The Land Report

A publication of The Land Institute / Number 88 / Summer 2007

Ideas in a Little School on the Prairie
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Dear Young Iowan
Prairie Festival 2007
The Next 49 Years

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Cover: *Village of the Plains*, by Lloyd Foltz. Woodcut, 1932. Spencer Museum of Art, University of Kansas.

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
In the field, wheat hybrids that had been bred back to their original perennial parent species, intermediate wheatgrass, were not affected by a hard freeze in April or the heavy disease pressures this year.

The late freeze didn't hurt plants backcrossed to wheat either, but disease hit them hard. Moist conditions from a wet spring defoliated annual wheat, and also stripped these hybrids. We harvested the hybrids and are happy to see some plants regrowing. We're sending some seed elsewhere to see if these hybrids prove perennial in cooler climates.

This difficult year for wheat was good for wheatgrass, which in addition to breeding with wheat, we're domesticating directly. Heavy rain helped make many large seed heads, and we expect high yields. Dampness brought leaf disease outbreaks on some plants. But diseased wheatgrass usually isn't a problem in our climate, and we took the opportunity to rate plants to select in breeding for resistance.

About 200 of our perennial sorghum plants that survived the winter of 2005-06 also made it through winter 2006-07. From last year's most croplike plants—best seed, shorter stalks—we've sown plots for further selection and improvement. There are almost 2,000 rows, each 10 feet long, with about 20 plants in a row, covering some 3½ acres.

Publication
Scientific American's August issue features an eight-page, illustrated story about the need and promise of perennial grains, by our scientists Jerry Glover and Cindy Cox, and John Reganold of Washington State University. The editors wrote, "The challenge is monumental, but if plant scientists succeed, the achievement would rival humanity's original domestication of food crops over the past 10 millennia—and be just as revolutionary."

New Staff Members
Martha Bryant, with a doctorate in informal education, and formerly a fund-raiser for the New World Symphony in Miami Beach, Florida, and the Knoxville Zoo in Tennessee, is our new director of institutional advancement.

Debbie Turner is Bryant's assistant in development. She worked in fund raising for St. Francis Academy in Salina.

Ron Kinkelaar is our new mechanic. His jobs have included work on heavy equipment and big trucks, and building buses. He raises and trains horses, mules and dogs.

Nancy Jackson directs our effort to connect climate and energy in the popular imagination, and to work toward energy conservation, efficiency and sustainability. She was an acquisitions editor for the University of Kansas Press and a development director for the school.

Scott Allegrucci, former director of tourism for Kansas, is helping Jackson. They will speak about the Climate and Energy Project on September 29 at our Prairie Festival.

Liz Elmore will work a year for us as a research technician, earning credit at the University of Missouri.

Presentations Made
May 25-27 we held an annual introduction to our work. Attendees were mostly undergraduates, but included a sociology professor and a filmmaker—not filming, but learning.

June 10-16 brought our annual workshop for graduate students whose work we support. A feature about that starts on page 4.

Institute President Wes Jackson spoke March 12 to the International Relations Council of Kansas City, on global sustainability and national security. He spoke about our research, climate change and fossil carbon March 20 at William Jewell College in Liberty, Missouri, April 23 at Texas Energy Futures in Fort Worth, April 26 to the Kansas Health Foundation and July 5 at the Aspen Ideas Festival. On April 14 he spoke at Salina's part in a nationwide demonstration to reduce carbon dioxide emissions.

Jackson covered much of how humans are missing those aims, including fossil economics and how it has driven population growth and consumption, May 9 at the Chicago Botanical Gardens.

He took that theme, and invitation for action, to commencement speeches: May 12 at Kansas Wesleyan University, where he received his bachelor's degree 49 years ago, and May 20 at Washington College in Chestertown, Maryland. (For the Washington speech, see page 18.) Both schools gave him honorary doctorates. The school where he earned his master's degree, the University of Kansas, gave him a distinguished service citation May 18.

Agroecologist Jerry Glover told of perennial grain crops April 24 at Iowa State University. On May 9 in Chicago he talked to Humans and Nature about the potential of Conservation Reserve Program acreage—cropland restored by subsidy to native vegetation—for biofuel.

On May 2, Managing Director Ken Warren delivered in Manhattan, Kansas, a talk called "Living as if the Future Matters"—about resilience and sustainability.

Presentations Scheduled
September 14, Wichita, Kansas.
October 11, Gainesville, Florida.
October 23, Leawood, Kansas.
November 5, New Orleans.
November 7, Chicago.

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

Ideas in a Little School on the Prairie

People migrate to our Prairie Festival each fall for a shot of what I'll call enlivening enlightenment. It's not just education that entertains. It's something like a revival meeting. It's an energizer for those who want to better fit us humans into our homes, the land, and who might feel they're at least a bit of a minority. And it's a hand offered to those who are intrigued. (See page 17.)

We stage a similar meeting each June. This one is much smaller—a few dozen attendees rather than several hundred—and longer—a week rather than two days. And the language gets more arcane. But there's a dance, a talent show, a visit to high prairie at sunset and conversation late into the nights. It's called the Graduate Fellows Workshop, and it's for students whose work in our research vein we fund at schools from California to New York. These young scientists can use major universities' tools, and their studies plant our ideas at institutions that might otherwise find the pursuit too risky, too lengthy or unnecessary for agriculture today.

We bring new fellows to Salina for a crash course in how The Land Institute is working to develop perennial grain crops, and why. After two days, we move the workshop southeast to the Kansas Flint Hills and about double

Jose Guzman, a Land Institute graduate fellow, east of Matfield Green, Kansas, during our weeklong June workshop for fellows. Explorer Zebulon Pike might have taken this same vantage in 1806 when he saw bison and elk herds range over the

the size of Matfield Green, population 50. There, continuing fellows and sometimes a few past fellows join in. To both venues come speakers from across the students' science disciplines—agronomy, ecology, etc.—and from fields outside science—this year including commodities trading, ethics and news media.

For the past few years, I've asked new fellows to sketch their research for you. This year we'll paint the workshop too, so you can better appreciate the fellows program. May you take something from the presenters' material as well.

—*Scott Bontz*

Why We Need Perennial Grain Crops

Jerry Glover is our soil scientist and agroecologist, the scientist studying how farming works as an ecosystem, and how it might work better if more like a natural one. He's also the lead organizer of the fellows workshop. Here is some of his introduction to new fellows:

Humans usually go completely against natural ecosystems. Natural systems recycle most everything, run on contemporary sunlight, and are dominated by perennial plants growing in species mixes. Eighty-five percent of North America's native plants are perennials. Their ground cover

prairie. Now the land's big animals are domestic cattle. But the Flint Hills remain native tallgrass prairie, the largest stretch left in this country. They inspire our aim of an agriculture more like natural ecosystems. Scott Bontz photo.

often is even higher. But the great majority of agriculture is annuals grown in monocultures.

Humans take almost 40 percent of what the planet's life produces. Eighty-one percent of cropland is cereals, food legumes and oil seeds. These foods meet 70 to 80 percent of our caloric needs. They are energy that is compact, and that can be stored and moved. "Humans really rely on those grain crops. That's what our civilizations have grown on."

These crops get two-thirds of the synthetic nitrogen put on farm ground. More than half of this fertilizer sinks or washes away as waste. "It's very difficult to even use 50 percent of what's put on the crop. Typically 30-40 percent is captured."

Grain fields make big environmental problems, including erosion, because there aren't mature plants covering and holding soil year-round. And life leaves vast areas around river mouths because that nitrogen runoff becomes a poison. The Millennium Ecosystem Assessment said agriculture is the biggest human threat to biodiversity and the working of ecosystems.

In normal years, nearly half of water falling on annual crops might be wasted. Perennials have been shown to cut water loss from crop fields by a factor of five. Perennials get started earlier than annuals, and can grow later, turning more of the sun's energy into food. In May our perennial sorghum's roots can be 6 feet deep, when annual sorghum's is 6 inches.

Critics say that perennials skimp on seed in favor

At left, cloddy soil from a field of wheat. At right, out of adjacent prairie, soil porous to air and water, rich crumb around perennial roots. Graduate fellows saw the same sort of contrast from adjacent plots of wheat and intermediate wheatgrass, a perennial plant we're both domesticating directly and breeding with wheat. Steve Culman photo.

of roots and can't compromise. But seed carbon needn't sacrifice roots. Perennials' extra growth capacity can be reallocated to grain production. They'll produce more in a farm field than in prairie, because they will be pampered as crops, their competition controlled. Farmers and breeders did the same thing with current grain crops, all of which began as wild annuals.

Perennials also have a big advantage of sustained production on marginal land, because they tend to hold and build soil.

More benefits regard global climate change. Perennials can sequester several times more carbon than annuals. That and their lessening of fertilizer and machinery use should make them net reducers of atmospheric carbon dioxide, while annual cropping continues to add greenhouse gas. And models predict that while warming will reduce annuals' yields about 0.5 to 1.5 tons per acre, production by resilient, efficient perennials might use the extra energy to increase yield by 5 tons.

Jann Williams, an ecologist from the University of Tasmania who came to speak at the workshop, asked Glover how livestock would fit into perennial grain cropping. He said animals might help fight plant disease, by eating leftover vegetation, and speed the cycling of nutrients. They also might be used to go after cool-season weeds in a field of warm-season crop plants.

Kayje Booker, a fellow from the University of California at Berkeley, asked how the market will come to adopt perennial grain crops. Glover said that if the perennial seed is like an existing annual's, the market is already there, and consumers will be accepting. He also noted that Americans quickly welcomed the newfangled soybean from Asia.

Other changes will make perennials more attractive to the market. The cost of synthetic nitrogen fertilizer is three times what it was five years ago. Perennial cropping that includes legumes should help relieve farmers of this expense. And perennials will take less machinery fuel.

But perennial grain crops might better be sold first where they are more needed, in places like Australia, which lacks North America's luck in having thick, rich soil.

Fellows boarded a wagon with hay bales for seats, and rode downhill from the science office and across the Smoky Hill River, which heavy May rains continued to run at several times the usual volume, muddy, high and wide. The fellows stopped in a field of 45 long plots totaling about 15 acres, where Glover is making a years-long study. Some plots were lush green perennial grasses, some browning wheat, some bare soil only recently dried enough to plant their annual crops. Glover continued:

We're comparing water, soil quality, nutrient use and production in five treatments: native prairie plants, plantings two years apart of intermediate wheatgrass, which is an introduced pasture crop that we're also breeding to make a perennial grain, and the annual crops of wheat, sorghum and soybean, grown in rotation.

Among the things we've learned from these plots for our new kind of farming is that over time perennials crowd one another and production suffers. We can't let perennials go wild in competitive growth like prairie, but must control spacing as with annual crops.

We also must deal with perennials' greater ability to soak up water. If there isn't water left when seeds fill out, total plant mass might be high, but seed production low.

And we need to make an agriculture that can work well for farmers of various abilities, not only for those with the highest skill. The success stories in what is now called sustainable agriculture, with annuals, rely on exceptional farmers.

The wheatgrass plots show one of the great advantages of perennials. Planted in 2002 and 2004, they were thick and tall in mid-June 2007. Plots that were to grow beans and sorghum remained bare. In a good year, these would've been planted in May. But this spring was wet in central Kansas, and we and many farmers had to wait. That left the ground exposed even longer to erosion, and wasted more water and sunlight. The establishment year for any crop is risky, and "Every year is an establishment year for annuals."

The situation in the wheat plots is different. Kansas wheat is planted in fall, cut in mid- to late June. Wheat puts early spring rain and sun to use. But its roots reach only a fraction of the length of perennials'—or corn and sorghum, for that matter—and then only near maturity. Meanwhile, though some water is picked up, much is lost. And April brought a bad freeze that knocked back wheat and made 2007 a bad year in Kansas. The wheatgrass, with its mature roots and rhizomes, seemed unfazed.

Upper Midwest farmers growing corn and soybeans envy winter wheat country for how the crop covers ground so much longer. But the difference between wheat and perennial ecosystems is tremendous yet. A probe hydraulically driven into the soil by a pickup truck pulled out samples from wheat and wheatgrass ground to compare. The wheat soil chunks showed no obvious root architecture to make a healthy soil. Even crumbled apart, one piece of wheatgrass soil dangled from another, held by roots.

As they did for breakfast, for lunch the fellows gathered on a lawn of buffalo grass under two tents outside our office. One of our other many yearly visitors, the chimney swifts, twittered overhead. Meals were homemade, by one of the institute scientists and his family. Afterward, Glover told of another ongoing study:

As a Land Institute intern, in 1996, he found a prairie in the county north of ours that had never been plowed, and, because of no access to water, never grazed. The original settlement family has been haying the field for 100 years, taking everything but stubble away as feed. They use different equipment now, but it remains essentially the same yearly process. In all of that time, they've added no

fertilizer.

Despite a century of this, there is no obvious degradation of the soil quality. And the prairie still exports about as much nitrogen, a major part of protein, as does an adjacent wheat field fertilized for the past three decades. The prairie soil is higher than wheat soil in organic matter and total soil nitrogen and carbon.

To learn how this is possible—how the prairie can keep exporting with no imports, while the wheat must be spoon-fed—we're examining the soil nutrient budgets closely. This study has expanded to similar sites of adjacent hay and crop fields found in four other central Kansas counties. The work involves 12 scientists, including six graduate fellows.

In England, a hay field study made over 120 years shows no loss of organic matter. This might be because the ecosystem continually recharges with nitrogen from the atmosphere and relies on weathering of soil for phosphorous and other nutrients. (For more about this, see "The Phosphorus Question," page 14.)

If we ask what makes an ideal farm, the answer would include export of nutrients, with lots of nitrogen; no reliance on heavy inputs; sustained high soil and water quality; and provision of habitat for wildlife, which benefits the ecosystem including the farm. Prairie makes an ideal model for all of this.

The protein coming from Kansas wheat fields has risen through the past century, while hay yields have remained flat. But from the start, wheat ground had an edge. The lowlands favored for grain and row crops are more fertile than the uplands more likely to be used for hay and pasture. What would Kansas' hay productivity be like now had we never plowed those prime lands? Probably like our study's ungrazed prairies, which were left unplowed because of isolated, irregularly shaped fields, not because of lesser soil.

Pathology as Spice of Life

Cindy Cox is The Land Institute's plant pathologist. She told how disease plays out in annuals and perennials:

Critics of the idea of our work say perennials will be disease-ridden. But pathogens are like Dr. Jekyll and Mr. Hyde—they're not all good or bad. They can actually help maintain plant species diversity, and enhance genetic diversity and structure in natural ecosystems. "Pathogens definitely have a role in shaping our ecosystems."

Perennials beat annuals with a longer growing season. But more time growing gives more time for pests to work. And perennials are prone to foster a cycle of pests reproducing in accumulated dead leaves and stems. Here annuals have the advantage of crop rotation—the foe of one plant tends not to go for another.

But most perennials are naturally more resistant to pathogens and herbivores than are their annual relatives. "They need to have a tough system, a better system to deal

The New Fellows' Work

Since the fellows program began in 1998, we've awarded 76 fellowships, of up to $9,000. We aim for a worldwide interdisciplinary network of researchers. Following are sketches of the work by this year's new fellows. For more about the program, see www.landinstitute.org.

Nathan Bard
University of Wisconsin

Clover in Corn Fields as Fertilizer and Soil Saver

Kura clover, a perennial, can be a living mulch and the sole nitrogen source for corn. It cuts soil erosion and nitrate water pollution without hurting yield. This attracts organic farmers, who now fight weeds with expensive and erosion-prone tillage. But the clover must be controlled with herbicides. I am testing mechanical means, hoping to help organic growers and farmers who want to cut chemical use with perennial ground cover.

Robin Mittenthal
University of Wisconsin

Relationship of Organic Fertility Management, Plant Nutrition and Insect Response

Perennial grain polycultures should require smaller inputs of nitrogen, phosphorus and potassium for sustained productivity than do current annual systems. Some inputs will likely still be needed over the long term, however, including minerals such as calcium, whose replenishment in the soil by natural processes occurs slowly. Some research with annuals suggests that failure to supply these nutrients may diminish plants' abilities to defend themselves against insect pests. Working over years in an organic system of diverse annuals, I will explore the effect of various calcium fertilizers on plant growth, palatability to insect pests and pest population growth.

Matt Bakker
University of Minnesota

Disease-inhibiting Bacteria in Prairie and Farm Soil

In almost all cases, agriculture represents a vast simplification of complex natural systems. This simplification may lead to the loss of important ecosystem functions, such as constraints on plant disease. *Streptomyces* are ubiquitous soil bacteria that produce a wide variety of antibiotics. They can inhibit many plant pathogens, so changes to the *Streptomyces* community may have implications for plant disease. I will compare the *Streptomyces* communities in diverse prairie and no-till annual agriculture systems, focusing on genetic diversity and the ability of each community to inhibit four plant pathogens.

Jose Guzman
Iowa State University

Effects of Restored Tallgrass Prairies on Previously Cultivated Land

I will study how slope and time affect restored tallgrass prairie and cropland soils: their carbon, microbial populations, root mass and related properties. I will couple these measurements with what goes on aboveground in vegetation and photosynthesis. Findings will help with soil carbon sequestration.

Kayje Booker
University of California, Berkeley

Perennial Prairie Grasses for Biofuels

Ethanol and biodiesel are promoted as important tools for fighting global warming and enhancing energy security and rural development. But U.S. biofuel production largely fails to meet these objectives, relying exclusively on corn and soybeans, annual crops that require large amounts of fossil fuel inputs. I will examine how using diverse mixes of perennial native prairie grasses instead can achieve more environmental and economic benefits. I also plan to study barriers to this shift, and what kind of ownership and scale work best for making biofuel from prairie grasses.

Megan O'Rourke
Cornell University

Do Diverse Landscapes Matter to Pests?

Most insect pests in agriculture are highly mobile. In diverse landscape, this means that they face many kinds of habitat. We don't understand how different habitats affect insect dispersal. If diverse landscape reduces pests' dispersal, theory predicts it will cut their populations too. I will study dispersal rates of two field corn pests from agriculturally intensive and forested areas of New York.

Stephen Bramwell
Washington State University

Integrating Perennial Forages into Crop Rotations

Integration of crops and livestock is important to improve biological efficiency and reduce petroleum use on farms. I am studying how to bring perennial, grazed forages back to cropping in the Palouse region of Washington and Idaho. I'll assess perennial establishment, per acre costs and potential profit, energy use of crop-livestock systems, productivity of triticale grain following eight years of alfalfa, and perennial-to-annual transition strategies. I'll emphasize how livestock might cut energy use by substitution of long-term rotational legume grazing for petroleum-based fertilizers.

Jennifer Gardner
Cornell University

How Farming Method Affects Nitrogen Loss

Nitrogen carried from grain farms down the Mississippi River is the main reason that thousands of square miles of the Gulf of Mexico lose oxygen and life each summer. I will measure the potential for nitrogen losses under the range of management practices used on grain farms and perennial pastures in the river basin. The calculations will include nitrogen fixation by legumes.

with pathogens." Evolution has provided this. Breeding annual crop plants might have unknowingly whittled away evolved defenses.

More plant species, as we envision farming, usually brings more soil microbes, which potentially means soil that better suppresses disease. Competition prevents dominance by one pathogen and the wiping out of a field. "So I guess we have to keep the pathogens busy."

For a technical article on disease management in perennial grain cropping, see www.landinstitute.org, and look in Publications: Science.

The Complex, Happy Medium

The fellows briefly toured our greenhouse. In winter, breeding plants pack the place. In June there remained some hybrids of annual wheat and the perennial intermediate wheatgrass. Fellows heard about them from breeder Lee DeHaan, himself a former fellow:

Most of the hybrids don't regrow after harvest. But some of the tall hybrids more like wheatgrass are successful perennials. If less than 50 percent of the chromosomes are from the perennial heritage, we get an annual plant.

"We're trying to move toward that happy medium."

Some of the occurrences that push a wild plant toward favor as a crop plant, such as the accidental hybrid that made bread wheat, might occur in nature only once every several thousand years. With plant breeding techniques we can produce the same hybrid reliably.

But genetic engineering isn't our answer. A great number of traits—perenniality, big seeds, lots of them, and short stature, to both avoid falling and not waste energy competing for sunlight—make a good crop plant, and some of these involve hundreds of genes. Simply inserting one gene won't do. And genetic engineering, though novel and several times more expensive that conventional breeding, makes a commercial crop plant no sooner.

For more about our breeding work, including questions we're frequently asked, see www.landinstitute.org, and look in Programs: Overview.

After introduction in Salina to our work and supper overlooking the Smoky Hill River, the fellows workshop moved two hours away, to Matfield Green. The little town rests in the heart of the Flint Hills, where much of the soil lies too thin and hilly for plowing, and so remains in native tallgrass prairie—rolling from northern Oklahoma across Kansas, it's the nation's largest remaining stretch.

The prairie's ecology models for our agriculture. But to see the Flint Hills in mid-June, with wildflowers speckling the warm-season grasses, inspires in more than a scientific sense. Fellows relish being there, and so do staff members in the workshop.

Day one in the Flint Hills took fellows south of Matfield Green to Pete Ferrell's ranch. Ferrell, a Land Institute board member, rotates cattle through paddocks over 7,000 acres. Concentrated, the animals eat from all of the plants, not just their favorites. This way the pasture doesn't grow weedy like many surrounding, less carefully managed ranches.

Fellows also saw arrayed over the Ferrell ranch's windy hills 50 turbines, each 387 feet tall. A total of 100 turbines in the area make enough electricity to power 42,000 homes.

Fellows don't just hike and enjoy the Flint Hills. Most of the time they're at Matfield Green's schoolhouse. This brick building went up in 1938, and closed with waning population and school consolidation. Our worker in Matfield Green, Ron Armstrong, renovated the schoolhouse 1994-96. Now we and other groups use it for meetings.

Speaking of Science

Next day the workshop featured the theme of communicating science, like the fellows' research, to a lay public. Since scientists and nonscientists alike convey their message by media, and we like supporters to tell about our work, we pass along here the suggestions from our speakers.

Kathy Richardson was a spokeswoman for Colorado Gov. Richard Lamm, and also for Denver water engineers. She also worked as a reporter. Now she designs jewelry and runs Small World Gallery in Lindsborg, Kansas, with her husband, Jim Richardson, a *National Geographic* photographer who has also taken pictures for The Land Institute. (See the August *Scientific American*.) Her tips:

Scientists should not be reluctant to talk with media. "It gets you more funding. It gets you more attention." Also, you have an ethical responsibility to society to tell of your work, and increasingly people are interested in science.

The key to communicate with media: As much as you can, take a message that is boiled-down, clarified and with as little as possible left to chance. Put yourself in the reporter's shoes and imagine what it would be like to know little to nothing about the subject, usually have little time to learn it, and even less to present it.

And, "You can't be afraid to put a little show-biz into it … a little flavor."

Institute scientist Stan Cox, who also writes for the mainstream, added this: Make your key point with a colorful expression—the reporter might use just one quote.

But Richardson warned: Listen to lines of questioning to detect journalists who are "quote shopping" to fit preconceived notions, rather than coming with an open mind. To them, say you can't help, or don't want to be part of it.

When first approached by reporters, don't launch immediately into explanation. Ask for their deadline, and say you'll call back. Buy some time to organize. And say to them, "Tell me about your story. … Get them to talk to you about what's in their brain." If they're driven by pop culture, the gee whiz, interest in breakthrough or a policy, "You need to know that going in, because it will shade what

you prepare."

For television, you need movement. For radio, think sounds and voices. For daily print, figure 15 short paragraphs and maybe a picture.

It's always better to interview face-to-face than by phone. "You get to see how they're reading your information." And it's better to go to lab or field than to sit at a desk. "Because then you're an actor. You're active."

Most important: Have a paper, in everyday language, to tell your story. This minimizes your risk. The print can be clearer and more useful than what you might say. "I felt naked without it."

In print or spoken, remove jargon, or at least define it.

Clarity is more important than simplicity, to keep integrity.

Explain what's important, and also the uncertainty of science, that it's not simple.

Telling of shortfalls helps make you credible. But stay cool and confident. Don't let them smell fear. And if they're glassy-eyed, start over.

When you see the result, don't be bothered much by small inaccuracies. They're bound to happen.

Matthew Matcuk directs development of exhibitions for Chicago's Field Museum, the fourth largest natural history museum in the world, which sees 1.5 million visitors per year. His suggestions, applicable not just to displays but to writing:

For planning how to present a topic, make an "ignorance list." "I write down every single stupid question that pops into my mind." This helps put you in the viewer's head. As you learn more about a subject, you can go back to your initial list to see how many of those questions have been answered by your story.

Simplify your message. This isn't dumbing down. "I think that a good exhibition is always just a good introduction," as is good science writing.

Tell a story. Even when content doesn't lend to narrative, seek an obstacle, a hero, and resolution.

Beware of jargon. "It's hard not to use jargon, it feels good, but try not to do it." Include only that argot necessary for the story, and explain it, in a way children can understand, but which doesn't make adults feel talked down to.

Help people understand the distinction between basic research and applied science.

Do the unexpected.

Being personal can help.

Use a good style guide.

Use strong verbs, steer away from adjectives and adverbs.

Don't worry if your first draft stinks.

Be brief.

Listen to the sound of your writing. Read it to someone, and see if your ears burn.

Remember that people are most interested in themselves: Tell what's in it for them.

New Vibrancy for Homogenized Land

Laura Jackson, a biology professor at the University of Northern Iowa and one of Land Institute President Wes Jackson's daughters, talked about how to restore and protect biological diversity in farming itself, and not just rely on biodiversity in scattered nature preserves:

The upper Midwest has few species unique to the area—not much to trigger the Endangered Species Act and make a case for conservation. And little native prairie remains—only one-tenth of 1 percent in Iowa. The rest is mostly farmland.

But until the mid-20th century, hay and pasture covered about half the land of northern Iowa farms. Now this kind of agriculture is almost entirely absent. In its place, and still expanding, is row cropping of corn and soybeans. The older system, which included small grains, still kept more land in perennials, used legumes for adding nitrogen, recycled nutrients in manure—with crops and livestock still raised together—and was better for water and wildlife. The second system makes a monotonous two-crop checkerboard shown in an aerial photo of 320 square miles of Iowa. Driving from Cedar Falls, there's nothing else for four hours east, four hours west, two hours north and two hours south.

The lesson: Until perennial grains are available, at least return to longer crop rotations, with 50-70 percent of farmland in perennials for hay and pasture. Put much less in corn and soybeans. These crops largely feed livestock anyway.

Reasons why farmers don't make this change, though they know it would be good: There are fewer of them, their average age is rising, they're increasingly renting and their landlord owners are farther away. And conversion is very risky, lacking the subsidies that can make up half or more of a commodity grower's income. Only a few extraordinary farmers can do it. It takes learning new methods and, against big producers, niche marketing.

The primary shapers of the farm landscape are not farmers, but farm policy and the food system. We must stop trying to persuade farmers to change, and instead change a system answering to 2,182 agribusiness lobbyists and their employers, who make $81 million in campaign contributions.

Running Toward Empty

Tad Patzek is a professor of civil and environmental engineering at University of California, Berkeley. He has worked for oil companies, and studies the human econo my's energy flow, the sustainability of energy use, and fuel

Continued on page 14

We showed to our graduate fellows pictures made around the world by *National Geographic's* Jim Richardson, along with displays comparing annual and perennial roots. It was "the gallery opening," complete with cheese, crackers and wine from a box. At far right, Richardson tells of his work, which has included photographing roots with us in an ongoing project. The roots hanging near center in this picture are, from left, soybean, Indiangrass, intermediate wheatgrass and wheat.

The middle two are perennials. So are the big bluestem, compassplant and Maximilian sunflower mounted to a stand against the right wall, behind graduate fellow Matthew Rouse, who's about 6½ feet tall. These displays show vividly something of how perennials trump annuals. But their roots are not just more massive: They're also alive longer, take water and nutrients that annuals miss, and give aboveground growth a head start capturing sunlight for food. Photo montage by Dennis Dimick.

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made from plants, of which he is a prominent critic. He offered these numbers:

The United States gets 98 percent of its primary energy—energy that has not changed form, as when coal burns to make electricity—from fossil fuels and uranium. This means that how the nation lives is 98 percent unsustainable.

Americans consume 105 times as much energy as what they need merely to feed themselves. That energy metabolized could make each of them a sperm whale 50 feet long and weighing 45 tons. There are an estimated 360,000 sperm whales in the world, and 300 million Americans.

The nation's numbers are projected to grow by another 110-170 million in the next 50 years. "Just the population growth will overwhelm whatever we do with biofuels."

Conventional oil production—distinct from more difficult mining such as from oil shale—already has peaked. In 30 years, U.S. population growth would intersect total world oil production. If China consumed at the U.S. per capita rate, it would already use all world oil.

"The U.S. is beyond the point of no return. … This is happening right now, today, and we're doing nothing about it."

The Phosphorus Question

Tim Crews teaches agroecology and environmental studies at Prescott College in Arizona. He studies soil and plant nutrient cycles, and farming that uses little or no purchased inputs. He's also one of our most regular collaborators and supporters.

Much of his crop nutrient research has been with nitrogen. For this workshop he delved into another of the big three plant nutrients, phosphorus.

He began with these questions: Is our goal to have no nonrenewables in farming? Will this work within our current socioeconomic system and values? Does it represent our best understanding of how ecosystems work over time? And with this note: The University of Manitoba's Vaclav Smil, author of several books on energy and food, including *Enriching the Earth*, figures that 40 percent of current humanity would not be alive if not for nitrogen fertilizer made using fossil fuel.

On phosphorus: It's the nutrient originally derived from rocks that often limits what a field can produce. Nitrogen, which comes from the atmosphere through legumes and bacteria, or is synthesized using fossil fuels, gets more attention. But the nitrogen fixed by legumes often depends on available phosphorous. "Legumes tend to have very phosphorous-rich lifestyles."

Studies show that plants take up as little as 45 percent of phosphorus that farmers apply. Some leaches or runs off. Most is tied up in the soil by other elements, such as iron, aluminum, and calcium. There it remains largely unavailable to crops.

Nitrogen is the biggest on-farm energy cost for U.S. agriculture. But phosphorus takes a lot of energy too, including for its mining.

The United States supplies 38 to 50 percent of the world's phosphorus demands. But many believe the nation will become a net importer in the next half-century. Morocco has 52 percent of known unexploited reserves. "Whether it takes 10, 20 or 30 years, the bottom line is, entropy happens. And we can't reverse the depletion of nonrenewable phosphorus reserves."

It's hard to measure soil mineral weathering, the breakdown of rock to a form that plants can use, especially for phosphorus, because it's wrapped up in other elements and organic matter. But E. I. Newman at the University of Bristol has estimated that weathering delivers 0.05 to 1 kilogram per hectare, which roughly equals the same number of pounds per acre. The upper limit is 5 kilograms. An additional 0.07 to 1.7 kilograms might come from the atmosphere, for a total typically of 0.12 to 2.7 kilograms.

Newman says phosphorus balance for a typical modern British wheat farm looks like this: Coming in are 0.3 kilogram from weathering and 25 kilograms from fertilizer. Going out, by leaching and erosion, and in harvest and straw, is 22.9 kilograms. So it's "essentially hydroponics," Crews said. Modern farming takes out an order of magnitude more than the natural inputs from weathering.

Oliver Chadwick of the University of California at Santa Barbara and Peter Vitousek of Stanford University estimated phosphorus weathering in soils of different ages across the Hawaiian Islands. Soils along the southeast coast of the big island are only decades to millennia old. At the oldest end of the island chain on Kauai, the soil has aged for millions of years. At a site there, the phosphorus weathering is only 0.01 kilogram. But even at the young site phosphorus weathers only at 0.35 kilogram each year.

Meanwhile, north of The Land Institute in Kansas, a native prairie never fertilized but hayed each year for a century yielded cuttings with 7.58 kilograms of phosphorus per hectare in 2004 and 4.17 kilograms in 2006. An adjacent phosphorus-fertilized wheat field exported 11.9 and 8.65 kilograms. Where could all of this phosphorus in the hay come from? Maybe from weathering, maybe from the fallout of burned wheat stubble, or maybe from the gradual drawing down of phosphorus-rich soil organic matter.

If the prairie's impressive yields primarily come from the mining of soil organic matter, then someday they too might fall. But if the perennial vegetation is synchronized with soil and rock weathering, then high yields could persist for a very long time. For this to happen, weathering rates would have to be much higher than Newman or Chadwick and Vitousek have estimated.

Other examples of unusually high weathering exist.

Hopi farmers have grown corn with no fertilizers for centuries in a sandy Arizona soil devoid of organic matter. Crews estimates that a typical harvest exports 2.2 kilograms of phosphorus.

Another note for hope: Perennial prairie roots might induce weathering in ways that we don't understand.

But for most soils, it is likely that weathering won't keep up with modern crop demands for phosphorus or other rock-derived nutrients.

So, if we want to farm without importing them, we might need to use fallows, times when fields are rested from production. Fallows bank nutrients weathered over years, to be cashed in on over one or two growing seasons. Nutrients also can be concentrated by livestock management and floodwater deposits.

Building Toilets in Haiti

Sasha Kramer, a former fellow, first visited Haiti as a human rights observer in 2004, following overthrow of President Jean-Bertrand Aristide. She had read his book *Eyes of the Heart*. Kramer observed demonstrations, visited political prisoners and wrote articles. She moved to Haiti in 2006, and with the country under new democratic government, co-founded Sustainable Organic Integrated Livelihoods, a nonprofit group promoting integrated work on poverty, public health, agricultural productivity and environmental damage.

With a sister group run by Haitians, SOIL's main work has been promotion of composting toilets. Eighteen of these serve 2,000 people who had no toilets. The toilets not only

Bass player Carole Brown and graduate fellow Whitney Broussard during the graduate fellows' visit to the prairie vista shown in this story's opening picture. After a day of classes in Matfield Green, Kansas, the fellows made an informal field trip to open country east of town. Brown lives nearby. Some fellows stood before the players for talk and music. Others explored fauna and fossils on slopes below. Scott Bontz photo.

improve sanitation, they will make fertilizer. While industrial nations apply nitrogen fertilizer at 100 to 200 pounds per acre, Haitian fields get an average of about 1 pound. With human waste efficiently recycled, that rate could rise 15 times, to boost production and restore soil fertility.

At the workshop's "Prairie Howl" talent show at Matfield Green's bar and grill, The Hitchin' Post, $1,117 was raised to build another toilet in Haiti. It will serve about 100 students.

For more information about the program, see www.oursoil.org.

Breeding Perennial Sunflower

When their research for us ends, fellows report what they found. Brent Hulke, who is moving on to be a sunflower breeder for the U.S. Agriculture Department, gave this story:

Pioneering Soviet crop scientist Nikolai Vavilov made the first attempt to breed a perennial sunflower by crossing annual crop sunflower by a perennial relative, *Helianthus tuberosus*, popularly known as Jerusalem artichoke. The project was dropped because Stalin put Vavilov in prison, where he died of malnutrition.

Today, work to develop a perennial crop sunflower continues at The Land Institute and the University of Minnesota. The idea: "Plant the seed once, and harvest many times."

At Minnesota, Hulke collected *tuberosus* from the wild, and in 2003 began breeding it with annual sunflower. It has six sets of chromosomes, annual sunflower two. The offspring had four sets. Genetic material usually is stable with an even number of chromosome sets. And the hybrids were fertile.

But breeding these back to annuals to improve yield and seed characteristics got three chromosome sets, no male fertility, little female fertility and no perenniality. It was a dead end.

So Hulke doubled annual sunflower chromosomes to four sets by treating seedlings with a chemical called colchicine. Backcrosses to these plants made something closer in appearance to annuals, but with rhizomes, the underground stems that make *tuberosus* a perennial. These backcross hybrids also had four sets of chromosomes, which should make the plants fertile. Unfortunately, it didn't. Last summer, these backcross hybrids produced almost no seed. But eight plants, out of more than 1,000, proved perennial. This was the first time a backcross hybrid kept the perennial habit.

Now that more is known about these hybrids from trial and error, the next step is to plant plots and let them breed randomly to increase the likelihood of moving genes for perenniality near those from improved yield—a numbers game.

An advantage to working with perennials is that as long as they survive, you can go back and try again. "It's an insurance policy."

What Did You Get Out of All This?

We invite an outsider to the workshop to grade us and make suggestions. This year the evaluator was Berkeley professor Tad Patzek, and he wrapped up the weeklong meeting with questions for the fellows:

What is the message from this workshop? What is there to tell others? What is it we really care about?

One answer: That agriculture doesn't have to destroy the land. Another: That we're not crazy, that this is feasible.

Caterina Nerney, an entomologist and finishing fellow from Berkeley, said that there is much talk about approach to problems by crossing disciplines, but little action. She said that one place with movement—with the attending agronomists, ecologists, biologists and others—is the fellows workshop.

At compartmentalized universities, Patzek said, "We live in our little tunnels and we never get out of them."

Whitney Broussard, from Louisiana State University, said that encounters at other conferences are brief, but at the workshop they are intimate and allow time to work: "It starts my flywheel and gets me going."

Minnesota's Brent Hulke said he couldn't think of one class in his agronomy undergraduate education that taught him about ecology, and he guesses the converse is true. When he leaves the workshop, he's pained that plant breeding works against ecological principles.

Patzek asked the fellows for the workshop's high points.

Tiana DuPont, of the University of California at Davis, said the prairie. Broussard seconded her: "the sea of grass." Robin Mittenthal, of the University of Wisconsin, said country around his home is annual monocultures, and in the Flint Hills the land is more what natural systems agriculture would look like.

Stephen Bramwell, Washington State University, said that the talks were engaging, unlike those at agronomy seminars.

Jennifer Gardner, Cornell University, said another highlight was the gallery of root displays and *National Geographic* photographs, which she described as engaging the other side of her brain.

Nate Bard, University of Wisconsin, said that too often science restricts itself to logic. He said the institute attracted him because it doesn't shy from things like art and spirit.

Closing the workshop, Patzek said, "Now it's a downer—back to reality."

Organizer Jerry Glover added the good news: "And to lunch."

That was the last of thirteen home-style meals cooked for four dozen by a handful of Matfield Green women in a kitchen scarcely big enough for two to pass. In the adjoining gym-turned cafeteria, fellows gave a standing ovation.

We expect they'll come back for more.

Spring No. 1, by Jin Lee

Prairie Festival

September 28-30, 2007, at The Land Institute, Salina, Kansas

Celebrate and talk of land and country, at a place working to make farms like natural ecosystems, resilient and healthful.

Speakers: James Howard Kunstler, author of *The Long Emergency* and *Home from Nowhere.* Bruce Babbitt, former Interior secretary and Arizona governor. Fred Kirschenmann, organic farmer and fellow of the Leopold Center for Sustainable Agriculture. Steve Ells, founder of Chipotle restaurants. Kamyar Enshayan, director of the University of Northern Iowa Local Food Project. Wes Jackson, president of The Land Institute and author of *Altars of Unhewn Stone: Science and the Earth*. Our scientists, on their work to develop perennial grain crops. Nancy Jackson, leader of the institute's new Climate and Energy Project. **Plus:** Jin Lee photographs (sample above). Barn dance and bonfire. **Costs:** $18 for institute supporters. $24 for others. Less for one day. Students: $10. Saturday night supper: $12.50 extra. For more information, including a schedule: www.landinstitute.org or 785-823-5376.

The Next 49 Years

Wes Jackson

Expanded from the commencement address at Washington College, Chestertown, Maryland, May 20.

I was born in the midst of what was called the Great Depression. Nevertheless, it was a time of great hope. There had been depressions before in America, and knowing that, adults could imagine that the depression would end. And it did. World War II came and afterward the use of material goods and energy accelerated without interruption, to a level never seen. Unfortunately, this great success by "children of the depression" has made you "children of the depletion." Now reduced options, more than your initiative, could set the agenda.

I want to provide a perspective, not widely appreciated or acknowledged, that makes our time different than the 1930s. Back then we still had an abundance of five pools of energy-rich carbon. Let me go through that history to help us appreciate how unusual our time is. Civilization began 10,000-12,000 years ago with the tapping of soil carbon for agriculture. Then there was the forest carbon, which made possible the bronze and iron ages, and countless buildings. In 1750, coal burning started the industrial revolution. In 1859, Col. Drake drilled the first oil well, in western Pennsylvania. Natural gas extraction soon followed.

Also often overlooked is a discovery of 1909. Two Germans, Fritz Haber and Karl Bosch, developed a process we now use around the globe to turn atmospheric nitrogen into ammonia. Natural gas, the last of the five pools, serves as the main feedstock for this essential fertilizer. Without this process, according to Vaclav Smil, 40 percent of humanity would not be here now.

That reality needs to be tied to one other. Anyone who died by 1930 never saw a doubling of the human population.

And now, as a forecast: Anyone born after 2050 likely won't live with another doubling.

The human population that has tripled in one lifetime depends on these five carbon pools. But the world's leading petroleum geologists say humans have burned through half of the global supply of oil and natural gas, and the other half may be gone in as few as 30 years. There is a lot of coal in the world, but China is building a new coal-fired electric power plant a week. The state of the world does not look good: We have rapid climate change. Human population growth continues to follow an exponential curve, with 6.6 billion of us now. There are an estimated 27 million slaves in the world, more than at any other time in history.

Even considering only these things, we live in challenging times. But depletion comes in many forms:

■ One billion people lack access to fresh water.

■ The current rate of species extinction is being compared to the five known mass extinction waves. This sixth wave is caused by humans, not an asteroid, and according to the Millennium Ecosystem Assessment Report, agriculture is the largest threat to biodiversity.

■ Soil destruction now claims 24 million acres a year worldwide, about half the size of Kansas, a quarter the size of California, or 3.5 Marylands.

If this isn't bad enough to contemplate, the world has never been less secure:

■ Eight nations have nuclear weapons, and two more are known to be working to get them.

■ In January 2007, *The Bulletin of the Atomic Scientists* moved its doomsday clock two minutes closer to midnight, "reflecting global failures to solve the problems posed by nuclear weapons and the climate crisis."

Thinking that most of you are close to 22 years old, here's one more item for perspective: A 22-year-old has lived through 54 percent of all the oil ever burned. In my first 22 years, which ended 49 years ago, I had lived through 16 percent as much as you have.

So here you are, not only "children of the depletion," but also "children of the momentum," which makes you "children of the rapid depletion."

It is natural, around the age of 22 at graduation, to look out on the world with great expectation. So you will ask, "What do we do?"

"We are a clever species," you may think. "Look at the technological array around us. Surely we'll come up with something."

Your future will feature many discussions between optimists and pessimists. Let me provide a couple of examples from the energy problem.

The optimist may say, "We'll build nuclear power plants."

The pessimist asks, "What about the danger?"

The optimist says, "The estimated probability of an accident like Chernobyl, where people have to leave, is as low as only 1 in 10,000."

The pessimist says, "Yes, but what if we have a thousand reactors worldwide? That means on average an accident every 10 years. We currently have about 450 reactors worldwide, which means an accident every 22 years. We're on schedule. Will we be able to repeal Murphy's Law? And now we have terrorists who would

love to get their hands on the fuel. Some of them are smart too. And we still have a problem of where to bury the wastes."

The optimist says, "The Faustian bargain is worth it."

Another discussion:

The optimist says, "We can make ethanol and biodiesel from our farm crops."

The pessimist replies, "Twenty-six gallons of gasoline has the same number of calories that the average American eats in a year. Let's say that we don't eat for a year, and turn all that food into ethanol for our cars, trucks and airplanes, for the postal workers, the street crew, bulldozers, whatever. We'd each get about two gallons a month."

"Well," the optimist says, "we will harvest all the agricultural waste—cornstalks, wheat straw, peanut shells, grass clippings."

The pessimist says, "It is not waste, but OK, now we have an additional two gallons per month, for a total of four."

"Let's stop all exports."

"Now we're up to six. But we haven't eaten, we've robbed the soil of countless nutrients for next year's growth, and we have no money from food exports to help offset the balance of payment deficit for foreign oil."

The optimist says, "But we now have a global economy. We'll get our liquid fuel from other countries just like we get oil."

The pessimist does more figuring: "OK, let's assume we use the entire world's wheat, corn, rice and soybean crops, currently over two-thirds of human food calories. We will use that to make ethanol and biodiesel. How much of the U.S. gasoline and diesel demand will be met? Thirteen percent. No one in the world eats food from that acreage, just American vehicles."

These discussions are going on in thousands of places.

My worry is that we live in a world of technological fundamentalism more serious than any religious fundamentalism. During this era of unprecedented exploitation of energy-rich carbon, discussion almost invariably drifts to technology becoming more efficient, rather than consider that old, dull word, conservation. There is nothing wrong with being efficient, but it is worth remembering that in 1865, William Stanley Jevons published the results of an extensive study in a book called *The Coal Question.* His conclusion: As industrial England became more efficient, it used more resources, particularly coal and iron. This is called Jevons' Paradox.

The majority never thinks of itself as fanatic. And this fervent belief that technology will save us resides in high places. Hear what Thomas Friedman said in the April 15 *New York Times Magazine*, under the headline "The Power of Green." It was the cover story, mind you, and millions likely read it. I mention it as an exhibit:

Keeping Up on Us

Enjoyable visits and conversations are our first choice, but not always possible. When you want information that might not be in the current *Land Report,* or want a friend or colleague to know more about us, please consider our Web site, **www.landinstitute.org.** You will find a variety of changing materials and archives. Start in the left-column navigation bar:

Calendar shows where Land Institute staff members will speak around the country. The list is by date/town, with details available for who/when/where. Let us know if you have ideas for other connections our staff member might make while nearby. Also in the calendar are events such as our Prairie Festival, with a link to the program and registration form.

What's New archives the e-mail news *Scoop* we send to supporters and those who request the news. These articles provide current news and can identify most recent additions to the Web site. To get *Scoop*, e-mail us or use the "Sign Up" button in the left-column bar.

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Best of all would be for you attend our Prairie Festival September 28-30, 2007, so we can visit in person.

> Presidential candidates need to help Americans understand that green is not about cutting back. It's about creating a new cornucopia of abundance for the next generation by inventing a whole new industry. It's about getting our best brains out of hedge funds and into innovations that will not only give us the clean-power industrial assets to preserve our American dream but also give us the technologies that billions of others need to realize their own dreams without destroying the planet.

Well, we're not going to destroy the planet. Even large asteroids could not do that. But to say that "green is not about cutting back" and that there will be a "new cornucopia of abundance" is to not acknowledge the destruction imposed on the ecosphere by our excessive energy use to date. Climate change will be serious for *Homo sapiens*. Moreover, Friedman shows no recognition of the importance of the Haber-Bosch process and the nitrogen fertilizer necessary to feed us, no acknowledgement of Jevons' Paradox, no understanding of soils. It would be too complimentary to say that this is liberal, neoclassical economic establishment fundamentalism spoken by a well-placed representative to silence anyone who does not so worship at the altar of technology. Friedman's statement lacks even that low level of sophistication. It is Main Street boosterism, glandular optimism, green cornucopianism. It strikes me as a statement typical of a man late to this issue but now transfixed by happy talk.

In painting you this bleak picture, I hope you understand that I am honoring you as adults. By the current so-called standard of living, you will be the most unlucky generation in the history of humanity to date. You were born on the up slope of energy and economic growth, but much of your life is likely to be on the down slope in the use of nonrenewable energy.

But now, I'm the optimist. In a large sense, you have the potential to be the most fortunate generation. In this era of transformation you will have the opportunity to help shape a graceful down-powering.

The negative consequences of the industrial mind are all around us. Highways have cut through beautiful farms. Small towns have been bypassed. People who worked the land go to town to flip hamburgers or build tires at the local tire plant. Even though all the small towns cannot hold all the city people, the potential of family and community gardens, family and community canning, family and community butchering of chickens, turkeys, rabbits, even beef and hogs, is huge. We can begin to eat locally and live in community rather than spend so much time on the freeway.

Down-powering won't be easy. It will require sacrifice. You will hear, again and again, that transformative sacrifices aren't necessary. Those are the voices who care not a whit about reduced consumption. Bubbly optimists will be everywhere. Steel yourself with understanding of the numbers and remember that the entropy law, the second law of thermodynamics, will not be repealed. If you do, you'll see why more clever technology will have miniscule effect compared with conservation. Realize the Thomas Friedmans of the world won't be around to experience the consequences of reduced energy and climate change. Most will be dead, you won't. You will be going through the greatest and most important transition in human history.

One of our great modern poets, Gary Snyder, has a poem in his Pulitzer Prize-winning *Turtle Island.* It is the last one in his collection and was written probably in the 1960s or early 70s. It is titled *For the Children*.

> The rising hills, the slopes,
> of statistics
> lie before us.
> The steep climb
> of everything, going up,
> up, as we all
> go down.
>
> In the next century
> or the one beyond that,
> they say,
> are valleys, pastures,
> we can meet there in peace
> if we make it.
>
> To climb these coming crests
> one word to you, to
> you and your children:
>
> stay together
> learn the flowers
> go light

Hope is not optimism, which expects things to turn out well, but something rooted in the conviction that there is good worth working for. —Seamus Heaney

Prairie Festival Recordings

October 6-8, 2006, The Land Institute

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☐ S4 The Farmer as Conservationist? Busting Leopold's Myth and Moving On ■ *Laura Jackson*

☐ S5 We *Can* Save the Planet Earth, But Not Alone ■ *Frances Beinecke*

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Dear Young Iowan

John Price

From a collection, Letters to Young Iowan: Good Sense from the Good Folks of Iowa for Young People Everywhere.

Dear Young Iowan:
Please stay.
Or go away and return—the sooner the better. Migration is as native to this prairie land as settlement. Think of the seasons, the birds, the once grand motion of bison and elk. This place needs you, as it does them, to be sustained and restored. To heal.

I know what you're up against, because I was up against it, too. You look around and see corn and beans and rivers and sidewalks, which can be pleasant enough, but you long for more. More grandeur. More wildness. More free, unfenced space in which to explore and get lost and find faith. You sense, even if you don't know, what is missing: a diversity of life that once rivaled the Amazonian rainforests, the great prairies and savannas and wetlands. Less than one percent of these native habitats remain, the worst record in the union. Let's not even mention the polluted water. This is what they have left you of God's creation here. And they wonder why you want to leave—for a summer, for a lifetime.

I know what you're up against, because I was up against it, too. You have talent—intellectual, physical, spiritual—and you want it to be nurtured and appreciated. You want to be around others whose talents are nurtured and appreciated. One measure of that is the public celebration and support of cultural diversity—in the arts, in education, in business, in religious belief, in human expressions of love and community. You see this diversity elsewhere, in growing places, and you want more of it here. Another measure is money and how it is shared. You know that this is an immensely wealthy country, yet you are sitting in an overcrowded classroom, next to friends whose parents (or your own) are unemployed or working several jobs, in a town selling itself to corporate "benefactors" only to be abused and abandoned by them. It's not like this for everyone—it shouldn't be—and that's part of why you wince when people talk about the Heartland. Where's the Heart?

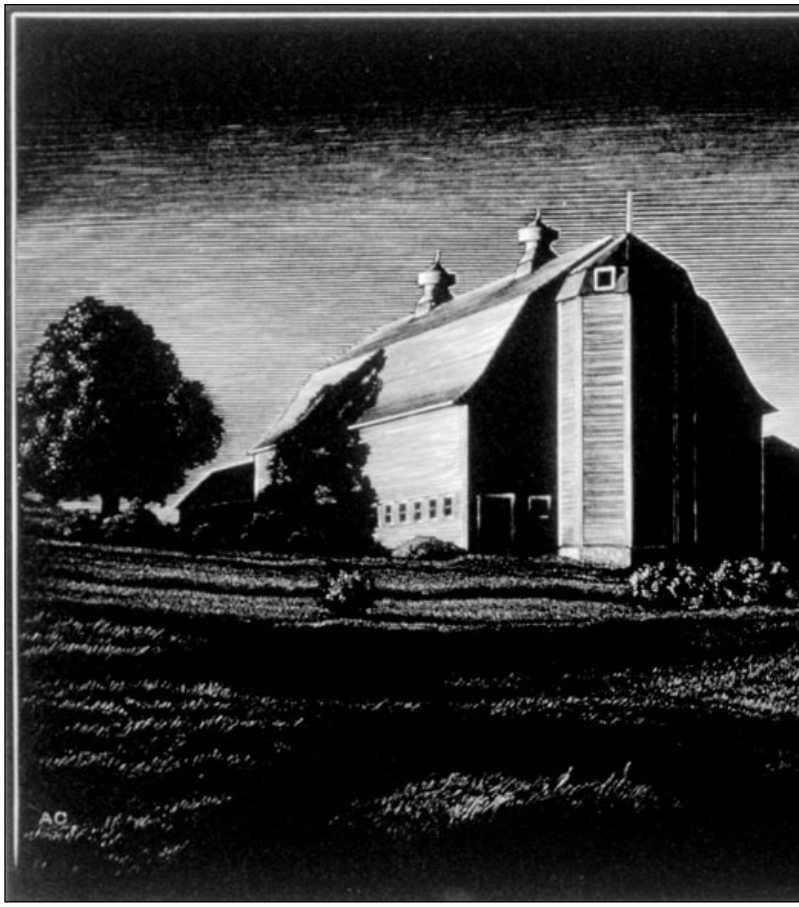
I know what you're up against, and I still hope you'll stay. I stayed and am grateful for it—this place is worthy of the best you and I have to offer. I do not say this out of self-importance (Iowans are, in general, a humble lot) but because I believe no place should take for granted the passion and talents of its people, young or old. By staying put, the place I once wanted to escape has taught me how to see the world in a new and better way, with a degree of hope I could've hardly discovered on my own. I still feel doubt and anger—as anyone does about their home—but Iowa has taught me not to rush off from any situation without taking at least a second, more careful look. Here are just a few of the results:

Where I once saw only fences and cropland, I now see native prairie plants hanging on in the margins and in miraculous prairie preserves. They need our protection.

Where I once saw a place empty of its native wildlife, I now see the trumpeter swans and the bison and the river otters and the mountain lions returning to home ground. They need our help.

Where I once only worried about polluted waters, I now see the heroic efforts of those working to heal them. They need our encouragement.

Where I once saw only dying rural and urban communities, I now see citizens working creatively to save those communities. My definition of community has broadened to include those not only joined by common civic boundar-



ies, but by a common vision. They need our imaginations.

Where I once wished for a place without intolerance and hate and economic injustice, I have learned to transform that longing into something tangible, through teaching and writing and raising children with moral consciences, even as I work to improve my own. Others are doing the same and we need your courage.

Where I once saw religious rigidity, I have come to understand the immense power of grace, an unearned love that can be applied to places as well as people. We need your faith.

So I know what you're up against, and I still hope you'll stay. Stay because of, and in spite of, what Iowa means to you: its brokenness and beauty, its peril and promise. You are an Iowan and that means you are willing to work when others have surrendered and fled. That is our heritage, and it is still used against us. Too often, we have lent our talents and vision to those who do not need or value them. Sometimes those people live elsewhere; sometimes they are our neighbors. That's how it will always be, but you are an Iowan and, whether you know it or not, you have learned to flourish inside conflict. Brokenness and beauty. Peril and promise. Iowa has always been a place where extremes have come together—in the sky, on the earth—and we who reside here will determine whether that coming together will ultimately be destructive or redemptive.

Stay because we need you, because this is your home and to have a home as good as this, despite its problems and imperfections, is no small thing in today's world. It is a privilege and an opportunity and, though I can't promise much, I can promise this: You will not be alone. You will be among family and friends and others, like me, who are strangers, but who are bound to you by the land we share and by the vow of all committed love: to be there, to try.

Where is the Heart in the Heartland? Beating inside your chest.

Break of Day, Vermont, by Asa Cheffetz. Wood engraving, 10 by 4.7 inches, circa 1944. From the collection of Steven Schmidt, courtesy of Spencer Museum of Art, University of Kansas.

The Environmentalist Within

Julene Bair

Environmentalists get a bad rap in farm country. Many farmers complain that environmental regulations interfere with their property rights and ability to feed a hungry world. To that end, these farmers want unfettered access to chemicals and genetically engineered seed. On the semi-arid High Plains, where I grew up, they also want all the water they can pump.

Yet only those who ignore science news can deny the human threat to every natural system on which life depends, be it climate, water, air or soil.

Carl Jung, who pioneered our understanding of the subconscious, wrote that when humans are unaware of their "inner contradictions, the world must perforce act out the conflict and be torn into opposite halves."

We externalize the side of us that we do not want to own. We look for scapegoats. Instead of getting upset about the possibility that humanity's present course could end civilization as we know it, we get angry with those who name the problems.

Environmentalists speak the other side of our own consciences. We vilify the messenger to drown the message. If we heeded the message, few of us would avoid implication.

I should know. If I wish to place blame for the most disturbing crisis on the High Plains, I need look no further than myself.

That crisis is depletion of the Ogallala Aquifer, the huge groundwater reserve underlying the Plains all the way from South Dakota to Texas. In some areas of western Kansas and northern Texas, the water usable for irrigation is already gone.

My family sold our Sherman County, Kansas, farm last year, but up until then, we were irrigators. Most of the water accumulated in the aquifer over 10,000 years ago. It took us only four decades to reduce the reserves under our irrigated fields by one-third. If the new owners keep pumping at the rate we did, drawing the water table down one foot per year on average, they can continue only approximately 60 more years.

In most years the 158 irrigation farmers in Sherman County, only one of several dozen High Plains counties where irrigation predominates, use more than half the amount of water consumed by the 1.12 million people served by Denver's main water utility. And for what? To grow a notoriously thirsty crop—corn—which is mainly used for livestock feed and ethanol.

If farmers continue pumping at current rates, they'll be forced to revert to dry-land agriculture and livestock grazing within decades. With encouragement from government farm policy, they could make that switch now. Then, limited primarily to domestic uses, the aquifer could continue supporting life on the High Plains for hundreds, if not thousands of years.

My father embraced irrigation's arrival, as did most of our neighbors. The water seemed limitless, and it removed one of the many wild cards that make farming such a gamble. Before and after he died, I complained about the waste. But he left other heirs as well, and not irrigating would have reduced our farm income by two-thirds. I found it very difficult to war against my family's financial interests.

Not only are farmers implicated in environmental problems. Many city dwellers water lush lawns in desert climates, spray those lawns with chemicals every time a dandelion appears, and buy unsustainably grown food that travels 1,500 fuel-consuming miles to reach the supermarket. They drive SUVs to work for companies that also waste resources and pollute.

Yet most of us would like a healthy environment and want our resources conserved. A 2005 Roper poll found that 90 percent of SUV owners want government to require higher fuel efficiency.

Fortunately, we still live in a democracy where we can choose lawmakers who will pass environmental protections. Only such government action can halt or reverse the damage we've done.

Instead of demonizing the environmentalists, we should vote for them. But making that choice in the voting booth requires that we acknowledge our own internal debates. Instead of dividing the world into "opposite halves," we would then begin to appreciate the unity of our self-interest and that of the general good.

We send Prairie Writers Circle essays to about 500 newspapers around the country. Other recent topics: how air pollution might bring famine to Asia, thinking about how our descendants will see us, annual cropping's bare earth policy, immigration reform, fuel economy standards and climate change. All of the essays are at www.landinstitute.org under Publications. They are free for use with credit to us.

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Thousands of tax-deductible gifts, from a few to thousands of dollars, are received each year from individuals and organizations to make our work possible. Our other source of revenue is earned income from interest and event fees, recently about 4 percent of total. Large and small gifts in aggregate make a difference. They also represent a constituency and help spread ideas as we work together toward greater ecological sustainability. Thank you, our perennial friends.

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The Writers and Artists

Lloyd Foltz, 1897-1990, was a native Kansan and charter member of Prairie Print Makers, a group of friends who aimed to further the interest of both artists and laymen in printmaking and collecting.

Steve Culman is a Land Institute graduate fellow at Cornell University. His ongoing research compares the diversity and community structure of soil bacteria in prairie with that of annual grain crops.

Dennis Dimick is an editor at *National Geographic*. He spoke about energy and climate change at our graduate fellows workshop.

John Price is a writer who teaches English at the University of Nebraska at Omaha and lives across the river in Council Bluff, Iowa. He is author of *Not Just Any Land: A Personal and Literary Journey into the American Grasslands*, and the upcoming *Man Killed by Pheasant (and Other Kinships)*.

Asa Cheffetz, 1897-1965, was an illustrator, engraver, etcher, and block printer who depicted rural scenes of the Northeast. He also designed the Library of Congress bookplate.

Julene Bair, from Longmont, Colorado, wrote *One Degree West* and is nearing completion of *The Whole Song*, a book on the Ogallala Aquifer.

Lee DeHaan is a Land Institute plant breeder whose rural home near a river gives close views of deer and dobsonflies.

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Have no fear: It's only an adult male dobsonfly, whose mandibles are good enough to grasp a female for mating, but lack leverage to inflict harm. He can't even eat. But both sexes can draw blood as bottom-dwelling larvae called hellgrammites—also toebiters. If fishers can avoid that, they like these largest of American aquatic insects for bait. This example was more than 4 inches long. Lee DeHaan photo.

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