it's easy to think of soil as dirt, as something dead, even though soil is teeming with life at the microbial level that we don't fully understand. Are there living things in the soil, or is the soil alive? How we answer that question doesn't change the material reality of the soil, but it can influence how we see that reality.

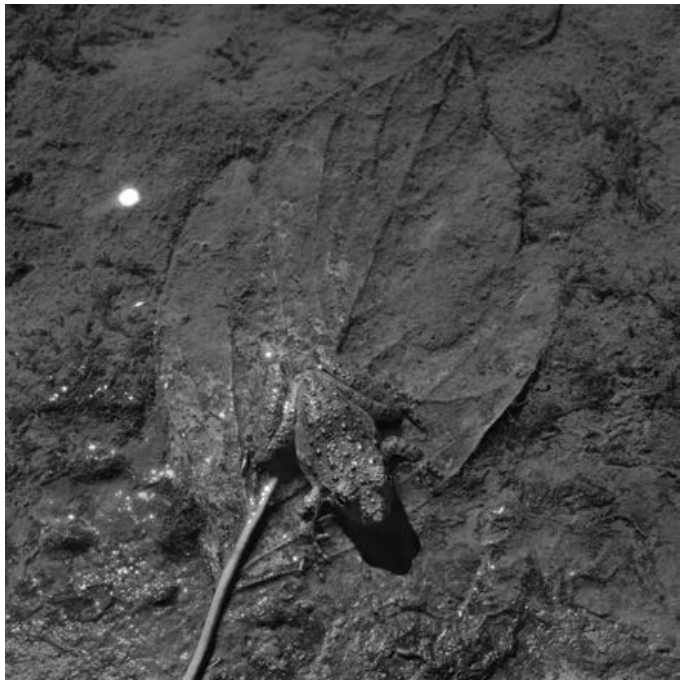
If we were to understand the world this way, we would be more thoughtful about treating apparently "dead" things as if they have no value beyond what we can do with them in the short term to enhance our comfort and pleasure. We would recognize the power of Wendell Berry's words from "How to Be a Poet" in his book "Given: New Poems":

> There are no unsacred places;
> there are only sacred places
> and desecrated places.

If we understood all the world as sacred, we would not have desecrated so much of Creation. But that's exactly what we have done and continue to do. Why? Because we think we are gods.

Who are we? I have no answer to this question, except in the negative: we are not gods. That may seem obvious, but not to everyone. For example, Mark Lynas writes in his book "The God Species: Saving the Planet in the Age of Humans": "Nature no longer runs the Earth. We do. It is our choice what happens from here." That's a way of saying that we are gods. If you doubt that interpretation, take Mark's word for it. A couple of pages later he writes that "playing God at a planetary level is essential if creation is not to be irreparably damaged or even destroyed by humans unwittingly deploying our newfound powers in disastrous ways."

If that's not scary enough, consider this: Mark is not a corporate profiteer from the 1 percent who is trying to rationalize the destruction of a living world for the sake of profit, but an environmentalist. At least, that's what he used to be. Now, in his own



Like any organism, we focus on our own survival. But increasingly we can see that success of our self-interest depends on outgrowing self-centeredness, and treating ourselves as part of an ecosphere. Scott Bontz photo.

words, he "campaigns on behalf of various pro-science causes." Science, in this usage, has less to do with rigor of the scientific method and is rather a synonym for the most dangerous kind of fundamentalism, technological fundamentalism.

Technological fundamentalism is a form of magical thinking that promises a way out of the problems that the extractive/industrial economy has created. Technological fundamentalists believe that the increasing use of evermore sophisticated high-energy advanced technology is always a good thing and that any problems caused by the unintended consequences of previous high-tech "solutions" eventually can be remedied by more technology. Perhaps the ultimate example of this fundamentalism is "geo-engineering," the belief that we can intervene in the climate system at the planetary level to deal with global warming. Given massive human failure at much lower levels of intervention, this approach – for example, what is called "solar radiation management," which would inject sulfate aerosols into the stratosphere to reflect back sunlight – is, quite literally, insane.

Am I unfair in my assessment? Let's go back to Lynas, who is one of the sort-of environmentalists who authored the "Ecomodernist Manifesto," which argues, "Intensifying many human activities – particularly farming, energy extraction, forestry, and settlement – so that they use less land and interfere less with the natural world is the key to decoupling human development from environmental impacts."

Lynas and his co-authors believe in applying human ingenuity to long-term planning, just not the kind of planning that could lead to reducing consumption. The ecomodernists believe we can keep pursuing our desecration of Creation – indeed, we can intensify the desecration – because we will magically decouple our consumption from the material world through more and better gadgets. In other words, we are gods. We can create what we want, out of the void.

Again, I am not unfairly slapping a pejorative label on the ecomodernists. Another of the manifesto's co-authors, Stewart Brand of Whole Earth Catalog fame, in 1968 wrote, "We are as gods and might as well get good at it." Forty years later, he updated that in his book "Whole Earth Discipline: An Ecopragmatist Manifesto": "We are as gods and *have* to get good at it."

In other words, after 40 years of the demonstrated failures of technological fundamentalism, the ecomodernists encourage us to double down on magical thinking, ironically all in the name of science.

What are we going to do about it? Again, my answer is in the negative: not more of the same.

That doesn't mean we abandon science, but simply that we abandon the narcissistic illusion that we can control our interventions into an infinitely complex world. Instead, we should cultivate the intellectual humility that helps us be more careful in our tinkering. Such an attitude obviously would eliminate geo-engineering as an option, and also would check the ecomodernists' enthusiasm for expanding production of nuclear energy, a process that we can't really control and produces waste for which we have no safe disposal system.

But it also would lead us to doubt the miracle-cure rhetoric around renewable energy offered by folks such as Al Gore, another sort-of environmentalist who prefers high-tech solutions that protect the affluent from accountability. We should continue to pursue research on renewable energy, using the best science, carefully, to reduce our use of fossil fuels. But it's equally important to

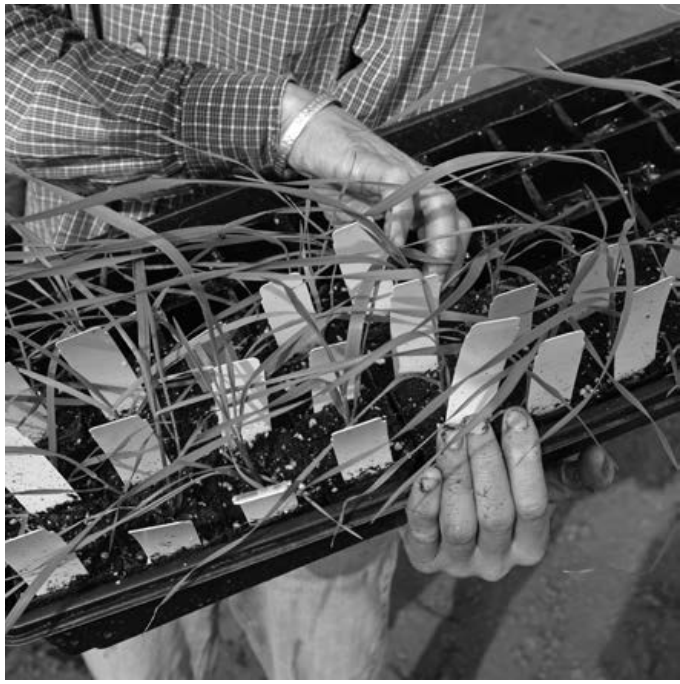
realize that no combination of renewable energy sources can power the modern industrial world at current levels of consumption. Instead of focusing exclusively on new ways to power up, we should put most of our ingenuity to work on how to power down – living with less energy, and less of most everything else.

If we recognize that Creation is alive, and that we are not gods who can manipulate and manage all of life, then we will stop trying to run the planet and stop running from our real task, which is to give up the modern worship of "progress," defined as more-and-bigger = better-and-better. The pursuit of that kind of progress is dangerous. As Wendell Berry once observed, "Progress has nowhere to go, and it is going there in a hurry."

What can each of us do about that? First, we can dare to imagine life in a low-energy world, and then work to create that world in whatever ways, small or large, we can. That is not a call to go back in time, to some romanticized past. It simply recognizes that our only hope for the future is to go forward with humility, which is the slow path, with no magic tricks to save us but instead the hope that we can uncover ways of living that can sustain us.

One of the earliest stories in our tradition, the tale of Adam and Eve's banishment in chapters two and three of Genesis, speaks to the need for this humility. In the garden, God told the couple that they could eat freely of every tree except the tree of knowledge of good and evil, and after they ignored that warning they were denied access to the tree of life. The essence of this story: Act 1: God says, "Remember, humans aren't gods." Act 2: Humans say, "Oh yea?" Act 3: Bad things happen. Getting back to that tree of life isn't easy, because God "placed the cherubim, and a flaming sword which turned every way, to guard the way to the tree of life."

Evolution doesn't run backward. We can't go back in history, but we can learn from it. We may feel as if "we've got to get ourselves back to the garden," but there are now just too damn many of us, and we have done too much damage to the tree of life. To abandon the tree of knowledge would be a recipe for disaster. Lynas and the ecomodernists are right about the inevitability of deploying knowledge, but their arrogance suggests that they haven't paid much attention to history. While we can't give up on knowledge, we have to contend with what Ronald Wright dubbed "progress traps" in his book A Short History of Progress – the problems humans inadvertently introduce



Instead of only seeking new fuels, we could apply our ingenuity to powering down. Intermediate wheatgrass, a perennial, should need far less tractor time than annual grains. Scott Bontz photo.

when seeking to improve our lives, which we then can't solve. We face an unlivable future, yet we can't go back. We are stuck with knowledge, and knowledge is dangerous in the hands of humans. There's no solution to that problem, and all we can do is be more aware of our weaknesses.

The lesson of the garden is not that people should avoid all knowledge, only that we should resist the temptation to believe we are godlike in trying to manipulate the complexity of the world. The larger living world of which we are a part – the tree of life – was adequate to sustain us, but we weren't satisfied. The story suggests that when we humans believe we can rewrite the rules of that world as if we have godlike omniscience, things don't turn out so well. When we try that, God – a term that for me embraces the ineffable wonder of Creation rather than naming a belief in a Creator – doesn't trust us and places a guard, armed with a flaming sword, to keep us from mucking things up.

To wrap up, let's go back to those three basic questions: Where did we come from? What happens to us when we die? How are we to live? When we go ecospheric, the answers are easy: We came from the ground, we return to the ground, and we should live knowing we are part of the ground. It's an old idea – ashes to ashes, dust to dust; we don't own the Earth, the Earth owns us. If we understood that, we would question a social system built on claims of ownership, which takes us out of right relation with each other and the larger living world. An economic system that claims we can own not only the ground but life itself is, literally, insane. How are we to live? According to the always-popular Micah 6:8, our task is "to do justice, to love kindness, and to walk humbly with your God."

The first step in walking humbly with our God is remembering we are not gods. We don't own the world. We can't competently run the world. We need to scale back our expectations. We must think about what we really need, recognizing that much of what we want is nothing more than things we have been trained to covet by a pathological economic system. We might ponder the question that a historian offered at the end of his recent "big history" of our species: "Is there anything more dangerous than dissatisfied and irresponsible gods who don't know what they want?" I might offer a friendly amendment: dissatisfied and irresponsible gods who think they know what they want.

The title of Yuval Noah Harari's book, "Sapiens: A Brief History of Humankind," got me thinking about how our self-naming reveals our fatal flaw, that hubris. Our genus, *Homo* (Latin for "human being") began 2.5 million years ago with *Homo habilis*, which is usually translated from Latin as "handy" or "skillful." We named ourselves Homo sapiens, the "wise" human beings. Imagine asking two people how to describe themselves. One says, "I'm pretty handy." The other declares, "I am wise." Who would you rather hang out with?

We are better people, individually and collectively, when we reject hubris and embrace humility, and we stand a better chance of making real progress – defined by Rowe as "whatever is conducive to sustainable participation in Earth's ecosystems" – when we better understand the world and our place in it.

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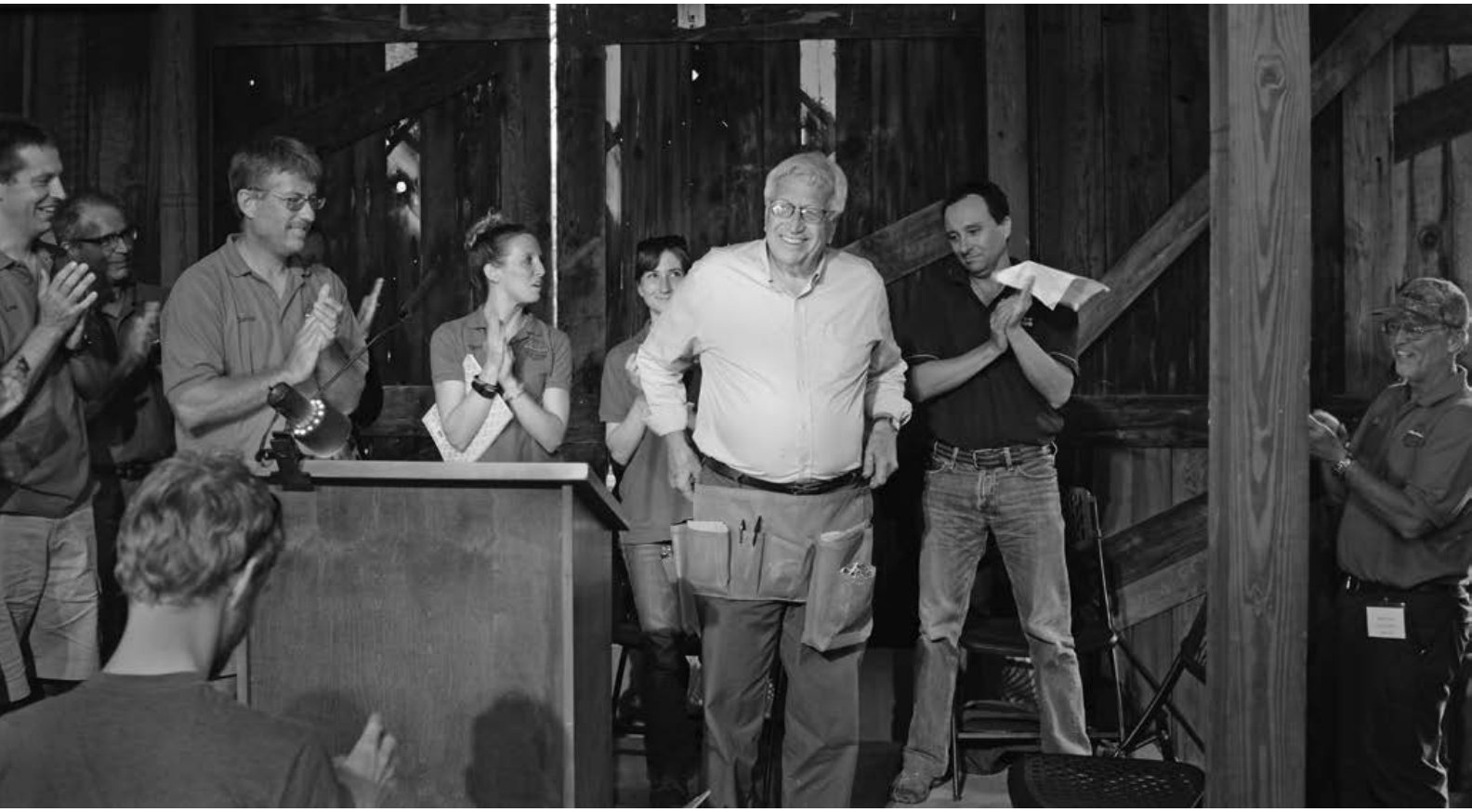

Land Institute plant breeders present to departing President Wes Jackson their tool of the trade, a pollination apron, at the 2016 Prairie Festival. For more about changes in the institute's management and Board of Directors, see page 13. Scott Bontz photo.