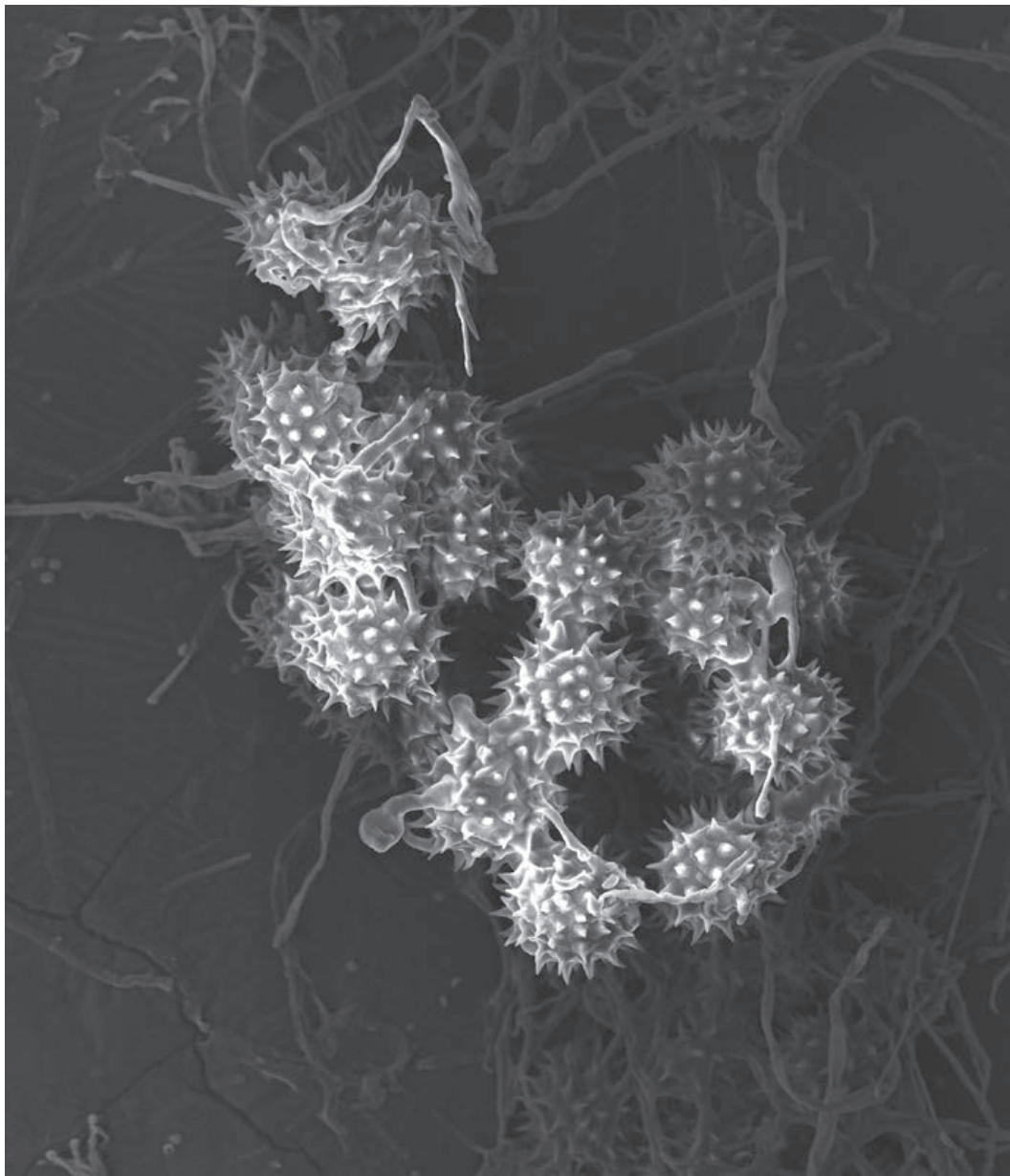


Land Report

Number 124, Summer 2019 · 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 mim-

ics 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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bontz@landinstitute.org, or the address or phone number below.

ELECTRONIC MEDIA

For e-mail news about The Land Institute, write to info@landinstitute.org, or call. Website: landinstitute.org.

SUPPORT

To help The Land Institute, see the contribution form on page 31, or go to landinstitute.org. Contributors receive the Land Report.

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Land Report

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4 Commonsense

Britain's enclosure acts concentrated power over land in private hands. Modern enclosure pushes further, to owning particular use of human genes and a few seconds pulled from a song. David Bollier finds this stifling. To make our lives socially richer while treating the world with more care, he advocates bottom-up reclamation of an arrangement called the commons.

14 Prairie Festival

The event, September 27-29, has the theme title "Carbon, Culture, and Change: From the Ground Up", and includes writer Bill McKibben.

16 Land Institute shorts

Kernza featured in a cereal. Kernza by collaboration. A global gathering around our mission. What silphium researchers can share. Perennial grains in Turkey and Russia. Never bored with insects. Employees win a seat on the Board of Directors. Other board changes. Angus Wright's history. Planting with a sense of sanctity. A plant breeder's path. A show of roots in Vail. A story from the BBC.

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Cover

Pollen of Silphium integrifolium, The Land Institute's perennial oilseed crop. Land Institute research resident Alexandra Griffin made the picture with a scanning electron microscope at Williams College in Massachusetts, where she studied biology. A beam of electrons bounces secondary electrons off of the specimen and onto an imaging screen. Electron wavelength

can be 100,000 times shorter than with photons of visible light, and this makes for much finer resolution. The pollen particles are about 30 micrometers, about the diameter of fine human hair. The electron microscope sharply reveal the pollen's spiny surface, which help it cling to insect pollinators.



A garden can be a commons. Land Institute employees share ground at a house for interns, and share responsibility for planning, tending, and harvesting it. A bumper kale yield was shared with others at work. From left: Madeline DuBois, Sydney Schiffner, Angela Brekalo, Alexandra Griffin, Anita Chase, Crystal Ma, and Piyush Labhsetwar. Scott Bontz photo.

Commonsense

Bottoms-up economics aims for a durable society that makes things to share

SCOTT BONTZ

Zaatari refugee camp's main street is called the Champs-Élysées. Here in the Jordanian desert you can buy flowers and ice cream, have pizza delivered, and find a barbershop, a pet store, and a travel agency with airport shuttle service. Zaatari's 14,000 homes went up in about a year, cobbled from tents, cinderblocks, and shipping containers. Some have courtyards. They are served by makeshift sewers, and toilets both private and portable. There are some 3,000 washing machines, more than that many businesses, and at least 150 gardens. Zaatari is 80,000 Syrians displaced by civil war who quickly turned a camp into a working city.

The place is still overseen by the United Nations and Jordan, which spends about \$870 million a year on refugees. Germany contributed a \$17.5 million solar power plant. And Zaatari has problems, including violence, as in any mass misfortune – or in any city.

But David Bollier sees in this story an example of the social, material, and spiritual answer to a destructive and inhumane economic and political system running amok around the world. Zaatari's fiber is a *commons*. "It is not simply a makeshift

survival camp where wretched populations queue up for food, administrators deliver services, and people are treated as helpless victims", Bollier and Silke Helfrich write in an upcoming book, "Free, Fair & Alive: The Insurgent Power of the Commons". "It is a place where refugees have been able to apply their own energies and imaginations in building the settlement. They have been able to take some responsibility for self-governance and owning their lives, earning a welcome measure of dignity".

A commons is something that no one owns and is shared by all. Actually, Bollier says, it's more social arrangement than property, more verb than noun. But it's not simply about "sharing", as happens in countless areas of life. It's about building durable social systems that make the things to share. He says this arrangement is more democratic, engaging, and enlivening than

the so-called free market, which is really state power and corporate capital joined at the hip, largely to entitle the few and control the rest.

Though Elinor Ostrom won a Nobel Prize in economics for upsetting conventional wisdom with her study and vindication of the commons, US political discussion avoids



David Bollier says vernacular governance by a commons can outperform official government. And he thinks it's more engaging and enjoyable.

the word. The idea of sharing material and intellectual wealth, and sharing responsibility for it, rather than seeing their reduction to commodities for trade and private accumulation, has been dismissed at least since Ronald Reagan and Margaret Thatcher – dismissed as suspicious or tragically misguided. That people could self-organize enriching, durable ways to manage resources seems utopian or impractical.

In eight books over two decades Bollier has argued otherwise. And although his voice was the one speaking for commons at The Land Institute's Prairie Festival in September, it's far from alone. "A rich community of commoners, both in the US and around the world, has given me a context for my work, ongoing collegiality, and support", said Bollier, who directs the Reinventing the Commons Program at the Schumacher Center for a New Economics.

Here is another illustration of commoning. In what's called community supported agriculture, you subscribe for food before it's grown, so farmers are guaranteed an income and not left to the caprices of the food economy, where demand is flat but supply suffers at the whim of weather. You also can meet farmers, see their fields, and in some deals pick the food yourself. There is a sense of interdependence, of community, that's impossible at a supermarket.

Also a commons is Wikipedia, the online encyclopedia that anyone may add to and edit. "Wiki" is from a Hawaiian word for "quick", and now means a way of making collaborative websites. The World Wide Web is a host infrastructure for all sorts of commons. For commons hardware there are Arduino's open source circuit boards – no copyright, no patent – with which you can build a computer. WikiHouse, begun by two young architects in London, publishes open

source house designs that can be modified for circumstance and thrown up without skilled labor at relatively low cost. Open Source Seed Initiative lets plant breeders designate their varieties as open source.

Wi-Fi service can be a commons. In 2004, when Internet access was scarce, engineer Ramon Roca adapted off-the-shelf routers, which distribute data in a network, on a line serving municipal governments in northeastern Spain's Catalonia. Though improvised, Guifi.net rapidly grew through crowdfunding from one node to more than 35,000. Its charter shows a commons philosophy: You have freedom to use the network as long as you don't harm it, the rights of others, or the principle of neutrality that allows free flow of information. You have the right to understand the network, and to share that knowledge. You have the right to offer services on your terms. You have the right to join the network, and then the obligation to extend these rights to anyone else. Bollier and Helfrich say Guifi.net provides better broadband service at a quarter to half the price typically paid for US service. They attribute this to mutualizing of costs and benefits in a commons.

Bollier's examples of commoning often involve computer technology or intellectual property, both modern developments. But commons must be as old as the first human tribes. Wolves essentially run small co-operatives, and ants sometimes grand ones. Commons were common into relatively recent Western history. Yeoman and tenant farmers shared management if not ownership of much of England, and cooperated in deciding what to grow and how. This way they could share ox teams and graze their stock in common on dormant crop ground. The animals also grazed land deemed unfit for cultivation, and farmers had common rights there to gather material such as fire-

wood. These kinds of commons and their antecedents worked for millennia.

As early as the 13th century, and greatly accelerating with agricultural innovation around the time of the American revolution and then the industrial revolution, English landowners consolidated the small farmers' complicated crop strips into large, homogenous fields and enclosed them. The bigger farms were arguably more efficient and brought higher yields for landowners. Then the owners, eager to build an export market for wool, put sheep on the marginal ground once used in common. Small farmers who were able to stay lost control, which was all they really had for their lives beyond subsistence crops. Most farmers had to leave. Especially with arrival of the fossil slavery supplied by coal, while Britain built a world empire these people migrated to cities, drove down the cost of their labor, and lived an uprooted poverty unknown on the farm. "The Great Transformation" is the title of Karl Polanyi's history of how this new "market society" changed the world. Jim Crace's "Harvest" is a novel about the enclosure.

Enclosure serves modern-day commoners as a general name for the continuing privatization of wealth. Enclosure takes what was managed in common as a whole, and makes it fungible, a moneymaker for one or a few deemed in legal control. Bollier called it victimization by the market. "This is really an act of radical dispossession", he said, exploitation reaching from crop ground and public places to the Internet's digital commons and our body's molecular code.

A century after the peak of hundreds of enclosure acts passed by the British Parliament, in 1968 American ecologist Garrett Hardin wrote for the journal *Science* an essay called "The Tragedy of the Commons".

That year Paul Ehrlich's book "The Population Bomb" forecast a world overwhelmed by humanity's sheer numbers. That end is what concerned Hardin. On his hypothetical shared pasture, a metaphor for commons in general, each herdsman will selfishly use as much of the common resource as possible. This inevitably leads to overuse and ruin. Hardin's solutions were to grant private property rights to the resource in question, or have the government administer it as public property or on a first-come, first-served basis. "The alternative of the commons is too horrifying to contemplate", he wrote. "Injustice is preferable to total ruin". The essay has appeared in more than 100 anthologies. Bollier said it is *Science*'s most cited article, and the phrase "tragedy of the commons" became a cultural buzzword of economists, social scientists, and politicians. What they and the phrase have done is promote and preserve what he called a "tidy, tenacious little smear" used for the celebration of capitalism and private property.

But what Hardin described is not a commons, it is a free-for-all, with no boundaries, no management rules, no punishment for overuse, no community of users. It's what some would call an "unmanaged common pool resource". Commons scholar Lewis Hyde elaborated, calling it "The Tragedy of Unmanaged, Laissez-Faire, Commons-Pool Resources with Easy Access for Non-Communicating, Self-Interested Individuals". In Simon Fairlie's essay "A Short History of Enclosure in Britain", E. P. Thompson says Hardin overlooks "that commoners were not without commonsense". Then anthropologist Arthur McEvoy is quoted: "English farmers met twice a year at manor court to plan production for the coming months. On those occasions they certainly would have exchanged information about the state of their lands and

sanctioned those who took more than their fair share from the common pool The shortcoming of the tragic myth of the commons is its strangely unidimensional picture of human nature. The farmers on Hardin's pasture do not seem to talk to one another. As individuals, they are alienated, rational, utility-maximizing automatons and little else. The sum total of their social life is the grim, Hobbesian struggle of each against all, and all together against the pasture in which they are trapped".

By 1991 Hardin admitted that his title **B**should've been "The Tragedy of the Unmanaged Commons". But a half-century after the essay, privatization prevails, in what Bollier calls a second major enclosure movement. The "code for control", as Hervé Le Crosnier put it in an essay for another book from Bollier and Helfrich, "The Wealth of the Commons", includes private use of public lands and waters, and extends property rights to brief music samples and the modern arrangement of lights on the old Eiffel Tower. There, unlicensed photos are OK in daylight, but not at night. A Science paper said one-fifth of the human genome is patented for use, mostly by companies and universities. Market and state share a vision of technological progress, corporate dominance, and ceaseless growth and consumption, Bollier said.

In his introductory book, "Think Like a Commoner", he says commoners see this pursuit as a mad utopian fantasy. Le Crosnier says it threatens commons themselves, as in pollution by fracking, distortion and propaganda on Wikipedia, and research fraud that erodes confidence in science. It also endangers communities of the commons, as when the 2010 explosion of the Blue Horizon oil platform imperiled shrimp production and economies on the Gulf of Mexico.

Modern enclosure can also prompt conflict within a community. Traditional knowledge about things such as medicine from a plant can freely circulate until nations and corporations push on indigenous people the alien concept of intellectual property, and the UN's World Intellectual Property Organization negotiates who it goes to. Then there are communal lands sold by village leaders to companies, speculators, and states. Le Crosnier says both acts stir "suspicions and internal wars, ultimately destroying the forms of solidarity that had been part of a community's way of life".

Finally, there are threats to commoning in a general sense. Le Crosnier sees this in US and Japanese patent offices limiting exchange of code and algorithms among software developers, in mass tourism jarring landscapes, and in universities and their researchers, often publicly funded, patenting their work for profit rather than sharing it with the world. (The Land Institute might secure rights to a perennial grain crop variety, but only to prevent its commandeering by someone else – the type will be shared as public domain. Pete Seeger and three others together did the same with "We Shall Overcome", a song already long-evolved through borrowing.)

Bollier takes this critique of copyright to the art world. Proponents who've staked intellectual property down to a few sampled seconds of music argue that it rewards artistic creativity. Bollier says jazz and hip-hop were *made* by borrowing, and artists have always taken from one another. As in the plant world, artistic creativity thrives on cross-pollination. All but one of his examples in "How to Think Like a Commoner" are moderns taking from writers who died centuries ago. When asked if all artists should, like the exceptional Woody Guthrie, be happy to share, Bollier said that being

an artist has never been a career as such. Fewer than 1 percent of artists get most of the money. “If you have to hire a lawyer to win your case”, he said, “it’s a hollow right won”. He sees today’s territoriality in art as stifling creativity. Turning the copyright argument around, he said, “Until the creation of Creative Commons licenses, there was no reliable legal way to protect sharing of works”. But markets and commons can play nice together. He said the fashion industry is robustly creative because although you can own a trademarked label, “You can’t own the herringbone suit”.

What commoning invites is “bottom-up, do-it-yourself styles of emancipation”, Bollier said. It is not top-down, centralized control. Grass-roots, democratic, and often kept local, it demands governance by a community. Its success depends on conscientious stewardship of a resource – though in an interview Bollier said, “I don’t like the word ‘resource’, because it denies that you have a connection to this thing”. He suggests “care wealth”. Commoners must be able to make flexible, evolving rules for management and punishment. They assign responsibilities and entitlements, and arrange how to catch free riders. The economist Ostrom said a constant challenge in a commons is how to organize and govern for the benefit of all, when all face temptations to free-ride, shirk, or act opportunistically. Just like in other economic systems.

“To be sure, finite resources can be overexploited, but that outcome is more associated with free markets than with commons”, Bollier writes with Helfrich. “It is no coincidence that our current period of history, in which capitalist markets and private property rights prevail in most places, has produced the sixth mass extinction in Earth’s history, an unprecedented loss of fer-

tile soil, disruptions in the hydrologic cycle, and a dangerously warming atmosphere”. He calls it the Tragedy of the Market.

Bollier is the son of a Presbyterian minister and a schoolteacher, and grew up in eastern Pennsylvania and southern California. His younger brother is head of facilities at Yale University. His late, older brother became a venture capitalist. The world of his youth was more parochial and less worldly than today, but also – “at least for a white, heteronormative boy like me”, he said – more stable, civil, and welcoming. “There was a sense of public order and progress, and government as a vehicle for social betterment. I was keenly aware of the social and political upheavals of the 1960s, especially the civil rights movement, through my father’s church and socially minded Protestant ministry. I knew at an early age, maybe 8 years old, when I got a hand-crank printing press as a present, that I wanted to become a writer or journalist”.

At Amherst College, in Massachusetts, his wide interests took him to literature, economics, sociology, and history under the heading of American Studies. As a junior he left for a year in France. Back home he interned with Ralph Nader, and after graduation in 1978 he returned to the activist lawyer. Nader pioneered critique of corporations taking from public lands, and much of his work was to fight privatization, though not in the current language of commoning. Bollier said this was a time when in one year a third of Harvard’s law school graduates applied to be part of “Nader’s Raiders”, who pushed the Clean Water Act, the Freedom of Information Act, and the Consumer Product Safety Act, among other landmark legislation. Nader had the ear of President Carter.

“Thus began my political education about many things that were then novel, but

have since become self-evident in American political life”, Bollier said. “How industry routinely thwarts life-saving regulation – airbags, chemical bans, etc. – because it interferes with the wisdom of the Invisible Hand. How certain types of knowledge simply don’t get produced or propagated by mainstream institutions because it indicts the system. How bottom-up social activism and solidarity are ultimately the only effective engines for deeper change”.

By the early 1990s, during Bill Clinton’s presidency, Bollier had concluded that neither Democratic Party nor mainstream politics could be catalytic. At that time also came his education by ascent of the World Wide Web and its informal commoning, and his discovery of Nobel winner Ostrom.

“It was long unanimously held among economists that natural resources that were collectively used by their users would be over-exploited and destroyed in the long-term”, the Nobel Prize website says. “Elinor Ostrom disproved this idea by conducting field studies on how people in small, local communities manage shared natural resources, such as pastures, fishing waters, and forests. She showed that when natural resources are jointly used by their users, in time, rules are established for how these are to be cared for and used in a way that is both economically and ecologically sustainable”.

For a quarter-century Bollier helped television writer and producer Norman Lear in public affairs. In 2001 he co-founded Public Knowledge, feeling that intellectual property law was prejudiced by industry influence against the sharing of knowledge and culture. He studied the rise of open source software, digital media, and the organization Creative Commons, and wrote “Viral Spiral: How the Commoners Built a Digital Republic of Their Own”. He

also wrote “Ready to Share: Fashion and Ownership of Creativity”, and “Brand Name Bullies: The Quest to Own and Control Culture”.

In 1996 Bollier moved to Amherst, Massachusetts, with his wife and two sons. “It’s a lovely small town with socially engaged and community-minded people”, he said. His employer, the Schumacher Center, in nearby Great Barrington, is named after E. F. Schumacher, author of “Small is Beautiful: A Study of Economics as if People Mattered”. Bollier collaborates internationally through the Commons Strategies Group, which he co-founded.

Bollier said the debate of private enterprise versus government is misleading. Largely overlooked is a non-market, non-state world, including nature and social life, whose value he thinks is illustrated by the Web. So conventional politics won’t bring change. At the Prairie Festival he talked of a war against human imagination, a backlash against progressivism and new ideas generally, instigated by Reagan and a neo-liberal political culture of lobbyists, think tanks, corporations, and the likes of the Koch brothers. Young people now leave college with debt that chokes dreams, and corporate media limit discussion of what’s acceptable. The “investor class” and political elites continue the enclosure of riches once shared.

A commons requires moving from that transactional worldview, reduced to terms of money, and instead making a world of relations: connection with, dependence on, and vulnerability to other people, honoring real-flesh faces more than portraits engraved in green. That makes commons richer in sense of commitment and in memories, Bollier said, and their social engagement makes for more satisfaction and fun. Commoning is social practices less like an

organization, which may become static, and more like a movement, which is dynamic. And he said that if a commons is based around a place, it can make the place more beloved, even sacred, in a way that the market cannot.

Relations, dependence, and vulnerability aren't likely to be embraced by individualists, neo-liberals, and self-made men. But Bollier said that being self-made is an illusion. We're far more embedded in the ecosphere than we realize, deluded by fossil energy and modernity. He doesn't expect this argument to win over libertarians. But he said climate change is starting to expose individualism's fallacies, and that the decline of coal and oil will bring people together with "convincing satisfactions".

Bollier thinks too few have too much, but he doesn't oppose private property as such, if it is accompanied by social obligations. He is as critical of state power as of the capitalism that goes with it. Property of the commons would be the aforementioned "care wealth". It's too early for him to draw a line between what should be common and what can remain private. But he said corporations regularly use the argument for private property to block new ideas. There are many ways to share wealth without resorting to statism, as shown by open source software, community land trusts, and wikis.

Commoning is less political or ideological to Bollier than it is vernacular, in the sense given by Ivan Illich in "Shadow Work": informal places where people assert their values and politics over those of the state, corporations, and other institutions. In such local life there is a sensibility and rootedness. This is how communities have been through most of history. There is danger of informal places developing odious attitudes and even criminal tendencies.

But a formal state will become tyrannical if it doesn't reflect peoples' evolving sentiments, Bollier said. And he acknowledges a role for state power. A state can set parameters, such as in enforcing civil rights, and otherwise give commons room to create and develop. He likes the idea of "emulate and federate".

But he doesn't see in state power much room for robust democratic control. There's too much distance between it and citizens, and too much rigid codification. He thinks many state systems, including liberal ones, are oppressively legalistic. Part of Donald Trump's popularity comes from people's legitimate concerns about belonging, household, and community under disruption by global markets and the likes of fracking. It may be legal, but it takes control of something close to people's lives. A commons gives and demands here-and-now democratic participation. It's quick to adapt. Its informal governance may outperform official government. "It's a cultural identity, a personal livelihood, a way of life", Bollier said.

The ethic of the commons boiled to one word distinguishing it from the market could be that of subsistence. Or sufficiency. Subsistence has been denigrated to mean mere survival, but Bollier said it's really about meeting needs of the household, *oikos*, the Greek root of both economy and ecology. When access to ubiquitous markets fuels the quest for wealth, he said, "Human wants start to drive it more than needs". A household of economy, of the commons, is not about satisfying wants and maximizing gains, but making sure that the family has enough. There are important needs still to be met in poor and developing countries. But we all face climate change. The new – or the renewed – benchmark for economic success, Bollier said, needs to be the ecologically minded household.



Detail from drawings made using powdered graphite and plant specimens from a prairie remnant at The Land Institute. The artist, institute research resident Rena Detrixhe, will show at the Prairie Festival.

Prairie Festival

“Carbon, Culture, and Change: From the Ground Up”

Bill McKibbin, a leading writer in the effort to stem climate change, will speak at The Land Institute’s Prairie Festival, to be held September 27-29. McKibbin’s 1989 book, *“The End of Nature”*, is regarded as the first about climate change for a general audience. He helped found the carbon-fighting organization 350.org. His book themes range widely: *“The Age of Missing Information”* compares watching a full day of programming on a cable service’s 93 channels with a day atop a remote mountain; *“Long Distance”* relates his training for endurance events; *“Hope, Human and Wild”* examines people living lightly. *“Deep Economy”* and *“Eaarth”* were best-sellers.

Another festival speaker will be M. Francesca Cotrufo, a soil ecologist exploring how soil can absorb more carbon. She grew up in Naples, Italy, earned her PhD at Lancaster University in Great Britain, and now works at Colorado State University. She also studies the dynamics of soil organic matter, which is crucial to plant growth.

Carolyn Finney is a writer, speaker, and consultant aiming for environmental organizations and the media to recognize for policymaking those without privilege. She wrote *“Black Faces, White Places: Reimagining the Relationship of African Americans to the Great Outdoors”*, has appeared on MSNBC, written for *Outside*, and advised the National Park Service on relations with diverse communities.

Amory Lovins is a Harvard and Oxford dropout who went on to advise heads of state and corporations on energy, to write 30 books, and to lead the Rocky Mountain Institute’s pursuit of sustainability through efficiency. He coined the term soft energy path, whereby renewables like wind and solar power would replace fossil and nuclear fuels.

Ana Luz Porzecanski is a biologist who directs the Center for Biodiversity and Conservation at the American Museum of Natural History. She grew up in wildlife-rich rural Brazil, daughter of an agronomist and an architect, earned a biology degree from University of the Republic in Uruguay, and a PhD from Columbia University, studying birds in arid lands of South America as well as international environmental policy issues.

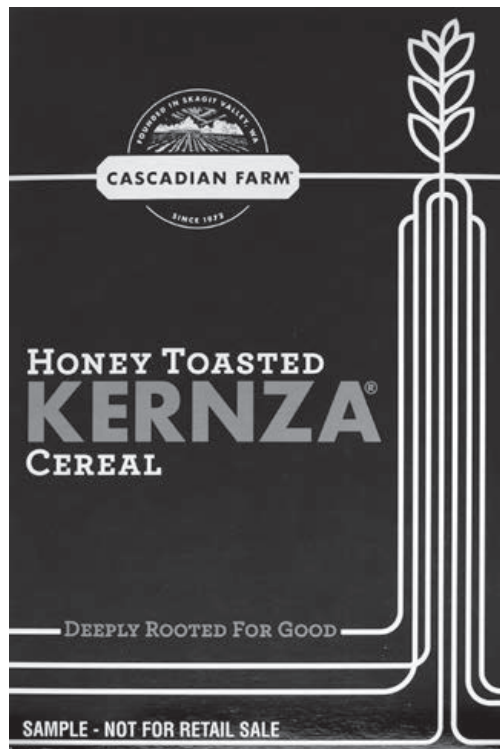
The festival artist this year is Land Institute research resident Rene Detrixhe, who looks at the relationship between humans and the “more-than-human” world. Saturday night music is by Eliza Gilkyson, a Texas songwriter nominated for Grammys and covered by Joan Baez and Rosanne Cash. The festival will open Friday night with a barn dance featuring the Land Band. Local singer-songwriter Ann Zimmerman will play Sunday morning. David Olson will lead yoga.

For more information, including directions and camping, go to our web site, landinstitute.org, and under About Us click Visit Us. Or call 785-823-5376.

Land Institute shorts

Kernza featured in a cereal

To benefit our research, General Mills subsidiary Cascadian Farm produced 6,000 boxes – more than 3,500 pounds – of Honey Toasted Kernza® Cereal, the first food from a large company to use one of our perennial grains. Kernza is the registered trademark for products from this crop, intermediate wheatgrass. The cereal isn't for supermarket shelves, but is shared with those who donate at least \$25 to "Deeply Rooted",



The first food from a large company to use one of The Land Institute's perennial grains.

Cascadian Farm's campaign "to create a national craving for climate-beneficial foods".

The cereal became available in April. By mid-July, contributions to receive a box were over \$25,000, and further giving to the campaign had passed \$20,000, Cascadian Farms spokeswoman Tammy Kimbler said. She expected the pilot cereal to be available through September, at deeplyrootedfor-good.com. The company plans to release the cereal commercially after enough wheatgrass acreage is certified as organic.

The graphic covering the back of the black cereal box says Kernza can protect water quality, stores carbon in deep roots, makes a home for wildlife, and supports healthy soil.

Kernza makes about 15 percent of the cereal. Other ingredients are rice, sugar, oats, molasses, honey, and sunflower oil. One cup provides 180 calories, 6 grams of protein, 43 grams of carbohydrate, and 22 percent of dietary fiber.

At Deeply Rooted's Web page is a video of food system discussion involving Land Institute President Fred Iutzi and environmentalist entrepreneur Paul Hawken.

Kernza collaboration

General Mills, the company behind the new cereal, and Patagonia Provisions, which developed a beer made with Kernza, had representatives among 115 attendees at the fourth annual conference for developing intermediate wheatgrass as a perennial grain. They joined researchers, farmers, and

policymakers from 11 states, mostly in the Midwest but also California and New York, and from Canada, Uruguay, Ukraine, and Sweden. The early July meeting was at the University of Wisconsin, home for researcher Valentin Picasso, a former Land Institute graduate school fellow. He arranged a day of wheatgrass plot tours and a day of reports and note-trading. Wisconsin's Driftless Brewing Company presented a Kernza beer, and Madison Sourdough baked Kernza scones, cookies, and hamburger buns.

Land Institute wheatgrass breeder Lee DeHaan was already fairly well abreast of progress with improving the crop, how to grow it, and how to sell it. But he said these face-to-face meetings are valuable for success of perennial grains. The Land Institute leads this work, and wants to expand collaboration around the world.

Global talk for perennials

For the international aspiration noted above, Lund University and The Land Institute brought to Sweden more than 90 people for a conference rhetorically titled: "Is the Future of Agriculture Perennial?" Attendees were from 16 nations on six continents, and included all but one of The Land Institute's lead researchers. (For a week our research building was a quiet place.) Seven attendees came from Yunnan University in China, and for the first time in Europe, there was served a meal of perennial rice.

Our research director, Tim Crews, came for a month-long research fellowship. Around Lund more than 50 acres are planted to intermediate wheatgrass, much of it grown with alfalfa or clover. This is Crews's focus, studying how legumes and other species can be intercropped with grains to reduce need for fertilizers and pesticides, and

perhaps to improve yields by how the plants occupy different niches in the soil.

Conference presentations and conversations were bookended by visits to the field. One trip was to the Högestad farm, which is in wheatgrass to make a beer for Patagonia Provisions. Next came a tour of wheatgrass and legumes planted in 2016, for interplay study intended to last decades. This was the Swedish Infrastructure for Ecosystem Science's Agroecological Field Experiment, which make the acronyms *SITES* and *SAFE*. Conferees also crossed Öresund, the Sound, to Denmark and the Deep Frontier project. This includes 14-foot-tall towers with windows that allow study of the usually subterranean workings – soil microbes, nutrients, and water use – of Land Institute wheatgrass and silphium. Also, cameras are sent 5 meters down clear plastic tubes among roots in the field. The project is run by the universities of Copenhagen and Aarhus, and the International Center for Research in Organic Food Systems.

Inside settings for the conference were at the university's Pufendorf Institute for Advanced Studies. Pufendorf pushes collaboration across Lund's disciplines – not just among the sciences and medicine, but also the humanities. Sculptures of the human form grace Pufendorf's building. At the first international conference for perennial grains, arranged by The Land Institute five years ago in Estes Park, Colorado, sorghum breeders met mostly with other sorghum breeders, soil nitrogen researchers with their like, etc. Since 2014 there have been annual meetings for the separate domains, like the wheatgrass assembly described above. Lund was the first conference more about stirring the perennial grains pot together.

Ten conference presentations are on YouTube. Search for "is the future of agriculture perennial Lund".



A perennial grains conference in Sweden drew from Argentina, Turkey, Germany, France, Denmark, Canada, Kenya, China, Uganda, United States. Photo from Lund University Center for Sustainability Studies.



Australia, Mexico, Mali, Israel, and Palestine as well as Sweden and the

A sunflower connection

One example of the kind of stimulation enjoyed at conferences is how Lund reconnected Land Institute silphium breeder David Van Tassel and a German researcher named Christian Wever, who a couple of years ago visited The Land Institute on a Midwest road trip to collect a *Silphium* species called cup plant. Van Tassel said Wever had a remarkable ability to spot cup plants from a speeding car, even after they'd lost their tell-tale flowers. His broad sampling brought the first cup plant to Europe since one, isolated collection in the Great Lakes region two centuries ago. From that sample has come all of the cup plant in European botanical gardens and bioenergy development – that is, fermenting the crop to make methane. The latter field is Wever's, at the University of Bonn's Klein-Altendorf Campus. He wants to plumb the wild species' wide genetic diversity to make a better and bee-friendly fuel crop. Domesticated cup plant might supplant maize, which produces as much mass, but at heavy cost in soil disturbance.

Van Tassel is interested in a food oilseed crop, not in heating energy, and although he studied cup plant, the species he settled on is one with better seed production, *Silphium integrifolium*. Cup plant is its closest relative, and the two sunflower family species have the same number of chromosomes, which makes for relatively easy crossing. Cup plant has more disease resistance, which might be bred into silphium. A cup plant also is more likely to pollinate itself, rather than need pollen from another plant. That might make it easier to sequence genomes and speed breeding, which also could pay off for *S. integrifolium*. The benefit to Wever might be to increase cup plant's seed production. A crop's seed must be affordable and easy to plant, even if

the farmer won't be growing it for the seed.

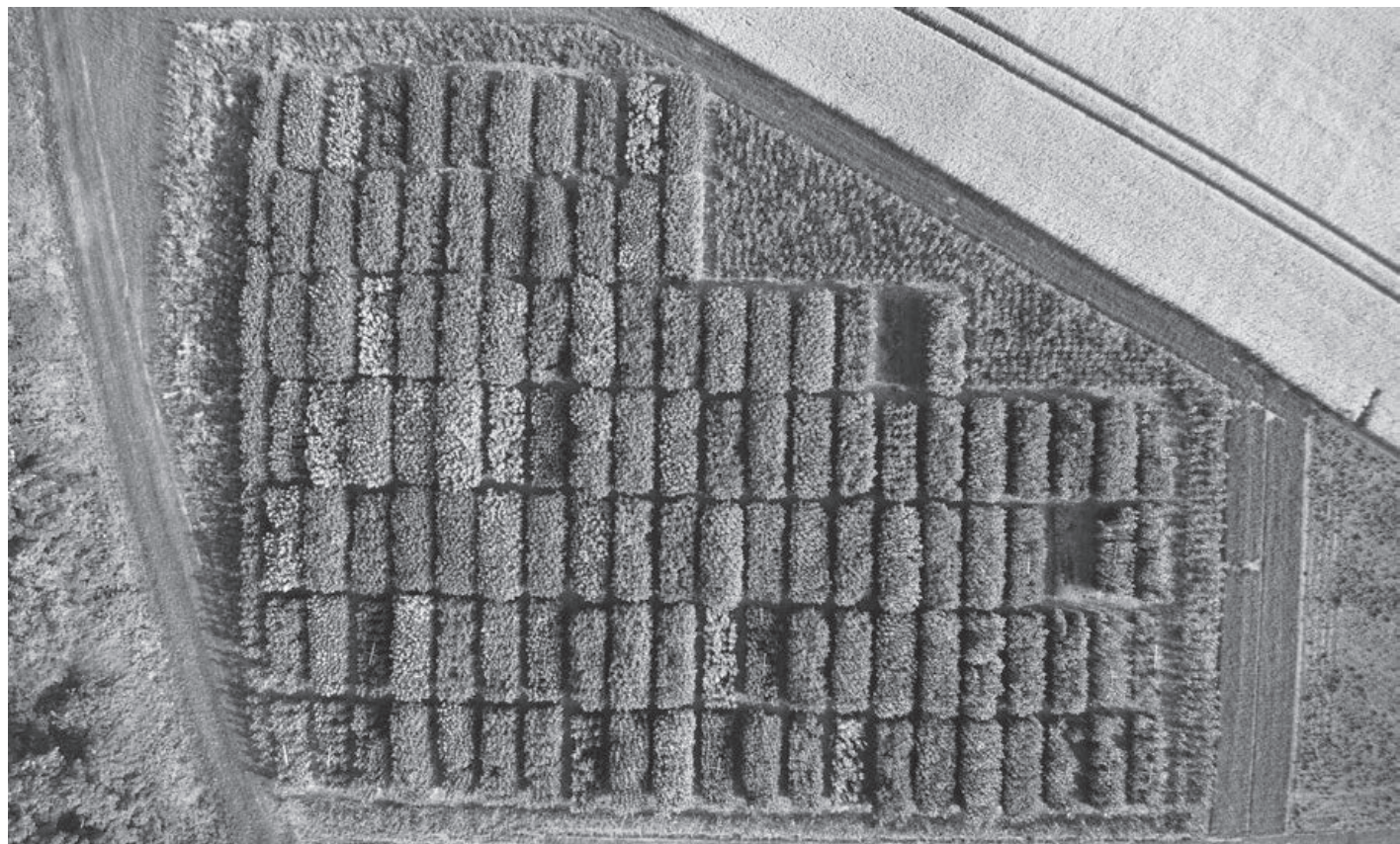
Perhaps, like in current study of intermediate wheatgrass, silphium could be grown both for food seed production and forage – livestock eating the greens. Forage cropping could be used during the longer breeding needed to make a wild plant into a seed crop. Silphium also might be promoted to foster pollinators and to diversify habitat.

A conference is not only good for producing such ideas, Van Tassel said, but for researchers' encouragement. Uncommon crops make for infrequent conversation

among the few people involved in this attempt to revolutionize agriculture. "That personal interaction is worth a lot", he said.

Perennials in Turkey, Russia

Talk with others breeding perennial grains also comes at home. On July 16, Alexey Morgounov visited The Land Institute before attending an international wheat conference in Saskatchewan. Morgounov, who grew up in Moscow, works in Turkey



German biofuel researcher Christian Wever's plots of cup plant from seed collected in the United States. The physical contrast reflects genetic diversity. Wever's cup plant breeding and The Land Institute's silphium breeding for an oilseed food crop might complement one another. The species are close, and can be crossed. Martin Höller photo.

as principal scientist of the International Winter Wheat Improvement Program. This is part of CIMMYT, a Spanish acronym for International Maize and Wheat Improvement Center, which began in Mexico and brought the Green Revolution. Morgounov first visited The Land Institute in 2015, and took back perennial wheat and intermediate wheatgrass seed to plant in Turkey and Russia. The wheatgrass survived lows of 20 degrees below zero Fahrenheit in the Omsk area of southwest Siberia. Farmers there were excited by the new crop, and a few received seed to plant. Morgounov plans to retire soon from CIMMYT, which he has served since 1991, and settle in Almaty, Kazakhstan. From there he'll seek collaboration to expand development of perennial grains in a vast region of wheat farming.

Know your enemy's nose

One swede midge, a fly about 2 millimeters long, can lay up to 100 eggs in a field of broccoli or cauliflower. The larvae hide in plant growing tips, vomit enzymes that rupture cells, and slurp the spilled nutrients. They can destroy a crop. To manage them, organic producers have only large crop rotations or netting that cost up to \$4,000 per acre per year. "Once they establish, you can't get rid of them", said Chase Stratton, The Land Institute's new post-doc for crop protection ecology.

Stratton earned his PhD at the University of Vermont by testing if midges could be repelled by odors from plants including cinnamon, oregano, rosemary, marjoram, thyme, coriander, and anise. From five to 50 different volatile compounds might emanate from one plant. About these scents a midge might feel attraction, repulsion, or meh. Stratton found that the odor

blend most similar to broccoli's is that of spearmint. To midges the distinction was not only clear, but also most repulsive. This makes sense because for a specialist like the midge, laying eggs on the wrong plant means dead offspring.

Stratton sorted things two ways. One was by using algorithms to break volatile compounds into data such as distance between atoms, and then measuring their similarity to host plant odors. This made a heat map, with data represented as color for thousands of little blocks in a chart of shifting hue. His other route was comparing genetic relations, which appeared as an evolutionary tree. Plants less related to broccoli tended to be more repellant. But the most repellant plants were the distant relations with the closer smell, such as spearmint.

Stratton spent months watching midges decide which way to go in a Y-shaped test tube with different odors at each end. Behavior varied. Some oils stressed midges enough that they flipped on their backs and flailed. Some odors had more consistent effects than others. Stratton also used an electroantennogram, which measures electrical current in antennae responding to stimulus. This confirmed for him that midges were actually smelling the odors. Finally there were trials in the field, including comparison of several broccoli varieties. In that test losses ran about 95 percent across the board.

But Stratton was able to conclude that some volatiles did repel midges, and that the most potent and practical of them were from garlic and eucalyptus lemon. Getting these results took applying 1 percent dilutions of the essential oils, which far exceeded the volatiles that come from simply planting garlic. Not just the quality, but the quantity of the odor seems to matter.

Still, losses remained high. More effective than volatiles have been nonionic

surfactants, already used to both disperse pesticides and improve water flow into soil. The surfactants might abrade leaves to release volatiles at a rate or kind unattractive to midges. More testing is needed. There's a long way to go in understanding and managing insect pests organically. That includes with plant oil volatiles, a new field. But in an hourlong explanation of his dissertation to his new co-workers, Stratton was opti-

mistic, even excited. He later said, "I can read a million papers on insects and never be bored".

Stratton found this calling after an undergraduate course on how plants and animals interact, at Virginia Commonwealth University, in Richmond, where he and his wife grew up. That combined with experience at an organic farm, where controlling pest beetles was confined to crushing them



Land Institute post-doc Chase Stratton fertilizes plantings for study of how mycorrhizal fungi in the roots of corn, annual sorghum, and perennial sorghum might help the crops repel insect pests. Scott Bontz photo.

between his fingers. He thought there must be a more efficient way. As a senior, for his first scientific field study he tilled his parents' back yard to make nine research plots. He tested how nearness of flowers to crops affected a wasp called *Cotesia glomerata* parasitizing another brassica pest, *Pieris rapae*.

Employees win seat on board

The Land Institute's directors voted unanimously to create a seat on the board for a representative of institute employees. The vote at a meeting May 21-22 followed discussion with representatives of The Employee Association at two board meetings since TEA requested the seat in fall of 2017. Institute President Fred Iutzi is a board member, but, as part of Land Institute management, is not a member of TEA. The employee association said the seat would help maintain "whole-workforce enthusiasm" as the institute grows. It cited employees serving on boards in Europe and at North American universities, and research supporting board diversity. Members told the board that they wanted to be collaborative, not adversarial. Iutzi, who before joining The Land Institute helped cooperatives in Illinois, supported the change. "I'm proud of us for doing this", he said at a staff meeting after the vote. Directors asked institute employees to make three nominations for them to consider, possibly at their September meeting.

More changes on the board

Jim Haines, Eric Gimon, and long-timer Angus Wright retired from The Land Institute Board of Directors, which elected two new members, Ruth Anne French-Hodson and Lennart Olsson. Haines, of Lawrence, Kansas, led Westar Energy,

and donated his home and land west of Lawrence to The Land Institute. He served on the board for three years. Seven-year member Gimon, of Berkeley, California, is educated as a physicist and works in energy policy for sustainability. He is a grandson of William Hewlett, co-founder of Hewlett-Packard. See more about Wright in the next story.

French-Hodson is a Yale-educated lawyer in Kansas City. She grew up in Partridge, Kansas, where her parents, Jim and Lisa French, have more than 1,000 acres in crops and cattle. Her father advised Kansas Rural Center and Oxfam, and her mother leads the Cheney Lake Watershed Project. As a child she attended Land Institute Prairie Festivals. She had wanted to write, turned off by the adversarial nature of lawyering, but was hooked by a class in constitutional law. She studied political science at the University of Kansas, with Donald Worster, an environmental historian and longtime institute board member, as her mentor.



French-Hodson

Before law school at Yale she earned master's and doctoral degrees in politics at the University of Oxford. This included study of how the government and private entities together made US Indian policy. Her work includes product liability, appeals,

international law, class action, and pro bono services. She has a personal interest in rural issues, especially in Kansas, and she and her husband recently bought land near Hutchinson that her family already rented to farm. Her brother is also an attorney, specializing in energy and public utility law.

Olsson, a geographer at Lund University in Sweden, is the first Land Institute board member from outside the United States. He learned of us in the early 1980s. “It was the radical ideas to fight land degradation which caught my interest”, he said in an e-mail interview. Olsson and other researchers from Sweden, Erik Steen Jensen and Anna Westerbergh, have collaborated with us since our first international perennial grains conference, in 2014. He won \$650,000 from the Swedish government to study how perennial grains, including our sorghum, could help farmers in Uganda. He also was key in organizing the perennial grains conference at Lund this year.

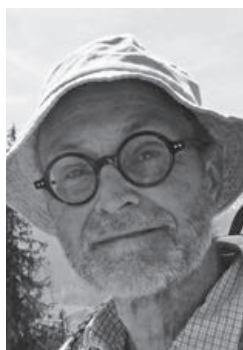
Olsson grew up as the youngest of three children in a small town about 20 miles from Lund.

Both parents taught at the local school, his father in biology and his mother in geography and social science.

Environmental issues were a passion. The family discussed Rachel Carson’s

“Silent Spring”. His mother complained about the crop dusters over his grandparents’ farm. In summer he helped there with the hay harvest and fished in a nearby lake, but was not allowed to eat the catch because of mercury from upriver pulp mills.

In school, he said, “I started with maths, but failed exams because I found it so boring and I didn’t know what to use it for. So I decided to study physics instead. In those days you didn’t apply in advance to university courses, you simply showed up at the introductory meeting. Unfortunately I overslept and missed the physics introduc-



Olsson

tory meeting. The introductory meeting of geoscience was in the afternoon – that is how it all started!”

He earned his PhD in physical geography, studying the spread of deserts and how people and nature mix in semiarid Africa. Olsson went on to found Lund’s Centre for Sustainability Studies. His research includes connecting humans, nature, and land degradation, and climate change, poverty, and food security.

History with Angus Wright

Angus Wright grew up in Salina, Kansas, where Wes Jackson later co-founded The Land Institute. But when Wright returned from dissertation work in Brazil, seeking a job, the biologist Jackson was at California State University in Sacramento, looking for someone with a broad social science background and an international outlook. Together they helped invent the field that became known as environmental studies.

At the universities of Kansas and Michigan, Wright had majored in history, with geography and economics. Influences included Charles Gibson, who Wright said “always looked to material conditions and environmental factors as key issues in society”. Wright also followed his parents in a love of nature and interest in nature-oriented Eastern religions. In an e-mail interview from Brazil, he said, “My parents were deeply marked by their experience in the Depression, including farming in Nebraska, and were strongly influenced by the New Deal discourse about soil erosion and environmental degradation as causes of economic distress. In college I became deeply interested in Latin America, where I saw in the history of agriculture many of the themes of the New Deal view of deforestation and soil

degradation working out in the context of large-scale monocrop export economies.

“As a teenager I usually called myself a pantheist, and I still am something of the sort. Throughout my travels in Latin America I was always awed by the beauty and variety of nature as well as by the complex relationship of humans to nature. At the same time, the war in Vietnam impressed me deeply and permanently with the capacity of governments, and in particular, the American government, to act in ways that systematically devastated nature and society. I remain in awe of nature, in terror of the human capacity for destruction, and in hope of the potential for creativity and good in human personality and society. That’s something like the essence of environmental studies”.



Wright

Wright wrote the books “To Inherit the Earth: The Landless Movement in the Struggle for a New Brazil” and “The Death of Ramon Gonzalez: The Modern Agricultural Dilemma”. He served as a Land Institute director for 26 years, including as board chairman for more than eight years. “Twenty-six years is a good long run”, he said. “I’m tired of flying. It’s time to make the board younger and more diverse. I loved being on the board and greatly treasure all that we helped to build and all the wonderful friendships that came out of the work”.

Wright is retired from the university but still in Sacramento, and still visiting Brazil and writing, including for a second edition of “Nature’s Matrix: Linking Agriculture, Conservation, and Food Security”, with Ivette Perfecto and John Vandermeer.

The ritual of planting

Taylor Keen, Creighton University’s business college instructor, friend of The Land Institute, and member of the Omaha tribe, visited on May 14 to lead planting of crops according to Native American ritual. The half-dozen species were annuals, but some were planted together, a common Native American practice, and one that goes with our aim to replace today’s vast monocultures with ecological polycultures. Keen wants to share how Native Americans relate to plants, and in turn to learn from Land Institute research. “We put hearts and minds together with good intention”, he said. “It’s going to take all of us to save the planet”.

The planting drew more than a dozen and a half Land Institute workers. Keen told them: Abandon your worries, forgive everyone, and consider the field sacred. “We do the work not for ourselves, but for all the souls to come”, he said. In tan shirt and pants, he removed his Land Institute cap. From a two-foot-long wooden box with three brass hinges he pulled and put over his left shoulder a dark blue robe with beads of white, lighter blue, and orange. He told a story of Wakonda, the great spirit, a genderless creative power. Then with a fan of large feathers, white tipped with black, he dipped into a bowl of water four times to cast drops north, east, south, and west.

He arranged the women in a line facing east. The men stood behind them. In each woman’s left hand – the hand closest to the heart – he placed a sage sprig. Each man received a bit of dry tobacco. Keen expressed gratitude for being able to see, to love, and even to feel pain. The group turned to face each cardinal direction, and at each he blew a shrill whistle. Then he dipped the feathers again before each woman, to touch both of her hands, and then, with a rippling sound

from the plumes, to fling droplets over her head. He invited participants to make their own prayers, and then give their plant offerings to the ground. Walking the two lines, he took both hands of each woman and thanked her, and then shook each man's right hand and thanked him.

Ceremony over, and photographs now permitted, he directed the planters to set seed for a tight wall of sunflower, and to put together corn and beans, with squash between, and to also sow okra and melons. Men were to dig and build the mounds, women to plant and water. Keen repeatedly talked of tilling as lightly as possible. They dug and planted a rectangle, and branching from its east side an inward spiral. While women poured from watering cans to start the seed, Keen followed and sang in Omaha.

Two months later, the squash plants were sprawling and showing fruit, scattered corn was about four feet tall, and a south wall of sunflower was head high.

The nonprofit that Keen founded to promote indigenous crops is Sacred Seed. At Creighton he teaches corporate strategy, entrepreneurship, strategic management.

A plant breeder's path

Behind Megan Gladbach's home while growing up in the Kansas City suburb of Shawnee were woods amounting to just a few acres. For Gladbach, her friends, and her cousins it held the adventure of an Amazon. When she was in high school a wealthy man bought the place, built a mansion that she could see through the trees in winter, and fenced it with iron. "He isolated this really special place to me", she said.

There were also camping trips. Friends went to Disneyland and Europe, but Gladbach's parents – an engineer turned





Native American Taylor Keen, sixth from right, led Land Institute workers in a mixed, ritual planting of six crops. Keen wants to share how Native Americans relate to plants, and in turn to learn from Land Institute research. Scott Bontz photo.

stay-at-home dad and then jack of many trades, and a computer scientist turned high school math teacher – took her and her younger brother roughing it. She didn't fully appreciate this. But she said, "Looking back, I'm really glad that's what we did instead". It furthered her love of the outdoors. She's not afraid of insects, and doesn't feel gross for lack of a shower.

Then came sitting in on an environmental studies class at Johnson County Community College. Gladbach had a scholarship, but had not found a life path. The class revealed to her the effect of climate change on places she loves, and the part she plays in the change. From there she fell in

love with botany and found the college's sustainable agriculture program, which included practicum courses with a market farm. That put her to work with plants she could eat. "I didn't know what a beet was before I started college", she said. (Her childhood diet was meat and potatoes. Now she's vegetarian.)

Gladbach was steered not by one defining moment, but a series. Included was learning that in dividing the human activities that contribute to climate change, and which define how we relate with nature, number one is agriculture. She doesn't like how use of the word "nature" separates us from it. But for lack of a better word, she



Sorghum technician Megan Gladbach staples bags over the heads of hybrid sorghum plants to control their pollen. She doesn't want the word "nature" to separate us from it, including in how we farm. Scott Bontz photo.

said she wants to redefine how we grow food and how we connect with nature.

From Johnson County she transferred to Prescott College in Arizona, for a major in environmental studies and sustainability, emphasizing agroecology, and minors in environmental education and cultural and regional studies. On a holiday trip home she toured The Land Institute. Her guide was an intern, and Research Director Tim Crew encouraged Gladbach to apply for an internship. She began last summer, after graduating from Prescott and camping in Kenya for two months to help the Maasai people create an English-Maa dictionary. And this year she became The Land Institute's technician for developing perennial sorghum.

Roots displayed in Vail

Perennials grown at The Land Institute are displayed at the Betty Ford Alpine Gardens in Vail, Colorado. The plants grew in tubes extending 10 feet underground. The plastic cylinders were pulled up and opened, and growth medium washed away to reveal the

plants' root mass. The Vail show is called "Exposed: The Secret Lives of Roots". Also displayed are National Geographic photographer Jim Richardson's pictures. Closing day is November 2. Named for the wife of President Ford, at 8,200 feet the site is touted as the highest botanical garden in the world. Its mission is "To deepen understanding and promote conservation of alpine plants and fragile mountain environments". Tim Crews, our research director, made a presentation at the garden.

Featured on the BBC

A BBC multimedia series called "Follow the Food" includes The Land Institute's work with perennial grains to arrest soil erosion by agriculture. President Fred Iutzi and Research Director Tim Crews speak in a video, beginning at about 17 minutes. Chief Strategy Officer Rachel Stroer contributes to an online article. Both features are on our website, landinstitute.org, under News & Events.

Thanks to our contributors

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