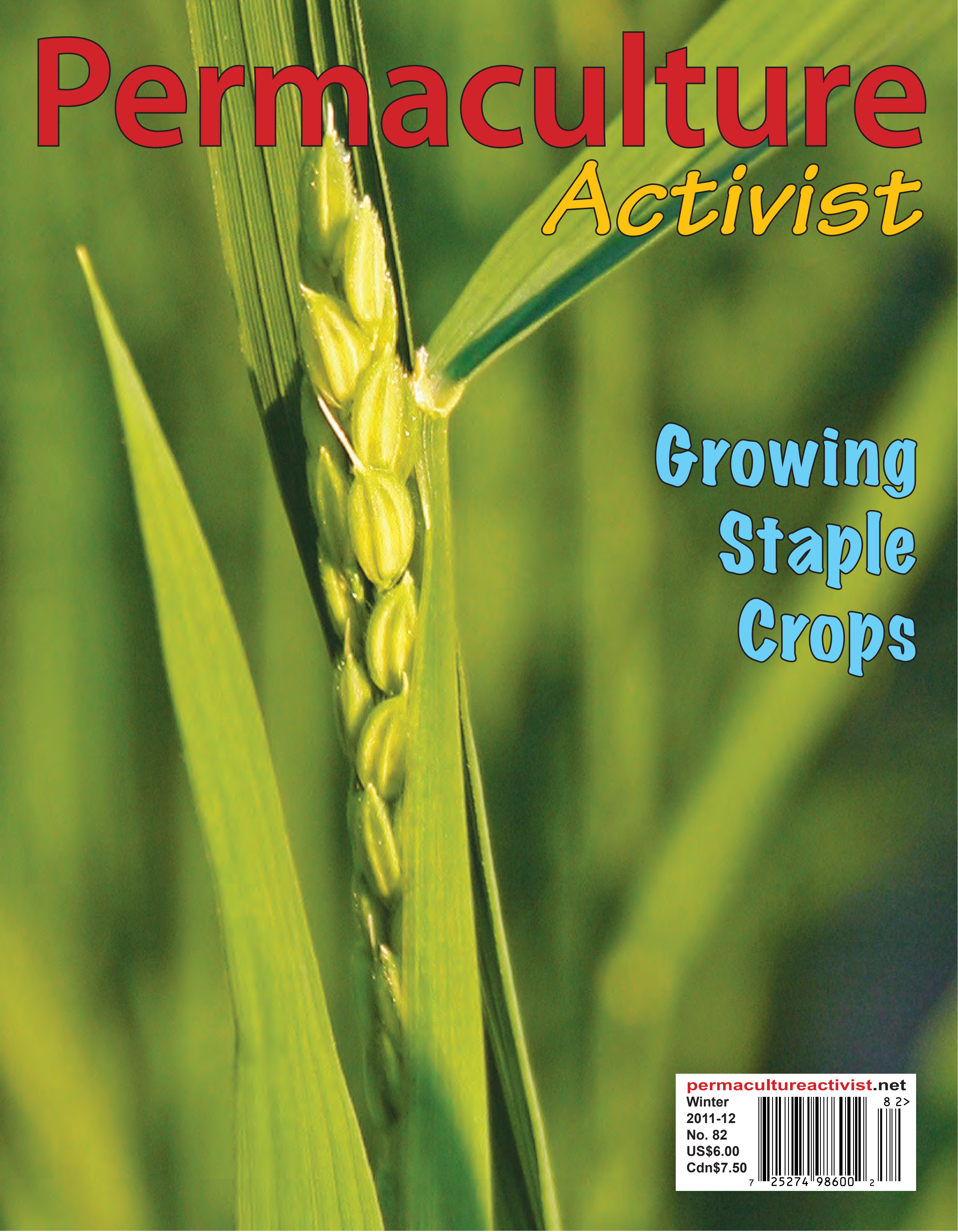
Permaculture Activist



Growing Staple Crops

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Permaculture Activist welcomes your articles, news items, photos, and other materials of interest. Please contact the Editor in advance of your submission to request writers guidelines and present your ideas. (editor@permacultureactivist.net)

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Permaculture is a holistic system of DESIGN, based on direct observation of nature, learning from traditional knowledge, and the findings of modern science. Embodying a philosophy of positive action and grassroots education, Permaculture aims to restructure society by returning control of resources for living: food, water, shelter, and the means of livelihood, to ordinary people in their communities, as the only antidote to centralized power. For 30 years Pc has combined top-down thinking with bottom-up action to make a world of difference in over 100 countries.
We are everywhere.

Editor's Edge

The Planetary Bakery

John Wages

LAST YEAR, I moved from Mississippi back to northern California. This required me to leave the farm where I grew up and where I spent the last ten years, continually astonished at the vigor of tiny amaranth seeds and the aerial agility of dragonflies, but also stymied by the tenacity of bermudagrass and the relentlessness of squash vine borers. Despite my failure to resurrect the farm, to make a dent in the conservative politics of the South, or to spark epiphanies in community college students, I'm glad for those ten years—not every lifetime includes the chance to go home again. I learned a lot about what to do and what not to do with farmed-out beeswax clay soil. While I was there, the shade tree I played under as a child (and where I tasted my first acorns, from the unapologetically bitter blackjack oak) met its demise during a thunderstorm—an apt metaphor for the decade. Such was my mind-state, about two weeks after the move, when Peter Bane e-mailed with an invitation to edit an issue of the *Activist,* whose theme was to be "Staples." Evidently, this grew out of a comment I made that I had grown some millet my last summer in Mississippi—he probably didn't realize it was about ten plants. What did I know about staples?

Without staples, my desk would be even more of a mess. As applied to food, staples provide the necessary major nutrients: proteins, carbohydrates, and fats or oils, in quantities sufficient to anchor a diet. The word staple comes from Middle English *stapel,* which means pillar, post, or foundation—a support. It's now clear: these two words aren't merely homonyms—they are actually the same word, with highly similar meanings. A staple food ties everything else together, as we build meals around it. Staples literally tie our bodies together, as the proteins of the rice and soy are digested, then reassembled into human proteins. As we assimilate nutrients, we literally become what we eat. As the basis of a cuisine, a staple joins together an entire culture: bread in Western countries, rice in Asia, corn in Mesoamerica.

Early in the planning process for this issue, we approached Ken Asmus of Oikos Tree Crops, but time did not permit him to write for this issue. Oikos offers many wild selections and improved varieties of nut and fruit trees, including some tantalizing selections of oaks with sweet acorns (for those who will want to grow some acorns after reading Kyle Keegan's article). This year's catalog introduces the hog peanut *(Amphicarpaea bracteata*), a perennial leguminous vine native to the Midwest. [Eric T., please add this to your list.] Also among this year's offerings are several productive groundnuts (*Apios americana*) and nine (9!) varieties of Jerusalem artichokes (sunchokes).

Has anyone tried using pigs to control rampant sunchokes? Sunchokes crowd out their own productivity by producing too many tubers. No matter how carefully I searched, I couldn't find all of them, resulting in smaller tubers each succeeding year. Only by starting a new bed could I grow good-sized sunchokes. After reading Bethann Wieck's article, I can imagine turning piglets loose in an over-run field to rejuvenate it. With so many new ideas crowded onto these pages, readers will be stimulated to try new crops and new planting strategies—not a coincidence that this issue comes to you just ahead of the garden planning season. Write us with the results of your experiments.

Over-reliance on a single (or several) staple foods opens us up to some risk. Before public health-mandated enrichment of flour and cornmeal, the rural poor in the South depended on cornbread. The lack of available niacin in corn led directly to an epidemic of pellagra. A now mostly forgotten disease, even in the South, its side effects included disfigurement from skin lesions and even death (niacin is a vitamin, after all). Its cause was unknown and variously thought to be an infectious agent or a toxic substance in corn, until the work of Joseph Goldberger and others. Similarly, beri-beri occurs due to over-reliance on white rice. Like pellagra, the cause of beri-beri was the subject of much research and even more conjecture, before the discovery of the first water-soluble vitamin, thiamine. The concept of staples is a much bigger one than I at first thought. If vitamins are essential substances, just as are carbohydrates and essential amino acids, then shouldn't currants and blueberries be considered staple foods? Where should we draw the line? Larry McAuliffe has a good point: many foods not usually thought of as staples are surprisingly rich in protein, carbohydrates, and oils. A diverse diet cures many ills.

Despite its deficits, the 21st century food system provides a wider variety of foods than ever before. In a few minutes, I'll walk down the street to a neighborhood market where I can buy at least five different varieties of potatoes and just about any vegetable and fruit, with a good-sized organic section. Blueberries from Chile, figs from Turkey, and Marcona almonds from Spain are just around the corner. The deeper reality is that the poor are not much better off. Diabetes, cancer, and hypertension are more common in the South today than pellagra ever was. As climate change and peak oil start to wreck havoc with our food supply, what will happen to them? As financial crises disrupt the global economy, how will the unemployed subsist? Let us remember that not everyone has access to land, not everyone sees our vision, and not everyone enjoys the support network that I and most of the PcA's readership do. Our role is to plant more than corn, wheat, beans, and hazelnuts—let's plant the seeds of a new system, where everyone has what they need not only to live, but also to thrive. Michelle Ajamian has something to say about this. So does Pablo Neruda. Δ

Hunger is a cold fire.
Let us sit down soon to eat
with all those who haven't eaten;
let us spread great tablecloths,
put salt in the lakes of the world,
set up planetary bakeries,
tables with strawberries in snow,
and a plate like the moon itself
from which we can all eat.

New Forest Farm

Growing Staple Foods in Permaculture

FOOD-BEARING, WOODY PERENNIALS have enormous potential to transform humanity's agricultural landscapes and bring on a Second Agricultural Revolution. In *PcA #56* (May 2005) [See also *PcA #40, 49*, and *50.*], I described the logic and methods used to establish a profitable permaculture farm based on tree crops.

Most permaculturists, along with the rest of humanity, depend on the carbohydrates, proteins, and oils produced on large-scale farms. Virtually all of our staple foods (corn, beans, rice, wheat, potatoes, etc.) are grown as annual crops. Their culture has led to the destruction of ecosystems through slashing, burning, tilling, and herbicide—these lay bare the soil into which the annual seeds are typically planted. After harvest, the soil often lies barren, vulnerable to erosion until the next season restores green cover.

How can we produce staple foods without destroying the ecosystems we depend on and without leaving deserts in our wake? Can we grow staple foods while RESTORING ecosystems and ecosystem functions? Can we do this on such a scale as to FEED the world? Can we actually INCREASE the world's food supply?

Clover sprouts back the next year vigorous and green, then we strip-till, clipping the top 2" of soil, to plant annuals.

His simple message fell into my mind like an acorn onto moist, fertile soil.

These are the challenges and questions that have motivated me for 15 years, since I first heard Bill Mollison in *The Global Gardener.* His message was simple. "Much of the design is taken from Nature," he said with an Australian accent nearly incomprehensible to my American ears. "The goal is to create systems that are ecologically sound and economically profitable. It can be as simple or as complicated as you like!" His simple message fell into my mind like an acorn onto moist, fertile soil. Growing staple food crops in permaculture systems has been my focus since then.

New Forest Farm, a 106-acre permaculture-designed farm in southwest Wisconsin, began in 1993 following a Permaculture Design course at the Central Rocky Mountain Permaculture Institute in Colorado. The three original founders formed a legal limited partnership on a sweaty napkin in the sauna after a long day of drinking from the permaculture fire-hose. The intention was to figure out how to grow staple food crops in permaculture systems instead of massive monocrops of grain, and to make money at it.

A model for the mainstream

Instead of following the market garden or CSA models, the founders designed the farm to prosper selling staple foods. From the beginning, we have sold farm products at wholesale prices rather than direct-to-the-consumer retail. Although this has resulted in lower farm-gate revenue, it has tapped into the mass market instead of niche markets. The farm's founders did not want our distinctive efforts to be dismissed as only applicable to market niches. With almost 20 years experience in broadscale agroforestry, New Forest Farm has proven that money does grow on trees. With climatically adapted species, our production system offers a viable model that can be adopted across the continent.

The main staple crops at New Forest Farm are chestnuts, hazelnuts, winter squash, small grains (wheat, barley, rye), and sunflowers. We grow a host of other edible, woody crops as well: pine nuts, walnuts, butternuts, apples, elderberries, currants, and more. It's easy to understand how chestnuts and hazelnuts grow, but the annual crops are a bit trickier. Rather than explain yet again that chestnuts grow on trees, and you harvest the nuts in the fall, and that hazelnuts grow on bushes, and you harvest them in late summer, I'll explain how we grow the annuals.

Annuals as a transition

We planted New Forest Farm on abandoned hay and crop land. Obviously, no revenue was coming from edible woody crops in the early years. We planted rows of woody crops, with annual cash crops in the lanes ("alleys") between tree rows, using the agroforestry technique known as alleycropping. At one time, we grew 12 acres of annual staple crops for sale—primarily winter squash. Not everybody realizes that winter squash and pumpkins are indeed staple foods. They store for long periods and provide an excellent source of carbohydrate calories. For example, there are approximately 204 calories in a pound of butternut squash—at 30,000 lbs. per acre, that's a LOT of food. We shipped picture-perfect squash to produce distributors in Chicago and Minneapolis.

For the past 16 growing seasons, we have used a reduced-tillage system that includes fairly long rotations, with small grains as a component. Timing of the steps is critical—the farmer has to pay attention to soil moisture, soil temperature, weed development, and the weather. When all goes smoothly, it is beautiful to behold, and it sets up future success. Missed timing, or being forced to work a field when the soil is too wet leads to troubles that can take a few years to iron out.

In order to grow annual crops, we plowed the production fields with a conventional moldboard plow; we have not turned the soil this way again since 1996. We followed this cultivation with a disk harrow, a practice we have continued. We mechanically transplant squash immediately after the field is disked, so the little squash plants get a head start on the weeds. We control weeds (well…OK—it's hardly control—it's more like preventing weeds from killing the crop!) with a manually operated wheel hoe and a 1949 Farmall C tractor pulling a cultivator plow. To reduce costs, we keep weed control to a minimum, grow squash seedlings outdoors instead of in a hoophouse, use soil in the seedling trays instead of an expensive potting mix, and use no insecticide sprays. Most information available on growing any kind of plant tells you what to DO. We strive to NOT DO! DO-ing costs money. Pesticide and fungicide sprays, whether chemical or organic, disrupt the ecological balance that we are establishing in the oak savanna mimic that is growing all around the annuals. Any squash that is less than market-perfect gets fed to the pigs—100% of the squash grown is used somehow.

Crop rotations build soil humus

In the fall, we harvest the squash, then sow a winter grain crop. After hand-sowing or seeding the grain with a broadcast spreader attached to the tractor, we disk the seed lightly into the soil.

In the springtime, when the soil is thawed but still firm and cold, we broadcast yellow-blossom sweet clover (*Melilotus officinalis*) into the young grain crop. Yellow sweet clover has an incredibly long taproot that goes halfway to Australia, and it fixes nitrogen for the crop that will follow it. Unlike red and white clovers, yellow sweet clover grows up to 8' tall and is covered with blossoms from 8" off the ground all the way to the top. We keep four or five beehives to take an additional harvest from the blossoms.

As the season progresses, the grain grows with the clover. Grain yields are reduced because of competition for light, water, and nutrients, but are still substantial. The grain is either harvested with a combine, which separates the straw from the seeds (clover and grain mixed), or cut and baled for use as combined animal feed and bedding. (No barns are used in winter for our livestock because they live in, around, and under their grain/strawbale pile. The winter bedding pack becomes the only compost we make.)

After harvesting the grain/clover late summer, we disk the field lightly to put the straw in good contact with the ground where it will feed the soil life as it decays in place. Rye and clover seed that spilled during harvesting operations mix with the straw/soil and sprout within a week for the winter's soil cover. The clover that escapes the disk harrow grows back vigorous and green, and overwinters to sprout again in its second year.

The following spring, we plant the field back to squash—strip-tilling the clover and planting squash in the bare soil between strips of clover. If non-crop plants (weeds!) show signs of dominating the clover/grain crop in the spring, instead of strip cropping, we will disk-harrow the entire field to disrupt the weeds, and plant squash into a bare surface with tons of organic matter mixed in with it. The two-year rotation then repeats itself

We strive to NOT DO! DO-ing costs money.

in the third and fourth years: squash followed by a winter grain, clover in the spring, grain/clover harvested in summer, then clover tilled in next spring to receive the squash.

This rotation incorporates a tremendous amount of organic matter into the soil. Winter rye produces 5-6,000 lbs./acre of dry organic matter above-ground and an equal or greater amount below-ground. Yellow sweet clover adds approximately 90 lbs./acre of nitrogen to the soil in one season. This rotation has turned hard, red clay into mellow, almost black soil within 15 years.

Heavy grain-stalk residues, yellow clover growing in strips, and the narrow fields of annuals lying between rows of trees limit

Clover and some of the volunteer grain has gone to seed; squash is packing on the pounds. Biggest weed problem is clover...aw shucks!

erosion. Some annual alleys are as narrow as 12’, while others, on the flattest ground, are 100’ wide. Tree polycultures between the alleys include chestnut/raspberry/mulberry/currant and various polycultures designed around standard-sized apples.

As our woody crops have matured, fewer and fewer acres of annuals have been grown. From a high of 12 acres of squash, we are now down to around three acres. A recent addition to the annual cropping system is several acres of sunflowers, which will be pressed for oil. After it is used to fry potato chips, the oil will fuel our vegetable oil-powered New Holland tractor.

At New Forest Farm, annual staple crops have been the economic driver to finance the establishment of the food-producing, woody crops that are the main focus of the farm. We have shown that, by using permaculture design and agroforestry practices, a run-down, highly erodible, corn-and-beans farm can be converted into a rich, diverse, staple food-producing ecosystem that is also a profitable farm. ∆

Mark Shepard is a 1985 graduate of Unity College in Maine. Trained in both mechanical engineering and ecology, Mark has developed and patented equipment and processes for the cultivation, harvesting, and processing of forest-derived agricultural products for human foods and biofuels production. Mark was certified as a Permaculture designer in 1993 and received his Diploma of Permaculture design from Bill Mollison. Mark’s knowledge and skills have been used since then in his landscape design business and now in his permaculture and agroforestry consulting business, Forest Agriculture Enterprises (www.forestag.com).

Badgersett Hazelnuts: Crops for the Future

Editorial Note:
These images from Badgersett Research Farm demonstrate the kind of polyculture Mark Shepard has been cultivating over the past two decades. Badgersett is a for-profit corporation experimenting with alternative staple crops—particularly hazelnuts. Please see a related article on bush hybrid hazel harvesting on page 63.

Looking up an aisle between a row of hybrid hickories (they are not ‘hicans’) and hazels, with a chicken tractor between the rows. The chickens in the foreground are grouped under a hickory that was coppiced in 2009. Hickories coppice well. We’re also pollarding to control canopy density and provide smallwood. Unfortunately, this interplanting arrangement hasn’t worked out very well. The hazels’ pH requirement is not compatible with the chestnuts’ pH needs. Also, the distance between rows is only 15’—for the first 15 years. Now that we’ve learned that the hazels cannot continue to produce a good nut crop under canopy, we’ll be removing the hazel row entirely—a lot of work, but leaving it there is more work by far. We think the hickories and hazels can be interplanted with careful attention to spacing. Photo contributed by Philip Rutter.

We have been experimenting with free-range poultry in the hybrid hazelnut aisles. The “chicken tractor” is moved every other day or so; a mixed flock of guineas and chickens is released every morning, and trained to go into the tractor at night, to prevent losses to owls, our most serious predator threat. Training is pretty easy; once trained, getting them in for the night takes about two minutes per tractor. We prefer to leave the tractor in place long enough to stunt the grass under it—as you can see in the foreground. It makes it easier for us to move around in the hazel row, making harvest easier; and makes it easier for owls to catch mice at night. The poultry eat far more grass than we expected; the fertility they add to the hazels is significant; we think they help control nut weevils in the hazels; and, according to our measurements, they help shift the soil pH in the right direction—as much as from 5.6 to 6.6 in one year. Our conclusion so far: we need more poultry. Note the vigor of these trees—the entire hazel row to the right was coppiced in 2003 and the row to the left, in 2010. Photo contributed by Philip Rutter.

The full circle of food

Tell Me Where You Get Your Bread

Michelle Ajamian & Brandon Jaeger

IN *PCA #75* (FEBRUARY 2010), we shared our story about building food security in southeast Ohio. The region already enjoys a robust local food scene with many small farms and food outlets sourcing from local growers. Our efforts center around production and processing infrastructures for high-nutrition bean, seed, and grain crops. These staples represent a large portion of calories and protein in a healthy diet and are vitally important to regional food security in the 21st century.

We began our venture by asking just how food-secure our locavore's paradise could be, if we didn't know the source of the bread, pasta, rice, beans, porridge, or pilaf that are the canvas for the brilliant colors and flavors of our fresh, local fruits, veggies, and animal products. A $5,800 grant from the USDA's SARE (Sustainable Agriculture Research and Education) program funded us to grow small test plots of high-nutrition grain, bean, and pseudo-cereal crops in 2008, and to take our first Permaculture Design Course. We were then led to start a network, the Appalachian Staple Foods Collaborative, to assess what's needed to build a regional staple-food system from field to plate. At the same time, thanks to our growing resonance with permaculture principles, we began to question how annual crops fit into a sustainable food system in a world of nutritious, but largely unused, perennial food sources. In 2010, we somewhat reluctantly took the charge from our advisory board to start a prototype facility and launched a business venture to coordinate chemical-free staple crop production by family farms in our region and to bridge the gap from farm to table by processing and marketing those crops.

It's been a swift journey from experimental grains production to processing beans and grains for a regional economy. Machinery to harvest, clean, and transport grains and beans are vital, but so is the invisible infrastructure to make the venture successful.

Raising the roof, raising the bar

Three years ago, we were trialing buckwheat, quinoa, millet, and amaranth in our own fields. A year later, we were persuading local farmers to try these and other nutritious crops. In 2010, we started Shagbark Seed & Mill Co. in a small room in Athens with a 10' drop ceiling. Between us we had little prior experience in food processing beyond home gardening and cooking for groups. This year, we're milling flour and cornmeal from spelt and organic heirloom corn and are cleaning, packing, and selling Black Turtle, Pinto, and Adzuki beans. To keep up with our long-term goals, we are upgrading to a more efficient operation in a new space with 20' to the rafters. With the help of mechanical engineers and good friends, we've built platforms rated to hold 20,000 lbs. of new equipment. The added height will allow us to use the free energy of gravity to move seed from the processing machines to the bagging room.

Our work is transitional, within a long view of the evolution of our system of food production.

Many things are looking up for the collaborative, and not only at the mill. We are partnering with local non-profits and low-income members of our community to grow and serve the high-nutrition foods we have found to be promising crops for the Midwest and Central Appalachian regions. Other businesses, including local bakeries, restaurants, pizzerias, and a tortilla factory, have begun to buy, use, and add value to our grains and beans. We are also working with a new start-up, the Wingnuttery, to test machinery and methods to crack shagbark hickory nuts—among the most flavorful of native foods. The aim is to bring this perennial staple to market. Importantly, we are increasing our collaborations with Amish and certified organic grain farmers who can grow and demonstrate these crops for the conventional farmers we hope to impact.

Indeed, we've discovered that farmers in our region have the knowledge and equipment to grow these crops. The missing link for winning our region's farmland back from the commodity crop system is the infrastructure, both visible and invisible, for processing crops and bringing them to market. The idea that we are wresting our farmland and farmers out of the hands of the corporate food system—a system hurtling toward a come-down from its generations-long greed-speed high—helps resolve our conflict about working with annual crops and with growers who, while they don't spray chemicals, till their soil and replant monocultures year after year.

Furthermore, many of us still rely a great deal on beans and grains for sustenance, even as we work on the ideal edge of food production (small commercial permaculture and forest gardens, etc). We've decided to build a forest garden on our farm and meet multi-generational annual bean and grain farms where they are, by building a regional market for the high-nutrition, non-GMO, chemical-free crops they can grow. That way, we have a much better chance at eventually transitioning that acreage and their land ethic to even more sustainable practices. In other words, we have come to see our work as transitional or intermediate, taking a long view of the evolution of our food system.

We aim to match scale to principles by focusing on regional infrastructure, food access, soil health, and democratized social entrepreneurship: all expressions of the permaculture ethics…

Still looking for polyculture

We've already begun to see evidence of this transition in adaptations that farmers are making in the face of rapidly changing conditions in the food-production sector. For example, we recently attended a meeting of the Ohio Ecological Food and Farm Association's (OEFFA) Grain Growers Chapter. Two stories that caused our ears to perk up at this meeting involved hints of permaculture. When we were invited to update the gathering about our work on "edible dry beans" (which is another way to say "beans other than soy"), one farmer was reminded of the time he was contracted to grow adzuki beans. He told the story of how volunteer adzuki bean plants emerged beneath his winter wheat the following spring, explaining that because adzuki beans are both very short and indeterminate, it's virtually impossible to avoid leaving a lot of seeds on the ground at harvest. The whole assembly joined him in laughter as he described combining (harvesting) the wheat just above the tops of the bean plants, and then getting an unplanned adzuki bean crop out of that field, before planting his winter cover. Another grower described an experiment he will be conducting this fall to avoid having to moldboard-plow his fields and leave them bare over the winter. The practice of using a moldboard-plow, which is regrettable both for the damage it causes to soil structure and for its cost in fuel, is still too common due to rains that often hinder soil preparation in the spring. The man explained that, by planting a mix of crimson

New equipment day at Shagbark Seed & Mill.

clover and oilseed radish in the fall he could avoid the moldboard. The clover would feed the soil, while the radish would increase soil tilth by sending its large and powerful root deep into the ground. Since radish dies in the winter, and the clover roots are not substantial enough to hinder light cultivation (not tilling, but simple agitation with a tined implement), the ground would be left covered but ready for spring planting.

We welcome and cherish these vignettes, because they encourage us when we feel doubtful. They also give us a sense of camaraderie among grain and bean farmers, when we might otherwise feel like a banana plant in a temperate forest, or a hippie finding herself sitting in First Class next to a head hunter for Fortune 500 companies (true story). Permaculture is everywhere. It's the way things go. It's successional.

Will there be spelt after the revolution?

In the spirit of ecosystem succession, we chose the name Shagbark to symbolize the future of sustainable, staple-food production. Rebuilding a regional-scale infrastructure is a big job after 60-plus years of entrenchment in the global system of chemical farming, long-distance markets, and low-nutrition varieties. Like the hickory, it will take several human generations to reach its fullness. The shagbark hickory tree, ubiquitous in all states east of the Mississippi, offers a large, flavorful, and nutritious perennial, staple seed crop. Yet, for all its promise, few people know that it was once an important element of the native diet. The global food system has distanced us from our food sources and has eroded awareness of the treasures at our feet—or in this case, just above our heads. Our name pays homage to the pre-colonial ecosystem of this land, and points to the future of agriculture: more diverse, more perennial, more aware of climate and soil.

Similarly, we have come to realize that the annual crops we grow and process have a rich history, worthy of explanation. For example, when we sell spelt at farmers' markets here in Ohio, where most of the US spelt crop is grown, new customers invariably ask us what this nutritional powerhouse is. Spelt was, at one time, an extremely important grain in the diet of people in America and in Europe. Industrial agriculture replaced it with modern wheat, because the hull of wheat comes free from the kernel as it is threshed from the plant. The hull of spelt holds on tight to the kernel, requiring an extra processing step. Like the shagbark hickory, it is a hard nut to crack. We insist on processing and promoting spelt, because of its superior flavor and nutrition, and its suitability to our climate.

A regional scale

Although the vision that these intermediate steps can move our food system toward sustainability has assuaged our discomfort about building a system around annual mono-crops, more conflicts and questions of a similar nature have emerged. These issues converge on the question of scale. Were we to follow the imperatives of a capitalist business culture, our mission would be to get as big as the market will bear, exploit natural resources with greater expediency than our competition, ship our products far and wide, and focus on those who can afford what we sell. Instead, we aim to match scale to principles by focusing on regional infrastructure, food access, soil health, and democratized social entrepreneurship, all expressions of the permaculture ethics: Earth Care, People Care, Fair Share.

Within the grain industry, our operation is analogous to the very small end of the microbrew continuum in the world of craft beers. We have recently begun calling ourselves a "micro-mill." Nonetheless, we are well beyond hand-powered harvesting, threshing, and winnowing—we are about to begin using a grain elevator to raise our beans and grains 22' into the air, allowing gravity to distribute them down through various mechanized process flows. We handle our beans and grains mostly in one-ton bags with a forklift. In one hour, our double-screen fanning mill can clean around 8,000 lbs. of beans or grain (1/2 to four acres of production), our de-hulling operation can de-hull and clean around 2,000 lb. of spelt (2/3 to one acre), and our stone flour mill can grind 350 lb. of spelt or 100 lb. of corn flour. It will take us a while to outgrow this machinery, yet this operation is tiny by modern standards.

Shagbark Seed & Mill Products

Spelt—As something like the "Great Aunt" of modern wheat, this grain still holds many of its ancient, wild traits, including more protein, fiber, and B vitamins, not to mention a richer, sweeter flavor. To top it off, Ohio has the ideal climate for growing great spelt.

Heirloom & Organic Corn—Heirloom varieties of corn contain the superior nutrition and flavor of their native ancestors, and farmers can replant their crop each year, instead of depending on seed companies. Our heirloom varieties have been passed down in our farmers' families for several generations. We also use certified organically grown corn from Ohio if we run out of heirloom corn, so that our customers always have the best tasting and most nutritious corn available.

Black Turtle Beans—Beans, beans, they're good for your heart—but that's not all! With more antioxidants, plenty of dietary fiber, and protein to regulate blood glucose levels, and a copious supply of heart-healthy magnesium and folate, it's no wonder Black Turtle Beans have been a staple of Central and South America for 7,000 years. Our beans are always from this year's harvest, and since they haven't been mechanically dried or stored on warehouse shelves for years, they cook more quickly, retain their vitality, and have a much fuller flavor than store-bought dry beans. Try them!

Pinto Beans—The "painted bean" is also very popular in Central American dishes, and we look forward to providing our customers with a variety given to us by the folks at Cayuga Pure Organics, near Ithaca, New York.

Adzuki Beans—Adzuki beans, tiny and red, are the second most popular bean in Asia, after soy, and they are commonly sprouted, cooked in soup, and used to make sweet pastes.

Our model must deliver food access to families of all socioeconomic classes.

Even as we scale up rapidly, we begin to see the nature of the larger problem. To impact today's unsustainable and unjust commodity food system we must provide food to families of all socioeconomic classes. Filling a boutique niche for well-educated hipsters with considerable disposable income is not enough. To meet our long-term goals, we must both build an infrastructure adequate to meet the dietary needs of a region's villages, towns, and cities, and deliver food at prices that ensure affordability. This is particularly important in regions like Appalachian Ohio, where economic hardship is persistent, and more than 60% of public school students are eligible for free or reduced-cost meals.

Good food for all

We are in the last quarter of a Wallace Center grant to develop market-driven solutions to healthy food access around the crops and products we sell. Despite the hopes and ambitions of our funder, there's not an easy fix for the injustices, inefficiencies, and inadequacies of the market food system. Fair share? We want to build an equitable food system, but how can those who aren't paid a living wage afford food that is grown, harvested, shipped, cleaned, milled, and packaged by people who are? The global system offers cheap filler—we won't call it food, because it's just not nutritious. Industrial food is produced through a series of injustices to the earth and its peoples. That system has kept millions of bellies full (too full sometimes), but has increased poverty and ill health worldwide, undermining farmers in the Third World who cannot compete with prices supported by U.S. government subsidies ($15.4 billion annually). To get healthy food into the bellies of everyone, we must address the elephant in the room: the disparity among the haves and the have-nots. Somehow, our mission must include the elimination of poverty.

Speaking of hard nuts to crack, ending poverty will take work on many fronts, including government policy, to reverse the decades-long trend favoring the concentration of economic power. Food production and processing are one of the most prominent examples of this trend, thanks to former Secretary of Agriculture Earl Butz's famous decree, "Get big or get out!" The past 20 years have seen a rise in the very small end of agriculture—small veggie farms on the fringe, feeding the most food-savvy and well-off. We know that innovative people across the country are creating regionally scaled production and manufacturing systems for fiber, fuel, housing, and machinery. We hope that among these, the new, "big-enough" agriculture will create the conditions for economic parity and robust regional economies.

Our intermediate solution is to use our Wallace grant to improve the efficiency of our operation, develop recipes, and provide good food choices where low-income people eat—school breakfast and lunch programs, summer meals programs, church meals, and community gardens. We also work with Youth Entrepreneurs from subsidized housing complexes to educate about selling and eating good food. As part of our effort to provide Good Food for All, we offer our lowest possible prices to schools, churches, and food pantries. We ask other local food businesses to do the same.

Good food—direct. Bags of Shabark Milled grains ready to feed the region.

Building for the future

Bigger machines and more crop-storage space not only enable us to lower prices to our customers, but put more farm acres to work in chemical-free production of superior grains and beans. We would have a hard time finding professional farmers willing to convert even the smallest of their fields if we were not able to purchase, process, and sell a substantial quantity of the crops supplied. Among our 2011 farmer-partners, we expect to process crop from 60-80 acres, up from last year's 25 acres.

Another outcome of this regional-scale approach is that a larger processing facility requires a larger market, and even though we intend to grow Shagbark so that it can fulfill the staple-food needs of our region, not everyone within the territory is prepared to switch to the regional system we envision. There are several barriers to this: lost cooking skills, unfamiliarity with the products, low brand awareness, limited physical access, and, despite our best efforts, cost.

We believe that as the supply of petroleum fuel declines, inevitable changes in the economy will make regional and localized manufacturing necessary. But to build that infrastructure now for the time when it will truly be needed, we depend on business strategies that will sustain our facility and ourselves in the interim.

Questions arise: How far from home should we market our products? How much effort should we put into the market in our own region, as opposed to delivering into already clamoring markets in adjacent regions? How can a principled business, which takes its role in the re-culturing of humanity very seriously, survive in the short run, while preparing to serve its community's needs in the long run? Perhaps most interestingly, can we design a model that allows us deliberately, if not gracefully, to ride the coming wave of re-localization of our economy by retreating from markets afar and assisting in a marketing analog of urban infill? Can we, in withdrawing toward our core region, also help others step into the supplier/processor role in the regions where we have opened markets?

We hope that we will have answers to these questions the next time we write. We do have the counsel of a few colleagues who are working on the same kind of venture elsewhere in the country, such as Cayuga Pure Organics and Farmer Ground, near Ithaca, New York, with whom we trade information, as well as equipment and seeds. In the meantime, we look forward to hearing our readers' thoughts, advice, and questions, and we seek ideas for collaboration in your region.

Here's to your staple-food security. Δ

Brandon Jaeger grew up in Levittown, Pennsylvania, literally a textbook example of suburban sprawl. He holds a BS in Regional Environmental Land Use Planning, has traveled across the continent on a bicycle, farming and learning about life, and is particularly interested in regional self-sufficiency and reculturing. Michelle Ajamian holds a BA in Appalachian Ethnography from Ohio University, has worked in social services, ecology, economic development, and agriculture for over 20 years. She has recently helped found the Athens Food Policy Council. The authors share a growing homestead and forest garden in Athens County, Ohio. In 2008, they formed the Appalachian Staple Foods Collaborative (http://asfc.weebly.com/), dedicated to building a replicable system for regional staple foods. Contact Brandon and Michelle at goodfooddirect@gmail.com.

Staple Crops without Tillage

Susana Lein

HIGH ON AN APPALACHIAN RIDGETOP, Salamander Springs Farm is not your typical broad-acre farm. A few acres of flat farmland with good soil would have cost as much as all 24 acres of this mostly forested "inaccessible hunting ground." Yet, since 2002, it has produced thousands of pounds of dry beans, corn, and other grains. The problem became the solution: with no topsoil, plowing would only have turned up more clay and shale, plus weed seeds. We had to find a way to regenerate the soil. There are no simple recipes for a transformation like this—only the permaculture principle of learning from nature's feedback.

In 1999, I determined that I would grow food to sustain a local community and would live from the food and resources of that place, not from a system that is dehumanizing the whole planet. After years in Guatemala, I was addicted to black beans and cornmeal—a wonderful complete protein diet. Popcorn has been a treasured part of my diet since childhood. Pintos are a common soup bean here in Kentucky. Wheat, and sometimes rye, are important winter cover crops on this farm, yielding food for people, for poultry, for the soil—and for clay-slip straw or light clay-straw building. (1) As a result, these have become our staples. I've also started growing hull-less oats and garbanzo beans, and plan to increase both. Lima beans and black-eyed peas diversify the larder each year. Buckwheat, grain amaranth, sunflowers, flax, sorghum, and quinoa are mostly used to feed poultry, pollinators, bees, and the soil, because their threshing and winnowing requires better equipment than I have.

Grains and dry beans are only one part of a sustained permaculture system that includes regionally adapted perennials and annuals. The orchard and food forest I planted a decade ago now bear abundant fruits and nuts from April through November. The majority of this land remains forested and provides mushrooms, ramps, fruits, greens, medicinals, firewood, venison, lumber, and pure spring water for the farm. We freeze, can, and solar dry tomatoes and other fruits, vegetables, and herbs. We also cold-store potatoes, onions, garlic, sweet potatoes, peanuts, pumpkin, and squash to provide a year-round food supply. Greens, carrots, and other root crops grow through the winter under low polytunnels. Chickens and ducks provide eggs and occasionally meat. We often barter food for services; neighbors provide meat and milk from which we make yogurt, butter, and cheese. Thankfully, I rarely see the inside of a supermarket. By working with plant succession and transitioning to a more perennial agriculture, we can sustain ourselves as we grow older with the land.

Masanobu Fukuoka's no-till rice farming made me resolve to start a rotation of wheat, then summer cover crops, and finally dry beans. Fukuoka said, "the earth cultivates itself." (2, 3) I've learned by experience what excellent cultivators earthworms are and how quickly they disappear when we till the soil. Their presence indicates—and requires—an extensive soil foodweb that creates soil fertility for us—if only we'll stop tilling and removing the plant materials that feed it! Several years ago at the annual Southeast Biodynamic Agriculture conference on Jeff Poppen's farm in Tennessee, microbiologist pioneer Dr. Elaine Ingham helped me to see and understand the importance of the soil foodweb. (4, 5) She showed me close-up the bacteria and mycorrhizal fungi in soil. I think of her when I see their white strands in compost and smell the sweetness of healthy soil teeming with life.

There are no simple recipes for transformation—only the permaculture principle of learning from nature's feedback.

In Part I of this article, I describe our dry bean field; Part II describes the Three Sisters cornfield (open-pollinated popcorn and heirloom meal corn, grown with heirloom green beans and pumpkins/squash). My story of a small, non-mechanized farm feeding a rural Kentucky community is only one of many positive responses to our food crisis. The Land Institute has been developing perennial grains in the heart of the former prairie. (6) The Appalachian Staple Foods Collaborative in Ohio has achieved funding to purchase shared

Beans sown while wheat was still standing, after which wheat straw (visible under bean seedlings at LEFT) was scythed to mulch the seed. With no rows, the beans provide a continuous cover. RIGHT: a 25' swath of black turtle beans. Buckwheat (with white flowers) separates black and pinto beans, which rotate annually—this swath of black beans will be buckwheat the following year.

processing equipment (See article by Michelle Ajamian and Brandon Jaeger in this issue.). Permaculture asks for a diversity of solutions at a diversity of scales; let each of us start by obtaining a yield, observing, and responding to what we learn.

Farm apprentices scythe rye and wheat: Dori Stone (2009) and Micah Wiles (2011). The tall rye cover crop forced us to experiment with planting beans into already scythed straw.

Part I - The Bean Field

What must not be done

> *Natural farming is a process of bringing your mind as closely in line as possible with the natural functioning of the environment... so you can instinctively understand what needs to be done—and what must not be done—to work in harmony with its processes.*
> —Masanobu Fukuoka

Masanobu Fukuoka's first principle was: "No plowing or turning of the soil, which alters the natural environment and promotes the growth of weeds... There is no need for man to do what roots, worms, and microorganisms do better." (7) Growing beans and grains became easier once I understood that.

It is tempting to fall back on what we know. Growing up on a farm where we disturbed the soil 6-7 times every year, I decided that running my neighbor's harrow "just to open the ground" for a no-till field (8) wouldn't be so bad, as long as the crop established itself right away. After all, how else would I get rid of those tenacious weeds, grasses, and briars? Never mind that the seeds of those weeds had for decades been falling onto the ground I was to "open up." Weeds are actually pioneer species designed to come to the rescue after events of callous destruction of the soil's food web!

Tillage is like bulldozing a home and cutting off the food supply.

Weeds to the rescue

This land had never been cultivated; the last time these weeds were called to duty was in the 1950s and 60s, when previous owners had run hogs after logging the hills. Hogs can do a lot of damage, and I imagine what little topsoil there may have been on this ridge was rutted out by them and washed away. Heavy spring rains in this area often wash away the soil of plowed fields before anything gets planted. Tilled soil with little organic matter soon compacts. It then cracks like a dinner plate as it dries out. Then it is tilled again to rid it of the weeds and compaction. In the summer, the lifeless dirt blows away.

I sowed the first bean field from a 5-gallon bucket in 25'-wide swaths across the field—as I still do—except it was on open ground rather than into scythed windrows of wheat straw. Having an ingrained belief that seeds needed to be covered, I raked the whole field to push the bean seeds into the soil! The beans came up fine—along with a proliferation of annual weeds like ragweed and foxtail. For two droughty years in a row, the dry beans gave a lackluster yield despite our best efforts to weed out the competition. When selecting the best bean plants for seed, I was happy if I found 12-14 pods per plant—these last few years, that's just an average plant's yield.

Crops on junk food

In time, I realized that in trying to eliminate the weeds and grasses covering the soil, I had destroyed the soil food web that the weeds were protecting. The beans started with an energetic flush of growth. Tillage mineralizes the soil, making quickly available all its nutrients—most of which leach from the soil or are lost to the air. But after the initial buzz, the beans weaken and can't compete with the more vigorous weeds. The natural soil nutrient can't be replicated with purchased organic fertilizers. Concentrated fertilizers tend to make the soil more acidic, while annual crops prefer a pH near neutral. If you were a plant, would you prefer food prepared by the living organisms of a sweet-smelling soil, or from trucked-in plastic bottles of smelly agricultural and fish-industry waste? The weakened crop becomes susceptible to the infestation *du jour* (e.g., Mexican bean beetles).

After a few years of no tillage, ragweed and foxtail are hardly found in the bean field. Dock, knotweed, and ironweed have a less-intrusive presence; they are working to break up the clay pan until more earthworms arrive and take over this work. I cut dock seedheads before they mature; both knotweed and ironweed are edible and medicinal, and I use their beautiful flowers in arrangements for the market. As Fukuoka well understood, plants, including "weeds," give back to the soil more than they take from it.

Working with nature

Our grain and bean production has evolved with seasonal conditions and in response to feedback from the ecosystem. There's no one best method. On a small scale (i.e., staple crops for a few families), the cardboard/layer-cake method I describe in Part II is a great way to begin to feed the soil. It's not practical for broad-acre production. Dry beans are legumes, a hardy pioneering family of plants able to fix nitrogen. As dicots with two cotyledons feeding each seedling, they're also quite capable of germinating on top of the ground and sticking their strong roots into the soil.

Wheat is my choice for a winter cover crop, because I use it for food, it grows well in this region, and it's not too tall to walk through as I'm sowing beans. After finding that vetch gets tangled in a scythe (causing much cursing in the field), I now mix the wheat (about 5:1) with crimson clover, an annual cool-season legume that can fix over 100 lb. of nitrogen per acre.

The first time I sowed beans into standing wheat straw was an act of faith. I walked the field using tall tobacco stakes as markers, sowing from both sides of each 25'-wide swath. When the beans poked through the scythed straw mulch to become a productive summer cover crop, I knew that Fukuoka was right. I sow as much bean seed at one time as I'll be able to scythe wheat straw onto the same day, so that I'm not walking on swollen and germinating beans the next day.

I separate plantings of pinto and black turtle beans by swaths of buckwheat and rotate these patches yearly. Buckwheat is an amazing cover crop for poor soils, as well as excellent bee and poultry food; it germinates within a couple of days of throwing seed on the ground, matures in 90 days, and self-sows to make a second crop while the beans are still maturing and drying in the field.

Another problem begged for a solution. Pinto beans have a more vining structure; they don't stand up straight in the field like black turtle beans. This becomes a problem in the fall, when some of their pods are lying on the ground absorbing moisture instead of drying. Seeing how this never occurred at the edge between pintos and buckwheat, I began sowing buckwheat with the pintos to help them stand up.

Dry beans are ready to harvest in August, and winter wheat is not planted until late September in Kentucky. Just before or as soon as a section of dry beans is harvested, I sow buckwheat into it. This forms a quick cover on the field. Winter wheat (or rye) and crimson clover are sown into the buckwheat before it is killed by frost. The bright green wheat field cheers one through the winter, even under snow, until it matures in the spring, when beans start the cycle again.

Taking inspiration from Fukuoka, I've sown daikon radishes with the wheat (or rye) for the past few years to improve soil structure. Their strong 15-20" roots penetrate the clay pan and decompose the following season. This leaves channels that allow water, air, organic matter, and the following crop's roots to penetrate the soil and increase microbial activity deeper down. Somewhere, I saw this called "biological drilling," a perfect description.

Responding to feedback

A severe drought in 2008 lasted well into the fall with conditions too dry for wheat to germinate well. The problem again became the solution. Rains began in earnest by early November, so I then sowed rye, which germinates in cold soil and is even more winter-hardy than wheat. I learned that rye is an excellent competitor for the weeds that had been prominent in the field during previous years. Rye, however, is almost six feet tall in May—too tall for someone 5'9" to walk through while sowing beans. You can't get even coverage! This problem invited new solutions to increase organic matter on the depleted land.

Weeds are pioneer species that come to the rescue after events of callous destruction of the soil's food web.

For the past few springs, we've scythed the rye or wheat straw and raked it into windrows about 25' apart, then spread it back over the field after sowing the beans, buckwheat, and other summer cover crops. This is more work than sowing into the standing wheat field and scything the wheat straw in place, but it has allowed us to spread a 150'-long windrow of compost across part of the field each season. A long-term investment to improve poor soil, the windrow provides about 1" of compost over a quarter acre of the field each spring. The pile stretches the length of the field and is made each fall from cornstalks, bean and squash vines, and horse manure with biodynamic preps. To save time last May, I had my neighbor mow the wheat with her riding mower, which cut it unevenly or just pushed it over, making it hard to rake. I had to cut some of it with a weed-eater and learned how much better it would've been to scythe it! Raking the straw into windrows has allowed me to cut weeds such as dock at soil level with a weed-eater to give the beans a head start.

Rye's ability to suppress weeds inspired me to seek similar

LEFT: Winter wheat grows through buckwheat/bean stubble on field; in foreground, horse manure is layered with cornstalks for windrow compost pile. RIGHT: Micah rakes compost from pile across section of field. The wheat was scythed first and raked into windrows 25' apart.

summer cover crops after I decided to fallow part of the bean field one year to allow more time for teaching and building. Sorghum-sudangrass suppresses weeds well, produces amazing amounts of biomass (it grows up to 8' tall), and the seed heads provide food for ducks and chickens. Into the sudan, I sowed Iron & Clay cowpeas, a summer legume that fixes up to 130 lb. of nitrogen per acre and also makes good poultry forage. I followed the peas with buckwheat, which my chickens love. At seed stage, I moved the chickens through that part of the field to enrich it with their phosphorus-laden manure; soil tests had shown it was lacking in the bean field. Beware, however! Chickens can become damaging tillers if not moved regularly. Plant a cover crop or mulch as soon as you move them!

Summer cover crops on fallowed part of field. LEFT: Sorghum grain heads add to chicken & duck feed. RIGHT: Chickens forage field of buckwheat and cowpeas to add fertility, especially needed phosphorus. Their next food supply is in background.

How not to till: feed the soil

I am no longer tempted to "open up" a field with cultivation of any kind. Tillage is like bulldozing a home and cutting off the food supply. Who could thrive in that kind of war-like situation? I've seen that plants germinate and grow stronger and healthier when sown on an accumulating layer of plant litter at the surface. Tilled ground quickly loses its artificial tilth. The decimated soil microbial life cannot provide balanced nutrients for healthy crops, and a diminished water-retention capacity induces plant stress. Soil water retention is critical for me, as irrigation of an acre-sized field is not possible from our limited storage of roof catchment and spring water.

Instead of tilling, I'd start a field with weed-suppressing cover crops, then scythe or mow the field close to the ground. While it might be unnecessary on better farmland, the addition of organic matter and plant-residue mulches has sped up the soil's rebuilding process at Salamander Springs. With what I'd have paid to till the ground, I invested in gifts to spread on the field after seeding. Large round bales of old hay sit on many fields around here—they're usually available for the asking. I unroll them downhill from the top side of my field. It's a one-time investment, like building a house—gratifying when the work is done.

The soil food web

Echoing Fukuoka, the research of soil microbiologist Dr. Elaine Ingham demonstrates that a living soil cultivates and fertilizes itself far better than we can. Mycorrhizal fungi form a symbiotic relationship with plant roots, helping them take up soil nutrients they cannot otherwise access—sometimes many feet away from a plant's roots! We can see evidence of fungal presence by the fine white filaments (mycelium) that look like root hairs in humus or good compost—or their mushrooms (fruiting bodies) coming up here and there. Organic matter from plant residues creates soil tilth and pore space needed for seed germination, and it holds and stores water and nutrients for the microorganisms. Bacteria and mycorrhizal fungi decompose organic matter into plant-available nutrients. In turn, they're eaten by protozoa and beneficial nematodes who conveniently deposit excess nitrogen and other nutrients in the plant's root zone! The food chain continues, and the presence of the more visible members of the soil food web—such as arthropods (the plant shredders) and earthworms (the tillers)—is a sign of healthy soil. These visible workers need the whole microscopic crew in order to prosper.

Earthworms mix organic matter with the native soil more efficiently than mechanized tillage. Their bacterially-dominated castings are 50% higher in nutrients than plain compost. Bacterially-dominated organic matter brings soil pH closer to 6.8, allowing annual crops better access to nutrients. For this reason, I mulch annual crops mostly with plant material from annual crops and use wood chips around perennials like fruit and nut trees (which prefer a fungally-dominated soil). Healthy agricultural soils have fungi as well, but fungi don't dominate, as they do in a forest.

Bacterial and fungal (mycorrhizal) inoculants have recently become a popular way to try to remediate the disastrous effects of soil tillage on soil and plant health. These amazing microscopic workers can help reestablish a food web in the soil, but will not thrive unless there is NO tillage and a sufficient, sustained level of plant material and living plant roots to support them.

We can regenerate depleted soils on a practical timescale, with the help of the soil food web.

Soil transformation & crop productivity

The dry bean/wheat field at Salamander Springs started at an acidic pH of 4.8 and was measured last year at 5.3. Had I tested only the top inch, it would likely have been higher. Over time, the pH of this field is moving toward neutrality. Organic farmers are told we must apply lots of lime to raise the pH of an acidic soil. Much money, labor, and energy is expended on an extracted mineral which, once applied, leaches out because it cannot be held by soils low in organic matter. To accelerate nature's process, I built a rich, healthy soil for our cornfield and intensive market gardens by adding organic matter in the form of crop wastes, mulches, and manures. The original clay soil of that field had less than 1% organic matter; now it measures from 18.1 to 20.3% O.M., with a pH of 6.6-6.8. Using only cover crops and some added mulches, the dry bean field, which also started below 1% O.M. now holds 3.8% organic matter.

In the last few years, the productivity of the bean field has risen, as the health of the soil's food web has improved. At 60 lbs/bushel for dry beans, the best yield so far has been 37 bu/acre, compared to the average 20 bu/acre in conventional fields. The lack of wide rows for tractor cultivation is one of the reasons this no-till bean field can now produce almost twice the beans per acre of a conventional dry-bean field. Productivity on already fertile farmland would likely be higher. Nevertheless, we cannot expect great yields in the beginning—a soil food web must reestablish a balance that sustains our crops. Even in a very fertile region, Fukuoka's fields took many years to become some of the highest yielding in Japan.

Low-tech harvest and processing

A good day's work! Dry bean harvest is a community activity; many hands make lighter work.

A short story by Wendell Berry inspired me to buy a scythe from the Marugg Company in Tennessee, the oldest scythe company in the US. (9) I call it my "gringo machete." I remember my first experience of wheat falling flat to the ground from the blade of a well-sharpened scythe. This was crystallized for me in the stunningly beautiful film, "Living Lightly," about a Canadian family who farm with a scythe and other simple human-powered tools.(10)

I've scythed most of the wheat field in a long day. Shared with others, the work is much lighter. The booklet sent with the scythe showed community grain-scything parties in New England at the turn of the century. Each day, a different farmer's fields were completed by a community working together. I tried to replicate that here a few years back—with only three scythes and little expertise, it was more of an educational field day. Several farm apprentices have taken naturally to the scythe. I once tried scything beans into windrows to harvest, but I lost too many beans to shattering and uprooted stalks and dirt clods.

Conventional dry-bean production depends on petroleum-driven grain drying, reaping, and threshing machinery. For centuries, people shelled dry beans and threshed wheat by hand, and mechanization is not necessary to produce grains and dry beans for a few families. At our scale, labor is stretched between many cash crops, and time-saving equipment is helpful. Shelling and winnowing beans takes a big chunk out of the fall and winter, when I want to focus on building projects. Small-scale threshing and winnowing equipment imported from Europe costs over $10,000—more than a year's income for me and double the total cost of building my house! One solution to this problem is community-shared equipment—but we first need more people producing staple crops.

Wheat

Wheat is not a cash crop for us. Instead, we use the grain here on the farm—for wheat sprouts and wheat grass and to grind with a hand mill for bread-making. A few 5-gal. tubs full of "wheat berries" is sufficient for us for a year. One farm apprentice made bread entirely of freshly ground flour; it was a lot of work, but made the best bread imaginable!

Previously, I made bundles of wheat to hang and dry, but after finding a quicker way to thresh, we began to harvest just the seed heads ("spikelets"). Because wheat stores better not threshed, we thresh when needed. I use a paddle (paint) mixer on a drill to thresh the grain in a 5-gal. bucket about 1/4 full. I drilled a 3/4" hole in the lid for the bit. About 5-10 minutes, shaking the bucket

The bean harvest, so much food!

occasionally, is usually adequate to separate the grain from the husks.

We winnow grains and dry beans on windy days. As we pour the grain from one basket or tub to another, the wind blows away the lighter chaff. A strong fan also works well for beans. The folks who designed the "wood chipper thresher" described below also posted plans online for small-scale winnowers with belt-driven blowers. (11)

Dry beans

We harvest dry beans when the pods are almost completely dry, but before they shatter in the field. Working in a 4'-wide swath, we snap off the beanstalks at the base, leaving the root in the ground. Taking the base of the plant in one hand and cupping my other around it, I swipe towards the top of the plant stalk, pushing the bean pods from the stalk into bushel baskets, and leaving the plant stalks in the field. If weather is uncooperative, we pile bean plants onto a tarp to dry under a roof until a sunny day allows us to resume processing. The "wood chipper thresher" described later processes entire plant stalks, so that the shredded plant material can be returned to the field.

I learned to shell dry beans in Guatemala using what I call the "sack method." First, I put a couple of pounds of dry bean pods into a feed sack. Next, I bang the sack on a board or sturdy bench, several times on each side. The heavier beans fall to the bottom of the sack, and I skim off the pods from the top. Next, I pour the beans into a basket or winnowing basin (like a large colander) and remove more of the lighter pods from the top. Finally, I winnow the beans (as above) to remove the smaller, lighter chaff.

I have bartered with local friends who shell heirloom seed beans to use their bean and pea sheller. This machine works like a wringer-type washing machine. The rollers separate the beans from the pods, then the sheller spits empty pods out the front and drops the beans through a slot into a tub below. (12) I've used it at the market and at festivals to attract and educate folks about how their food gets to them. I've not felt it speeds up the process enough to want to invest in my own at a cost of about $450. Washington State University has published plans for converting a leaf shredder/wood chipper into a grain and bean thresher. Based on their information, it speeds shelling considerably and the whole plant stalk can be fed into it. (13) I recently acquired an old chipper from friends. The conversion project involves bolting the tines (hammers) together like rasp bars so that they beat the beans but don't grind them, and also reducing the machine's rotational speed (rpm).

For packaging and sale, we clean the beans by removing any bad ones along with particles which did not blow away when winnowed. This job can range from quick to tedious, depending mostly on weather conditions before harvest. Heavy August rains, while not that common here, can make the stalks fall over. Bean pods are amazing in their ability to repel rainwater, but if the pods touch the ground continuously, there will often be one or two discolored beans in the pod. Obviously darkened pods are left in the field. I clean and package the best beans for sale first, leaving any tedious ones for home cooking—bad beans and chaff float to the top when you pre-soak beans to cook. With hand-harvesting, I've had little problem with small stones in the beans, which is common in conventionally combined beans.

When grown on a destroyed soil food web and "junk food" fertilizer, commodity grains and beans have markedly less flavor and nutritional value. The comment I most often get from customers about our beans is how flavorful they are! My biodynamic friends would claim the difference is from the use of biodynamic practices and preparations which feed the soil food web that, in turn, feeds our crops.

Here at Salamander Springs Farm, we have shown that we can sustain ourselves on staple proteins and carbohydrates grown without the continued destruction of our soil. At the beginning of the post-petroleum age, when extraction and waste will no longer be an option for agriculture, our model provides hope not only that we can avoid destroying soil, but also that we can regenerate depleted soils on a practical timescale, with the help of the soil food web. Δ

LEFT: black bean plants with pods beginning to yellow and dry. RIGHT: harvest begins when leaves drop and pods are dry.

Notes

1. Clay Slip-Straw and other natural building at Salamander Springs Farm/photo link as well as informational slides (permaculture workshop 2001-2011): http://wwwflickr.com/photos/28998021@N02/sets/
2. Fukuoka, Masanobu. *The One Straw Revolution: An Introduction to Natural Farming*. New York Review Books, New York, NY. 2009.
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6. The Land Institute, Salina, KS: www.landinstitute.org
7. Visit www.onestrawrevolution.net/MasanobuFukuoka.htm for more about Fukuoka's work.
8. The term "no-till" as used here should not be confused with conventional no-till systems that use herbicides to reduce cultivation and plowing.
9. The Marugg Co., Tracy City, TN, 931-592-5042. www.themaruggcompany.com/
10. For clips of the film and more information, visit http://www.treehugger.com/files/2011/03/scythe-to-cut-swath-earthdance-film-festival.php.
11. Appropriate Technology for Small Subsistence Farms archive. www.efn.org/~itech/
12. Taylor Manufacturing Co., Moultrie, GA, 800-985-5445, www.peasheller.com/
13. See hthp://sustainableseedsystems.wsu.edu/nicheMarket/smallScaleThreshing.html

Susana Lein first learned the principles of permaculture at the New Alchemy Institute on Cape Cod in the mid-1980s. She has studied permaculture in the US, Latin America, Europe, and Australia, where she received her design certificate from Max Lindegger of Crystal Waters Permaculture Village in Queensland. She left the US in 1990, working first with the Peace Corps, and then the non-profit ALTERTEC in Guatemala, helping teach campesino permaculture workshops and building appropriate technologies there and in several other South American countries. Returning to the US in 1999, she started Salamander Springs Farm in the Appalachian Mountains near Berea, Kentucky, clearing an overgrown ridgetop meadow in 2001 and building a gravity-fed spring-water system. In 2002, she began living most of the year on the land and built an open-air kitchen shack with posts of cleared locust and cedar, pallets, salvage materials, and slab wood from milling lumber for the off-grid passive solar house in which she now lives. Susana began making her living from the farm in 2003, selling locally and through Local Harvest (www.LocalHarvest.org/farms/M5606).

Part II—Growing Corn among Three Sisters

Susana Lein

LAS TRES HERMANAS (corn, pole beans, and squash or pumpkins) is a traditional polyculture common in *milpas* (cornfields) across Latin America. These crops mutually support each other: corn provides a stake for the beans; beans fix nitrogen from the air and donate their surplus to the corn; and squash and pumpkins cover a lot of ground, controlling weeds and retaining soil moisture, while providing a third crop on the same field.

The Latin American *milpa* includes more than the Three Sisters—there'll likely be a few fruit or avocado trees to work around, some self-sown tomatoes and chile peppers (often perennial), and the "good herbs" which volunteer each year, providing important green nutrients for the family. These are nutritious "weeds" like *Amaranthus* (pigweed), *Chenopodium* (lambquarters), and members of the *Solanaceae* (nightshade family). I remember seeing what looked like black nightshade in the markets and wondering why so many folks were selling a poisonous plant. When I saw it added to tamales, I learned it was a prized and nutritious food (like nettles) that keeps illness away.

When first I got a road and a spring water system down to the cleared meadow where Salamander Springs Farm now sits, I started building intensive garden beds on the south-facing slope. My neighbor and former owner of the land, Cecil, was quite interested in what I was doing with this piece of hunting and logging land. After showing him around one day, I mentioned that I planned to grow corn. Not usually so animated, he laughed out loud, "Now Susana, you can't grow corn on that ridge!" It seemed a crazy idea indeed on land with no topsoil, no fertility, solid clay and shale, logged and run with hogs into the 1960s. Soon all of Clear Creek would be having a laugh. Nonetheless, I couldn't fathom going without good popcorn or cornmeal.

Popcorn has been part of my diet all my life, but I was never a fan of cornbread until...I had the real thing!

A layer cake on top of the briars

Using the "layer cake" method to build soil, I started what is now about a quarter-acre cornfield. I laid a "plate" of cardboard first to block sunlight so that the sod would die and compost underneath. Over briars and tough weeds like ironweed, I put down a double layer of cardboard. I used BIG plain sheets, such as refrigerator and sofa boxes from furniture store dumpsters. I removed the tape and stickers, cut the sheets to size as needed, and overlapped sheets 8-12" so that no light could reach the sod layer.

"Daymon Morgan's" Kentucky heirloom meal corn.

The "cake" is a layer of manure, fresh compost, or other organic material which provides food for microbial soil builders. I laid down a good 6-8" of manure, forking it onto the seams between sheets of cardboard first, to hold them in place while covering the rest of the cardboard. If you don't need to create topsoil as I did, as little as an inch of manure will feed the soil organisms who build fertility and do your tilling for you.

Manure from grass-eating livestock is rapidly broken down by soil microbes into compost, then "tilled" into the soil by fat, happy earthworms. Horse or cow manure and old hay are easy to get and are free here in the Clear Creek Valley; there are many other possibilities. As Joe Jenkins demonstrates, even humanure is okay if you compost it correctly and long enough. (1) (I use humanure only on fruit and nut trees since I market my crops). Look around and ASK; almost everywhere in this country there are wasted resources waiting to be recycled into productive use.

The last—and most important—layer is the "frosting," which covers, protects, and also feeds the precious soil: a mulch of hay, straw, leaves, bean or corn husks, and shredded paper. Carbon materials from annual crops are best for mulching annual crop soils, which should be bacterially dominated. Use wood chips for mulching perennials and trees, which prefer fungally-dominated soil. After about three months (or the following spring), the manure and cardboard will have broken down and the field will be ready to plant.

Heirloom meal corn and popcorn

Popcorn has been part of my diet all my life, but I was never a fan of cornbread until—like enjoying a real tortilla in Latin America—I had the real thing! Cornbread from de-germed yellow corn flour and sugar does not even resemble cornbread made from this crunchy whole grain meal cooked in a cast-iron skillet. I've been known to eat half a panful in one sitting! In 2001, I got a small bag of heirloom corn from a neighbor, Daymon Morgan, whose family has grown it in Leslie County, Kentucky, for generations. He called it "Bloody Butcher," which is also the name of an all-red heirloom meal corn; but Daymon's strain had a lot of white and blue kernels in it. I've selected and saved seed over the past decade for the beautiful mix of colors, as well as for drought tolerance, ear size, and integrity. When I began to sell seed corn to Southern Exposure Seed Exchange (2), I named it "Daymon Morgan's Kentucky Butcher." At 80 years of age, Daymon is proud of the new name for this corn that he still grows.

In Latin America, "hills" of corn are used on the steepest slopes where rows are not practical—but planting on those slopes at all was not practical! I plant the meal corn a foot apart and the popcorn 6-8" apart, in rows about 30" apart (wide enough to pick beans comfortably).

Picking beans in a cornfield is a joy. It's cool and shady in the forest of corn, and the beans hang in full view.

The cornfield's first years were on a shallow 2" of topsoil (from that first 8" of manure and mulch). I parted the mulch for each row and made furrows with a hoe to plant the seed, then covered the furrow with compost or aged manure. I still do that where soil looks depleted. In Guatemala, I learned to use a planting stick (like a walking stick, with a pointed tip) which saves bending over to plant. Make a divot in the soil and practice your aim throwing the seed into it.

The tradition of *aporque* or "hilling" corn (usually at bean-planting time) in Guatemala is to provide extra support for the corn roots in shallow soils by pulling soil up to the corn plants from between the rows or hills. For a few years, I "hilled" the corn by adding aged manure or compost around the plant base. I made fertilizer teas of nutrient-rich plants. Each fall, I added a couple of inches of manure across the field. The soil at Salamander Springs Farm is deep now, and I no longer *aporque* with compost or use fertilizer teas except biodynamic preparations. By replenishing mulch or planting cover crops, I protect the soil foodweb that's doing the important work.

Heirloom pole beans

When the corn is 8-12" tall, I poke in a bean seed a couple of inches from each sturdy, healthy plant. The best timing for the variety of corn and beans you use varies with your climate. You do not want to wait until the corn is too tall, nor start when it is too small. I inoculate the bean seeds with *Rhizobia* bacteria which help legumes fix nitrogen from the air and store it in nodules on their roots (like nitrogen fertilizer pellets), for later use in producing their seed pods. The nearby corn laps up what the bean doesn't need and which is exuded from its roots. Each type of legume has its own preferred strain of *Rhizobia*, available from organic suppliers. I soak bean seeds for 10-15 minutes to speed germination, drain them, and mix with the inoculant. If you don't till, these bacteria will remain in the soil for future crops—eventually you'll no longer need to inoculate.

When the corn and beans are big enough, the straw mulch can be raked up close to the plants. Until then I scatter grass clippings on the open rows where straw mulch has been parted. Grass clippings break down quickly but cover the soil until the seeds come up. Clippings are easy to find (often bagged for you), but know your source if you live in a ChemLawn-addicted community! I get plenty from regularly mowing clovers and grasses in a future livestock pasture.

I plant pole beans on the first several rows of the outer edges of a cornfield. You can go further into the field; the beans become a later maturing, delayed planting that takes off again when the corn leaves start to dry up and let in more light. About 150' of row produces an average 40 lbs. of green beans per week in season. These heirloom pole beans also make good dry beans for soup, although the demand for them at the market keeps me from saving much more than seed beans.

Picking beans in a cornfield is a joy. It's cool and shady in the forest of corn, and the beans hang in full view. In contrast, pole beans on wire or string trellises often get tangled inside and underneath. The meal corn averages 15' tall (we once measured 19-1/2' to a tassel top!), and these pole beans head all the way up.

Photos two weeks apart. LEFT: mulch on the field is parted for rows to plant corn. Pole beans planted beside each corn plant are starting to germinate in this photo. RIGHT: pumpkin plant beside the stake in field of corn and beans.

We usually have such an abundance for the market that I leave the guys at the top for seed beans. The popcorn is not so tall (6-8') nor as strong. Heirloom "half runner" beans are planted on it. As their name implies, they don't vine to the sky like other pole beans. I started with an open-pollinated yellow popcorn seed, which seems to have grown stronger and taller over the years of seed selection. Our modern sweet corn is not strong or tall enough to support pole beans; likewise most modern beans (like stringless snap beans) are not as suited to climb with the corn as are heirloom pole beans.

One liability of its height is that severe winds and thunderstorms sometimes blow down some of the meal corn, usually toward the end of the season. Unless a fallen ("lodged") cornstalk breaks, it keeps maturing, which makes a tangled jungle and difficult bean picking! Stalks that break at the "sweet corn" stage provide tasty "roasting ears," a treat with lime and salt that's as tasty in Kentucky as it is in South America.

LEFT: Susana with a tubful of shelled popcorn to winnow. The 1903 International Harvester Sheller (with flywheel crank) makes corn shelling fast! RIGHT: Ted winnows popcorn in the wind after shelling.

Squash and pumpkins

Planted at the same time as the beans, squash and pumpkins go into spots along the row where corn failed to germinate, leaving small openings. Don't plant many where beans are planted—stepping over a few squash vines when picking beans is not a problem, but you'll inevitably damage the crop if there are too many.

The mighty cushaw squash, a local heirloom, and Seminole pumpkins are kept out of the popcorn, ever since one dragged down half a row of popcorn before I noticed. These two are now relegated to the CENTER of the 15' tall meal corn field—a couple of hills can cover most of the field from there, finding light as they travel amazing distances in one day.

My potato field usually is next to a cornfield (it follows corn in crop rotations), and squash vines grow out over the potato ground after the early potatoes are harvested. I plant smaller bush-type squashes (acorn, buttercup, delicata) along the outer edges of the field so that vines don't grow over the road or into the dry bean field. Butternuts are my biggest seller, and I prefer the very sweet, hardy African Butternut—butternuts keep all winter and into the next summer! Using regionally appropriate heirlooms in a polyculture reduces problems with squash vine borers and beetles.

Harvesting and processing corn

As I walk the field, doubling over each tall corn stalk and breaking off the ears, I remember similar harvests with my friend and mentor, Don Gavino Ca'al, near Tactic, Alta Verapaz, Guatemala. We wanted his corn to stay purely blue, and saved seed accordingly, signifying that it was of the Pokomchi people of his *aldea* (village). When I husk the ears of corn now, I feel like a kid in a candy shop, wanting to see what colors I'll find. The meal corn often yields a pound per ear and produces a small second ear as well. There are usually two ears of good size on the popcorn stalks.

Popcorn should be below 15% moisture to pop well, and cornmeal corn should be similarly dry to shell and mill. A moisture tester is expensive—cheaper to learn what "dry enough" feels like (as people have done for centuries) and to test-pop some popcorn. Fall weather usually dries the corn well. By nature's design, much of the drying happens on the stalk, as the ears bend down to keep the rain from penetrating the husk. My "corn crib" is made from stacked, salvaged bread trays, each stack with a scrap metal roof. They sit on big electric-wire spools that make it difficult for rodents to get to the corn.

Corn is removed from the cobs when it's ready to use. A few years ago, a friend found a 1903 International Harvester corn sheller at a farm auction. Its flywheel crank design and adjustable feed (smaller for popcorn, bigger for meal corn) make corn shelling a breeze compared to the common box-mount corn shellers. After shelling, the corn is winnowed by pouring it from one bin or basket to another, allowing the wind to blow away the chaff.

Here in Kentucky, most farms once had a corn mill to grind corn kernels into cornmeal; a few neighbors still do. We usually barter some of my cornmeal in exchange for milling services. I hope someday to run a mill at the farm off my solar electric system (and build a barn in which to put it!).

A quarter-acre at Salamander Springs Farm has yielded about 630 lb. of cornmeal and 520 lb. of popcorn while producing two other crops on the same field. With people on the farm eating cornbread and popcorn regularly during the season, we use about 45 lbs. of each here on the farm; the rest is sold locally and nationally through the Local Harvest online store. This corn is food for people, not a commodity used to pump out industrial meat. As a farm-generated value-added product, its price per pound is often similar to the commodity price per bushel (56 lb.) of genetically-modified corn grown throughout our nation's breadbasket.

My neighbor Cecil says he's never tasted better cornmeal. He and his sons bring me rolls of musty hay as barter, saying, "It smells like beer, so guessed you'd want it."

Growing mulch in place

Old, free hay is abundant in my valley, but its quality is variable, and its transport involves outside energy. Recycling carbon material back to your soil is feasible at any scale. It requires some planning and integration of appropriate cover crops into seasonal rotations. For example, wheat and rye don't mature until mid-to-late May, and if scythed for straw mulch before then, they will grow back—just like other grasses. We also use a crop rotation from corn to potatoes.

Nelson Drew, neighboring farmer, mills cornmeal for Salamander Springs Farm.

The creation of healthy soil

Soil rich in organic matter is like a sponge. When we've had flooding rains, I'm still able to plant, while others have compacted muddy soil, which cracks hard as it dries and "needs tilling" again. When severe drought hits, moisture is held in the organic matter, and our crops have produced well with no irrigation at all. I have limited gravity-fed spring water and roof-water catchment, so the crops are on their own once they're up.

A detailed soil test two years ago showed more than 20% organic matter in our cornfield. Cation exchange capacity (CEC) was 20.2meq/100g—an excellent representation of the soil's ability to hold on to cations (minerals) so they can be released for later use. Soil pH was 6.8 (original soil pH was 4.9). All nutrients except sulfur, copper, and sodium were present in the medium or high range.

...most farms once had a corn mill to grind corn kernels into cornmeal; a few neighbors still do. We usually barter some of my cornmeal in exchange for milling services.

In teaching organic farmers, I stress that we make more work for ourselves by tilling—more cultivation or weeding, more watering when the soil turns to dust, more composting and adding organic matter which is then rapidly depleted in the tilled field. A healthy soil food web makes unnecessary the expense of mechanized equipment and imported organic fertilizers and pesticides. Insects and disease cease to be a major problem.

Our task is to imitate nature's processes: to build UP soil and keep it covered, recycle local energy and nutrients back into the system, to plan efficient systems using polycultures and elements that fulfill more than one function. This is a task that requires more of us at the beginning, especially on land with poor soil, but the benefits soon become evident: when we pass through the heat of the summer without watering, fertilizing, cultivating, or weeding the soil that feeds us. Δ

Notes

1. Jenkins, Joseph. 2005. *The Humanure Handbook: A Guide to Composting Human Manure, 3rd ed.* Joseph Jenkins, Inc., Grove City, PA. 256 p.
2. www.southernexposure.com.

Growing pole beans

The Vagaries of *Phaseolus*

Leigh Hurley

OVER THE YEARS, I've noticed that when I mention pole beans to fellow gardeners, their eyes glaze over. I understand—I felt the same way at one time. Most of the pole beans I grow need at least 8' of pole above the ground. Who wants to go through the nuisance of putting up adequate support when you can simply plant bush beans and not be bothered? This widespread attitude has resulted in the disappearance of many outstanding bean varieties from the seed catalogues, and, in the case of my locale, northern New England, the loss of a major piece of our gardening and food culture.

I began collecting local vegetable varieties (popularly called "heirlooms") here in northeastern Vermont around 1980 and putting them into the Seed Savers Exchange network. At the same time, I was collecting stories about what people used to grow here, and researching varieties that had histories in northern Vermont and New Hampshire in order to bring them back if possible. What I found here were largely potatoes (mostly virus-infected) and beans, with a few other odds and ends. Beans and potatoes were the primary staple vegetables for people in this area for 200 years, until the late 20th century when eating industrialized food became the norm instead of subsistence gardening and farming.

Beans and potatoes were the primary staple vegetables for people in this area for 200 years...

Uneconomic advantages

The predominance of bush beans over pole beans now is due to the fact that bush beans are suited for mechanized growing and harvesting. They have been bred to their short stature from their long vining ancestors. Pole beans will not likely ever be a significant part of commercial bean growing, there is too much hand labor required to erect support, plant, cultivate, and harvest. But, for those of us who grow beans without tractors, pole beans are an easy way to grow significant quantities of a staple food in a small space, and they offer flavors and textures that can't be found in bush beans.

In my typically cool and wet growing season, bush beans are prone to disease, mold, and rot as the pods fill out, get heavy and touch the ground. Properly supported pole beans hold their pods far above the ground where there is much better air circulation and solar exposure. Most years the pods dry nicely on the vine without getting moldy. Finally, in terms of yield per square foot of garden space, bush beans don't come close to the harvests I can get from pole beans. I grow a few rare bush beans of local historical interest in order to keep the seed available, but, for our food needs, we rely on pole beans.

Four pole bean varieties from the author's garden. Clockwise from top left: Blue Shackamaxon, Dolloff, True Red Cranberry, Alfred Smith's Vermont Cranberry.

Beans and beans

There are other species of long vining beans, of course, but my interest is mainly in *Phaseolus vulgaris*, the common bean. Runner *(P. coccineus)* and pole lima *(P. lunatus)* beans can be grown and used in a similar way, but I haven't yet found any that are early enough to be productive in my short season and cold climate.

All species of *Phaseolus* originated in the Americas. Some were domesticated and grown by Native Americans throughout the two continents. Many *Phaseolus vulgaris* varieties made the trip to Europe long ago and have come back again, but all have their origins in the breeding work of Native Americans.

The most common pole beans are full-on, Jack-in-the-Beanstalk types that will climb 8-12 feet or more, but there is also a subcategory with more demure habits: short pole beans, known as twiners, half-runners, or cornfield beans. Twiners are generally 3-5' tall, and are the type of beans to use in a Three Sisters planting (corn, beans, and squash grown together). Native Americans bred the twiners for climbing corn stalks. Full-sized pole beans will overwhelm most corn, but the twiners are just right, as long as the corn is not a dwarf variety.

I won't go into detail here about individual varieties—there are hundreds of varieties and fabulous diversity in the Seed

Saver's Exchange and other heritage plant networks. Many have amazing stories, and are uniquely adapted for specific climates, and for specific food preferences: beans for chili, beans to cook with rice, baked beans, beans as a green vegetable. For the permaculture garden, it is well worthwhile to do some research to find the varieties best suited for your climate and how you like to eat them. In other words, research to source the seeds, and trial them in your garden and kitchen.

Beans for the future

When you find something good, commit to a long-term relationship: grow your own seed. Commercial seed sources cannot be relied upon to keep varieties available or alive. Plus, by participating in a network like Seed Savers Exchange, you will have access to the widest spectrum of varieties. Many pole bean varieties are at an "orphan" status, meaning that they are only being grown by a couple of gardeners (if that), and are thus in danger of extinction.

Saving bean seed is easy. If you're growing beans for drying, you're growing beans you can plant. The only difference is, for seed, you need to have a 20' separation between varieties to maintain purity.

Iron drop bar for setting poles.

Cultivation

Beans appreciate loose, well drained soil. I do all my tilling by hand, and our gardens consist of permanent raised beds. To prepare for planting beans, I loosen the soil in the beds with a digging fork, and remove any weeds. I lay some compost onto the beds where they're going to be planted, and work it into the soil lightly with the fork. Beans don't require heavy feeding because they fix nitrogen in the soil, and I take advantage of this by using the same garden spot for heavy feeders like tomatoes the following season.

I don't recommend teepees for pole beans, unless your priority is a children's play area. Teepee support might work decently in a very dry climate, but that configuration doesn't allow all the vines to get full sun, and it reduces air circulation around the plants and pods. As a result, the vines won't be as productive, and it will be harder to get the pods dry for harvest. I prefer to set the poles in a row, about 8" apart. For a long row, I run them along the north side of beds whose long dimensions run more or less east-west. This way, I can grow two rows of potatoes in the south portion of the bed. The beans and potatoes are good companions.

My favored means of support is ash poles for the tallest beans. I cut the poles when we cut firewood in late winter, or take the new growth off coppiced stumps of trees that have already been cut once. I look for more or less straight lengths of at least 12', with a butt diameter of 1-1/2" to 2" for the full-sized pole beans. The ash poles are OK for two seasons—beyond that, they're a gamble. It's very discouraging to have poles snap on you when they're heavy with vines and bean pods. Other species could certainly be used for poles, though I would avoid poplar—it rots too quickly. Materials other than wood could be used as well—some creative recycling of building materials, perhaps.

Essentially, they coppice the trees, and two or three years after the cut, there are often a lot of perfect bean poles sprouting...

One place to look for pole material is under power lines. Our local electric utility doesn't use herbicide under their power lines. Every few years, a work crew cuts and chips all the tall brush and trees. Essentially, they coppice the trees, and two or three years after the cut, there are often a lot of perfect bean poles sprouting from the stumps.

So, how do you erect a 12' pole so that it will stay up all season and hold the weight of your crop? A posthole digger is overkill for this application, and quite disruptive to the garden beds. I use a tool that belonged to my grandfather—he called it a crowbar, but it's not what most people think of as a crow bar—this bar is straight. It's a long iron bar like a spud bar, but with a blunt point instead of a chisel end, and it has a slight taper from the blunt point to the top so that the bottom is the heaviest part. I call it a "drop bar." It's one of my most frequently used garden tools.

To make a hole for a pole, I simply go to the prepared garden bed, hold the bar straight above the spot where I want the pole to be, and drop it into the ground. I repeat this several times, and then drop it in and roll it around evenly after each drop to widen the hole as needed, and repeat the drop-and-roll until the hole is deep and wide enough. The depth should be a minimum of 10". When the hole is ready, I drop the pole in, butt-end down, and very lightly tamp around it. The soil should be compacted as little as possible. With a deep hole, the pole will sit solidly with very little tamping.

When the poles are set, the beans can be sown. I usually put six or seven seeds around each pole in a circle within a couple of inches of the pole. Once they start growing, the bean tendrils usually find the poles, but sometimes it's necessary to redirect them to the poles if they start to wander early in the season.

Cooking and storing

Beans are harvested and eaten at three different stages, depending on the variety: green pod, green shell, and dry. Some pole bean varieties are multi-purpose and are good for all uses.

Green pod is the stage most gardeners know best: the immature pods before the beans fill out: string beans, snap beans, green beans, and filet beans.

Green shell, or "shelly" beans are less familiar to most people, but as recently as the 1950s, they were common in late summer and autumn in New England markets, sold in the pod. The pods are harvested when the beans are fully formed but not dry, and the greenness has begun to leave the pods. At this stage, the pods are not eaten. The beans themselves are bigger than they would be if left to dry and also generally don't have the full color that they will have when dry. The beans are removed from the pods (shelled), and used for baked beans, chili, or any dish for dry or canned beans, plus, they can be used as a green vegetable—for instance, sauteed or braised. One of the wonderful things about shell beans is that they cook quickly—no soaking or long cooking is necessary—they are not too far from *al dente* right out of the shell. They also have a certain sweetness that dry beans don't have—they really are a delicacy fresh. To store them as shellies, they need to be either frozen or pressure-canned. The varieties good for shell beans usually are large-seeded.

Pole beans in a row amongst other vegetables in the garden.

Properly dried beans can be kept at room temperature, or optimally, a little cooler and dryer, and in low light.

Properly dried beans can be kept at room temperature, or optimally, a little cooler and dryer, and in low light. I use glass jars—they don't need to be absolutely sealed, but the container should be tight. For seed purposes, bean seed can be kept this way reliably about three years; after that, germination declines markedly.

To harvest pole beans for drying, when the pods have dried, and the beans have colored, I pick the pods on a dry, sunny day, if possible, and put them into recycled, large, plastic-net onion bags. Ideal conditions for picking are that the pods are getting brittle. If conditions aren't ideal, they can still be harvested, if you expect frost or an extended period of rain. The more moisture in the pods, the fewer pods I put in each bag. I hang the bags initially in our breezeway, and then move them to the basement to hang from the rafters near the wood stove for their final drying. When they are fully dry, I put the pods in an old pillowcase, crush and stomp them until all the beans are out of the pods, shake them down, then remove the pods and debris. The last of the debris can be winnowed out of a shallow basket in a good wind, or in front of a fan. Or, you can leave a small amount of the debris in the beans for storage, and float it off in water as you use them.

Cooking dry beans, like setting poles for beans, is off-putting if you don't have the right tools. A good pressure cooker (non-electric, stainless steel, NOT aluminum) is a must for anyone serious about growing, cooking, and eating their own dry beans. With a pressure cooker, you don't have to pre-soak them overnight, or at all. It takes about 50 minutes under pressure for large-sized beans to cook soft, starting with unsoaked, dry beans. In general, a pressure cooker takes about 25% as much fuel and 25% as much time as a sauce pan to cook anything. In addition to being super energy-efficient, a non-electric pressure cooker can be used in just about any kind of cooking situation you have—from kitchen stoves to open campfires. We use our wood furnace when it's running—if it's not hot enough initially to bring the cooker up to pressure, I heat the cooker to pressure on the propane stove, and then put it on the wood heater. I prefer the inner-lid type of pressure cooker because they're very safe and easy to clean, though they are hard to find in the US.

I hope you'll consider adopting pole beans into your permaculture garden. You can find more information and stories about some of my favorite bean varieties at my blog (http://www.vtcommons.org/blog/leigh-hurley), plus you'll find a video showing how to set poles for bean support. ∆

Leigh Hurley (a.k.a. The Extreme Gardener) has been practicing permaculture and seed saving for 35 years at the same site. She can be contacted at leigh@goodideacreative.com. More info about the Seed Savers Exchange at www.seedsavers.org.

Ancient heirlooms for a native planet

Poor People's Food

John Glavis

In no case may a people be deprived of their means of subsistence. —International Covenant on Civil Rights

FOR THOSE OF US CONCERNED with the future of food, the challenges ahead seem to be growing exponentially. I need not elaborate here on the complex of circumstances facing today's farmers. Add to this the wild card of global climate change coupled with the economic downturn, and you come up with a very volatile situation indeed.

As a lifetime gardener, researcher, and permaculturist, I have struggled for some time with the question of how we may feed ourselves sustainably. How can we grow enough real food for everyone without surrendering to destructive farming and labor practices? My recent short-lived foray into corporate organic agriculture posed the question of scope—is it even possible to mass-produce staples without sacrificing our intimacy with the earth? Can we hope to remove the oil and the money from our food when an increasingly desperate future may force us into unsustainable compromises for humanitarian reasons?

For me, the answers to these questions began to appear in the markets of foreign lands—along dirt roadways and behind overflowing boxes manned by women and children. There, on the streets of high Andean towns were displayed a colorful cornucopia of strange grains, fruits, tubers, and greens. Fascinated, I became a regular visitor to local markets, buying produce, recording plant names, inquiring about cooking methods. As an oft-invited guest of local families, I feasted on delicious meals that nourished body and soul, and I savored the ceremonies and celebrations of gratitude not forsaken by these simple but sophisticated people.

Could we create neo-indigenous food forests and exotic edible landscapes that emphasized greater variety...?

It was after one such market day that I first became aware of a more sinister force at work behind these foods. Returning with a basket full of mysteries, I was stopped by a well-dressed city dweller who laughingly asked why I was buying "poor people's food?" Others became curious why this privileged American was shopping for such *comida de animales*, and I was warned repeatedly to wash and cook everything carefully. Thus began my inquiry into the world of lost crops and cultural belief.

Poor peoples' food

The English refused to eat potatoes for two centuries, in part because the Irish ate them: northern Europeans ignored tomatoes even longer, in part because Italians ate them; and even today in the US, collard greens are unacceptable to many people who consider them "poor folks food." (1)

Continued research revealed amazing contradictions. A good example is *Solanum nigrum*, the so-called "deadly nightshade." The belief that all parts of this common weed are to be avoided is widespread—only one problem: it's not poisonous. On the contrary, its fruit and leaves are eaten regularly by millions, and there has never been a single confirmed case of poisoning on record in the US.(2) Like nightshade, many stigmatized native foods are highly nutritious and adaptable plants, having been selected for certain traits for thousands of years. Colonial disempowerment of indigenous cultures and the ensuing demise of their extraordinary food systems destroyed a framework of food security that had been carefully developed over centuries.

"Without money, iron, wheels, or work animals for plowing, the Indians terraced and irrigated and produced abundant food for 15 million people—roughly as many as inhabit the (Andean) highlands today. Throughout the vast Inca Empire storehouses overflowed with grains and dried tubers. It was usual to have 3-7 years supply of food in storage. But Pizarro and most of the later Spanish who conquered Peru repressed the Indians, suppressed their traditions, and destroyed much of the intricate agricultural system. Crops that held honored positions in Indian society were deliberately replaced by European species that the conquers demanded be grown." (1)

Of the estimated 15,000 plants once used for food, we are currently using 150. Of these, approximately 20 crops feed most of the world. I began to wonder, "where are all the others?" Could any of these selections I saw growing in Ecuador be propagated back home in the maritime climate of coastal Northern California, which mimics the subtropical environment of the Andean Highlands? Might there be an undiscovered answer to the food crisis that uses biodiversity, rather than depending on conventional mono-crop staples? Could we create neo-indigenous food forests and exotic edible landscapes that emphasized greater variety, while replacing our need for large quantities with high-quality nutrition?

...places where committed individuals are holding precious pieces of the permaculture puzzle for the inevitable day of reckoning.

The BoTierra Project: a survival garden

In 2008, I realized my lifelong dream of establishing a biodiversity research garden when I was given access to a one-acre lot in Bolinas, an hour north of San Francisco. This wonderful land by the sea had been nourished for more than 25 years by the owner (who prefers to be identified as a "field worker") who shared the same dream and saw to it that the soils were re-mineralized, greenbelts protected, and windbreaks erected. The recent arrival of new neighbors brought down the fences between us at their request and opened additional land for use. With unlimited passion and very few funds, the garden has grown into a model of diversity, and we are well on our way to achieving our goals.

BoTierra's success is illustrated by last year's abundant harvest of quinoa, tarwi (Andean lupine, whose seeds are 40% protein, now being used in several South American school lunch programs), tamarillo (a.k.a., tree tomato, already popular in New Zealand), ground cherry, pepino, naranjilla, mountain papaya, and the luscious tubers: oca, mashua, and yacon. Add to these a couple of (lively!) black nightshades from Mexico: pachueca and miltomate; the US-native camas (a flowering tuber so tasty that it caused wars), Styrian pumpkins (an Austrian variety with high-protein hull-less seeds, often pressed for oil) and the truly amazing medicinal Angelica from the Izu Islands of Japan: ashitaba, and a few more regular garden favorites: the *Brassica* clan, beets, runner beans, artichokes, strawberries, and cane berries, and you end up with complete dietary (and delectability) requirements.

Building your own biodiversity garden

No matter what the growing requirements of your bioregion, there is room for biodiversity in your garden. I highly encourage everyone to trial at least some varieties in their area. With this goal in mind, I offer the following notes outlining the process used in developing BoTierra, which you may find helpful for starting your own biodiversity project. Although my focus has been the California maritime, these same guidelines should be applicable to your own region.

I dream sometimes of islands of biodiversity established all over the earth connected as a network of living Edens, exchanging people, plants, and possibilities. In reality, many already exist, places where committed individuals are holding precious pieces of the permaculture puzzle for the inevitable day of reckoning.

Research

As always, the best place to begin is with the land. What do you have to work with? How are your soils? What are the normal parameters of climate and weather (seasonal temperature extremes, humidity, rainfall, and other challenges: wind, pests, etc.)? Do you have microclimates created by nearby buildings, trees, or land contours? Be a good permie—map the area and spend time sitting, listening, and watching. You can then begin your survey of plants with potential. There are many resources for your perusal, some of which I have included in the resource list at the end of this article. Keep track of any plants that have promise and include any that ring your intuitive bell. I have no doubt that many of the plants at BoTierra arrived on their own.

Seed search

Once you have your plant list, it's time to search for seeds. Go straight to Google and type in the Latin name. Widen your search to include such topics as authorities and specialists on the subject. You might correspond directly with professors, scientists, and institutions. I found an enlightening article on quinoa's potential for use in deep space in the NASA archives (3), complete with full nutritional evaluations (and gems such as the fact that quinoa's yummy greens are 22% protein—even more than the grain!). Also, a growing number of seed companies, seedbanks, exchanges, and government institutions offer rare and unusual varieties. You might even luck out and find a source of plants at a nursery, botanical garden, or from an individual enthusiast.

Trials

Now that you have your seeds, you need a propagation strategy. Search for any information on germination requirements. Create an environment, such as a small greenhouse, covered raised bed, or just a well-lit indoor table, where you can control temperature and moisture. Some seeds demand long periods of dormancy. Others require a warm start. The germination conditions of many may be unknown—making you the pioneer. Be a good scientist and keep good records.

Once you have germination, give your starts time to strengthen (until at least four true leaves have developed) before transplanting into small individual containers, such as 4" pots. Once the seedlings reach 4-6", transplant to 1-gal. containers. Take note that your soil is not too rich or too heavy. Many indigenous plants grow in marginal soils in their place of origin but are quite adaptable to a wide range of conditions. When your seedlings are 8-10” tall, they are ready for the garden. Don’t forget to harden them off in partial shade for several days so they can make the transition intact. Now, like real estate, it is time to think, “location, location, location.” I suggest you grow out a large enough quantity of each variety to try placing plants in multiple locations if you have the room. Many Incan farmers planted at different elevations to minimize crop failure. Observe and cultivate, but be a good mother and take care not to interfere too much. If your plants end up needing excessive pampering, they may not be suitable. A golden rule of sustainability reads you can’t ultimately use more energy tending your garden than it gives back. Grow out through the season. Harvest and preserve.

Evaluation

Once your harvest is complete, stand back and look at what you have, and be grateful for the treasure and the mystery. Review your notes and record your comments. Did the plants flourish, manage to make it through, or barely survive? Were there identifiable causes for diminished returns such as weather or other factors? If successful, is the produce high-quality and worthy of production? As above, what is the ratio of energy expended to energy received? In other words, was it worth the bother?

I used a 5-star rating system to evaluate the trials at BoTierra:

*** Shows potential.** Underutilized, undiscovered (not widely known outside its area of origin), with qualities that make it potentially useful.

**** Record of historical use,** culturally rich, may have ceremonial or folkloric significance. Heirloom medicine or food.

***** Nutritionally dense** or has specific traits that make it attractive. May have had its composition evaluated.

****** Widely adaptable** to climate and soil variation. Exhibits resiliency.

******* Proven in our trials.** Seed to seed. Produce deemed favorable to delicious. Necessary processing accomplished. Recipes developed. Contents integrated into diet. It passes the test—you would take it to a pot-luck!

Successes

Once a plant is considered a success, it is included in the next propagation strategy and re-evaluated for production goals. What kind of harvest do you hope to achieve? What quantities of each variety do you need to include in the season? How much space do you need to allow?

Production

Seasonal grow out. Harvesting. Preparation. Storage. Call the musicians—it’s time for a barn dance!!!

In summary, biodiversity offers unique opportunities to craft a creative response to the modern-day food crisis. But what is being asked of us is nothing less than a complete transformation of our beliefs around food. What ends up on our plate is the result of a complex series of often invisible relationships and transactions. Once money enters the equation, our essential needs are reduced to commodities, and we lose our connection to the land. The fact that someone can starve due to a lack of money is a crime against humanity.

This brings us around to the word subsistence. If “subsistence is sustainable,” to quote a noted indigenous leader, then maybe we should rethink our definition of the word. Maybe in our well-meaning attempt to raise the standard of living, we lowered the quality of life. In the collision of cultures and concepts, we may have mistaken simplicity for poverty. There is a clear correlation between the loss of indigenous foods and increased economic development, as the last vestiges of original native plants disappear in the wake of relentless “progress.” A case in point: now that quinoa has entered the world market, and its value has increased, fewer Andean residents can afford to buy it, as they shift instead to processed noodles.

The good news is that we are beginning to see through the cracks in the facade of the glamorized consumerist dream. Every day, there are more humans gathering together in open space, with permaculture tools in place, in preparation for a marvelous dawn. May the new subsistence be a place at the table for all. Δ

Notes

1. National Research Council (US). *Lost Crops of the Inca: Little-known Plants of the Andes with Promise of Worldwide Cultivation.* 2005. My sourcebook for many of the Andean food plants trialed at BoTierra. Available free on-line at the National Academies Press: http://www.nap.edu.

Harvest-time among the diverse fields at BoTierra.

2. Thayer, Samuel. *Black Nightshade*. Available online at foragersharvest.com.
3. Schlick, Greg and David L. Bubenheim. “Quinoa: Candidate Crop for NASA’s Controlled Ecological Life Support System.” *In Progress in New Crops*, J. Janick, ed., p. 632-640. ASHS Press, Arlington, VA. 1996.

After a lifetime of environmental and food activism and travel among indigenous peoples, John Glavis founded the BoTierra Biodiversity Research Center in 2008 in Bolinas, CA for the study and propagation of under-utilized food plants. He also offers design and services for individuals and companies interested in creative transitions to sustainability and agricultural diversity.

A story of land transformation

Pig-powered Potatoes

Bethann Weick

DACRES IS TUCKED JUST OFF the main road in Dorchester, New Hampshire, a town of 300-some residents. Dorchester's many stone walls are all the evidence that remains of the vigorous farmland that once dominated the landscape. Though the fields are now fallow and wild, the stone walls are largely intact. With these prior boundaries in mind, and often in sight, we have begun a process of land transformation, preparing new garden areas, and building soil fertility. Most recently, we have explored the use of pigs to prepare land for potatoes.

The process began with our team of Jersey oxen, Henri and August, with whom we gradually cleared about two acres of forest over two years. The wood became a source of heat (for home, water, cooking, and sugaring), construction materials, cottage-craft materials, and wood chips (used in the gardens, outhouses, and animal bedding). Meanwhile, the field became pig habitat.

In the beginning...

Potatoes are a foundational element in our forest-to-garden conversion process. As the serviceberry blooms, we get to work....

We treat our "Dorchester Dalmatian" pigs as honored guests, because they prepare our garden beds. We allow their "pigness" to flourish—their snouts act as natural plows, and their taste for unwanted vegetation drives an all-natural fertilizer program. Their rooting skill gradually and naturally turns the earth of the reborn field, begins to break down small stumps, and dislodges stones and rocks, always present in New England fields. In addition to foraged greens, we also feed our pigs on restaurant scraps and grocery discards. Three times each week, we make the rounds of 15 local establishments, rescuing valuable calories destined for the dumpster. By redirecting the local waste stream into a beneficial nutrient cycle, we create a net energy gain from this organic matter that would otherwise end in the landfill.

Often we keep pigs on an area for several seasons before transitioning from pasture to garden space. Observation has demonstrated that the longer the time spent as pasture, the greater the quantity of compost that has been worked into the soil, and thus the healthier the soil, and the greater the fertility. It is, however, a balancing act—long-term pig habitat runs the risk of severe soil compaction and a devastated worm population.

From pasture to potatoes

As the new growing season approaches, the melting snow dictates our timeline. Once the ground is workable, we set new posts, distract the curious pigs with food scraps, and move the electric fence uphill, reclaiming almost half the space for new garden beds. Terraces are established, each section defined by a row of perennial plantings—a variety of apple and pear trees were planted this year. Though annual food crops will dominate this zone, we are simultaneously expanding our perennial food forest. Not only do perennials offer a decreasing quantity of work as the years, decades, and generations pass, but also these plantings will assist in erosion control, offer wind blocks to more vulnerable crops, boost diversity, and attract pollinator species.

Potatoes are a foundational element in our forest-to-garden conversion process. As the serviceberry blooms, we get to work planting these starchy tubers. Working with the contours of the landscape to minimize erosion, we establish beds and paths perpendicular to the direction of water flow. Large stumps are left as they are. We recognize their value as slow-release sources of nutrient and organic matter; leaving them in place also eases our task. Boulders are left *in situ.* Both wood and granite serve as stepping blocks where appropriate, or as landmarks for contours. Using hand rakes, we scrape what excess dirt exists out of the paths-to-be into the beds-to-be, marked by stakes.

Although the pigs have left a rich legacy of fertility, the soil is compact and fairly thin. 'Taters, and their preference for growing in mounds, make them an excellent beginning crop for the field. We shovel truckloads of home-grown compost into 5-gal. buckets, form 4”-6” mounds around each potato, and top with mulch hay or straw.

We hill the potatoes twice throughout the course of the summer. Each plant gets 1-3 gal. of compost, mounded about the plant, and again covered by a layer of mulch hay. The compost encourages the plants to set more spuds, and it helps rebuild the worm population decimated by hungry pigs. The mulch hay suppresses weeds, minimizes erosion, and maintains cool, moist soil. Hilling creates a wonderful synergy: while we are increasing the productivity of the potatoes, we are simultaneously creating raised beds along the contours of the field. By the end of the season, the soil is richest in organic matter just where we need it most.

Wielding our garden forks, we begin the treasure hunt. This process of digging incorporates the layers of mulch and compost that have been applied over the summer months.

The paths are not neglected. They are seeded with white clover in the spring. Clover not only fixes nitrogen, but also reduces erosion. In subsequent seasons, it will become mulch for future crops or fodder that can be fed back to the pigs—adding to the fertility of another pig pasture.

Potatoes, garlic, and beyond

Come September (August for early varieties), the potato plants mature, the foliage dies back, and we head to the field for harvest. Wielding our garden forks, we begin the treasure hunt. This process of digging incorporates the layers of mulch and compost that have been applied over the summer months. Once the harvest is complete, each bed is re-shaped and re-mulched. Just one season results in a deep, rich raised bed.

These new beds don’t sit unused through the winter season, however. Instead, we plant our fall garlic cloves 4”-5” deep with a thick mulch on top. Then, the beds rest. Soon enough, the warmth of another spring will begin a second season, stirring the garlic and awakening the soil from its frozen slumber.

Planting potatoes: the transformation from pig pasture to garden beds is underway. Serviceberries and other perennials are planted among the rows which follow contour to prevent erosion. Over time, a forest garden emerges.

In subsequent seasons, we will admit these garden beds into our general crop rotation. Flowers will be transplanted into the edges, and other perennials will be added as space permits and needs demand. Over time, beauty, bees, and bounty will dominate this patch once ruled by pigs. At the conclusion of every season, further compost will be added to each bed. By the addition of such organic matter, continual mulching, and the thoughtful use of crop rotations, cover crops, and green manures, soil fertility is steadily augmented steadily.

What began this year with thin, denuded soil has transformed into a lush 17 rows planted with 295 lbs. of potatoes. Yields look to be at least 7.5 lb. for every 1 lb. planted, based on the harvest figures from our early varieties. In the short term, this translates to over 2,200 lb. we can eat and sell through the winter months. In the longer term, this is the outset of an essential landscape conversion: from northern forest to edible food forest. Thanks to our potatoes, this new agricultural plot is already a rich contributor to our permaculture system. Δ

Bethann Weick lives and works at D Acres Permaculture Farm & Educational Homestead, a 501(c)3 non-profit focusing on education and community outreach. For the latest information on workshops and events, registration for the 2012 Permaculture Design Course, and opportunities to stay at the farm hostel or work as an apprentice/intern, please visit www.dacres.org. D Acres can also be reached by email at info@dacres.org or by phone at 603-786-2366.

Growing Rice—In Vermont?

Erik Andrus

IF YOU WERE VISITING EARTH from another planet and had to describe its inhabitants upon your return, you might say that the average person eats rice, and grows it as well, usually on a small scale. You'd be accurately describing the habits of over a quarter of the world's population. The cycle of agricultural intensification, environmental degradation, and collapse that began in Mesopotamia and moved through ancient Greece and Rome, then Western Europe, to the American Dust Bowl took wheat and barley along for the ride—but not rice. Rice, a successful staple and a backbone to enduring civilizations, has a special story, with an exciting chapter now unfolding in the northeastern US among a small but growing group of farmers.

Wet rice has been adapted to a wide range of climates. It is grown from Tierra del Fuego to the northern extremes of Japan—not bad for a plant with a tropical ancestor. But enduring rice systems demand permanent and labor-intensive changes to the landscape, making rice a poor candidate for expansionist agriculture. The US produces a large amount of commodity rice in Arkansas, California, and coastal Texas on capital-intensive farms that are much larger in scale than traditional Asian operations.

This is the smallest and best of our paddies so far. A double layer of fence surrounds it: a short poultry-wire fence to keep ducks in, and a taller electric net to keep predators out.

As a young adult, I became fixated on finding a way to own and farm a mid-size holding.

About 10 years ago, I lived for a time in Miyagi Prefecture, Japan. Miyagi farmers always grew at least some rice, often as much out of pride as anything else. They also manage systems wherein rice and dryland crops are grown side by side, the dryland crops shedding excess water into canals that kept the paddies filled. You don't create such a system overnight. That landscape, for the most part, was built with human labor. I regret to say that I didn't pay as much attention to the growing of the rice as I could have. Instead, a lot of my effort went into procuring wheat flour and dark beer for myself in a country where those commodities were hard to get. At that time, it had not yet occurred to me that rice could thrive in the Northeast US.

For alternative-minded growers, the combination of durability, simplicity, and productivity that traditional rice systems offer is compelling. But until a few years ago, farmers in the Northeast hadn't considered that rice could take root in our landscape. That has changed, thanks to the work of Takeshi and Linda Akaogi of Westminster West, Vermont, who began introducing their successful methods using northern Japanese rice cultivars in 2009. (1) Their work and outreach led to my bottomland mid-scale commercial rice project.

Many permaculturists will at this point be asking whether the Fukuoka method will figure into this article, and the answer is no. In the cold New England climate, there are not sufficient degree days to grow both summer rice and a winter cereal (like Fukuoka's barley). That said, we are only at the beginning of discovering ways to meld rice-growing with our landscape, wild environment, and agricultural traditions.

A vision of rootedness

While I didn't grow up on a farm, I did spend a lot of my youth (sometimes quite grudgingly) in and around wetlands—my father is a bryologist. Bogs such as those we visited to collect sphagnum moss were among the most infertile, overlooked tracts of land you'd be likely to find in the North, although they hummed with life adapted to those conditions. I guess it was part of my education to understand that humanity and wetlands are permanently at odds, with settlement in North America relentlessly filling in and draining wetlands for building and farming.

As a young adult, I became fixated on finding a way to own and farm a mid-size holding. Travel and farm work in England and France in the early 90s brought out in me a kind of quest to reinvent traditional farming and make it work on my native ground.

The old agricultural landscapes of the Northeast, with their hedgerows and stone walls and stoutly built timber-frame barns, bespeak an intention to stay put that resonated with impressions I'd developed of working European landscapes. Conventional dairy farming wasn't enticing to me, but dairy dominated the land around here to the near-exclusion of all else. Some still regard dairy and farming in the Northeast as essentially synonymous.

On the other hand, the few back-to-the land hippie rogues who had stuck it out through the 80s and made farmers of themselves tended to run smaller vegetable operations. Though this approach was more to my liking than the giant equipment, debt, and reek of conventional dairies, I really wanted a farming approach that would take me out of the garden and into the fields, to have a reason to maintain a hedgerow, an old barn, or a stone wall.

In particular, I wanted to be the guy in my community who could sell my neighbors a sack of grain. On a farm where I worked in France, a local baker would come by in his hatchback. We would load it up with bags of freshly-milled, farm-grown wheat until the rear bumper nearly dragged. I wanted to fill such a role, or if none still existed, to make a role for myself in my native land.

Another realization that came to me in the 90s was that we, in the densely-populated Northeast, had allowed our rural way of life to collapse. Nearly everything we could do with our land could be done more cheaply somewhere to the west. With farming in steep decline, the entire region had become a kind of bedroom community for the big cities of the seaboard. Old fields had grown up to brush, then to woodland, then to forest. True, a lot of those old fields never should have been plowed up in the first place—we know this now—but we have gone too far in the other direction.

Rice Finds a Crop Niche

Ben Falk

IN THE FALL OF 2011, we are nearing the end of our third year of rice production, the first year of which was done in 5-gal. buckets growing our seed crop for the following two years of paddy production. Unlike Erik's bottomland rice system, we are growing rice on typical New England terrain: sloping land with very poor soils. Our challenge is no different from what the inhabitants of hill and mountain country have faced for millennia: to grow a reliable staple crop from year to year on the same plot of land, without diminishing its productive capacity. Historically, this experiment has usually failed, and societies have been forced to move onto new lands from generation to generation. Where it has succeeded, it's done so by employing several principles:

- Slow and infiltrate surface water (usually achieved with swales, terraces, and paddies).
- Grow on contour—never shunt water downhill.
- Grow the most reliable, vigorous genetics possible.
- Grow intensively, and rely primarily on biology and labor instead of technical inputs.
- Return all nutrients back into the system.

Of all the successful examples of hillside staple farming—including the potato culture of the high Andes, the chestnut-swine *dehesa* system of the Iberian peninsula, and the terraced paddy-rice systems of northern Asia, the rice paddy offers the most immediate possibilities on Vermont's hillsides. Of note, we have planted nutteries of chestnut, oak, walnut, hazelnut, and other staples, but we think that the yields of those systems will always lag behind those of an annual, grain-based crop. We see these tree crops as an essential backdrop and the foundation of a highly productive, annual-cropping system.

Our rice-production system is fairly simple and makes use of the above principles at many intersections. Water is fed to the

continued on the next page

I wondered more than once whether Miyagi rice would grow in these wet conditions.

This year in Vermont, the number of dairy farmers dropped below 1,000 for the first time, even though the most "unproductive" farms had supposedly already been weeded out. Apparently, not even the richest land in the region can support a commodity dairy economy. But the problem's not the land—it's our bankrupt global economy and the relentless and rotten get-big-or-get-out advice from officialdom that farmers have been following for decades. The land is still there. And with the storm clouds building over the global economy—the one that keeps the grocery stores stocked with cheap food—the general public has begun to take the idea of local staple production seriously.

Boundbrook Farm, made for rice

In 2006, my family and I moved onto 110 acres in Ferrisburgh, Vermont, land that used to be at the bottom of Lake Champlain. The farm had supported a dairy operation before our arrival, and had been an old-style mixed farm long ago. The soil is heavy clay that goes down as far as anyone's been able to dig. Past farmers ditched the land to facilitate drainage. Excess water is the major limiting factor, and in our early years, heavy and untimely rains hampered our efforts to grow dryland crops such as wheat and barley. I wondered more than once whether Miyagi rice would grow in these wet conditions.

It wasn't until I attended the Akaogis' rice workshop in Burlington in February 2010 that I realized that something like the Miyagi landscapes I had seen could be devised on my farm, with wet rice integrated into a diversified cropping and pasture system. In addition, a rice paddy system gives you a great opportunity to create wildlife habitat. Managed correctly (with water in the paddy as much of the year as possible), a rice paddy can perform many of the same functions as a natural wetland: erosion control, groundwater recharge, water purification, and habitat for an incredible number of birds, amphibians, and insects.

Most compelling to me was the chance to transform my least-productive agricultural land into, potentially, the most productive. Rice yields in established paddies average over 4,000 lbs. per acre. National organic brands of rice retail for around $3 per pound in the supermarket. If sold at par with national organics, rice represents a real economic opportunity, even if a farmer manages only an acre or two. Although demanding to build, a well-engineered rice system can yield crops for hundreds or even thousands of years.

The real reason we grow rice: water, water everywhere.

Our project was not created at the expense of natural wetlands, nor would we encourage this in any way. As long as this is the case, any new rice paddy represents a net gain in regional wetlands and the ecological functions they perform.

Like other cereal crops, rice carries with it many traditions that draw the wider community...

Starting small

After the Akaogis' workshop, I went back to the farm and created my first rice paddy, just a few hundred square feet, made by hand in a swale in our barnyard. We obtained seed accessions from the USDA and, from 20g of germplasm, grew 22 lbs. of seed that we harvested in the fall—a 500-fold increase. The plants were very productive!

When encountering an idea I really like, I ask, "How far can I go with this?" The answer, for our farm, is five acres. We set about leveling and diking the land and digging a reservoir in early May 2011, even as rice seedlings from last year's seed crop were sprouting in the hoop house. Naturally, we cleared the proposed work with the relevant government offices, too. We're still under construction, but in 2011, we planted a little under an acre of rice which is now, as I write this in August, coming into ears quite nicely. It's still too early to say what rice will ultimately mean for farmers like myself, but it is a delight to grow and to eat. It likes water, and we have more of that than we know what to do with on our farm.

Like other cereal crops, rice carries with it many traditions that draw the wider community into rituals based on the life of the crop. From the start, we've made a point of welcoming school and community groups onto the farm to get their feet wet with rice—quite literally. This kind of experience can build community identity and broaden young peoples' views of what farming can be. We don't yet know how rice will impact the local culture, but looking at rice traditions in Asia throughout history, it seems likely the opportunity to celebrate and create beauty will arise.

Like many aspects of farming, rice is

***Rice Niche** continued...*

two paddies of rice, one directly above the other, from a holding pond located about ten vertical feet above the top paddy. This collects overland surface flow, as well as rainwater harvested from the house and farm buildings. The pond then warms the water, which aids in rice growth, and stores it between rain events. In most years, this pond alone could water the two paddies for the entire summer if needed, even without rain. Drought has not recently been an issue: the pond has been full or nearly full almost every week of the past five years. The water leaving the pond flows to a small pool into which we put fertilizer. Ducks are allowed access to it, and other nutrients such as chicken house bedding and human urine are introduced. From this pool of manure tea, warmed, nutrient-rich water is gravity-fed via 3/4" poly tubing, as needed, to the rice paddies below. Two other pond-pool pairings also feed into this system in-series further up the slope.

We believe this method of irrigating and fertilizing the rice can maintain the paddy's fertility perpetually. The paddy design, which holds water and nutrients back, allows the crop to convert the organic wastes back into food. The rice paddies have overflowed only on rare occasions (tropical storms). When they do, the overflow is shunted into a sinuous series of swales, the tops of which are planted to elderberry, pear, apple, and many other fruits and nuts. During the growing season, water never flows off the surface of our landscape except in extreme rain events of 4-5" or more.

At this stage in our experiment, it is clear that rice can be produced successfully in a wet Zone 4 climate with no off-site inputs. It is a fertility-cycling crop that can handle extremes of both drought and flood with ease. The challenges to its production include weed control—aquatic weeds are moving into the system—and damage by birds. We plan to introduce our ducks into the paddies earlier next year to reduce weed pressure. Ducks find most aquatic plants palatable, but not rice with its high silica content. We will also be netting or otherwise deterring birds much earlier in the season. ∆

scaleable. Each operation will look quite different depending on the natural and social characteristics of its locale. There could be significant opportunities at a variety of scales of rice growing (say from a few hundred square feet up to 10 acres) both to enhance habitat (more edge effect) and to spur collaboration and cooperation among neighbors. If machinery or storage facilities are used, it often makes sense to share such investment. In Ferrisburgh, some of the older residents remember a "threshing ring" in which a communal crew with heavy harvest equipment worked their way through the fields of participating households in the town. This is a sensible way to share labor and limited capital resources. It can work even better when there is a lively interdependency at a mix of scales than it might if each household were preoccupied with its own subsistence.

The grower of staples, in the broad scope of human experience since the dawn of agriculture, have been key figures in the survival of their communities.

As Fukuoka made famous in *The One-Straw Revolution,* a key advantage of rice cultivation is the possibility of using little or no tillage, so that requirements for capital equipment can be modest. After all, the majority of the world's rice is grown with simple technologies. That said, we use early 20th-century equipment to harvest the grain with horses and thresh it from the straw. But we've imported a modern rice huller because it saves hundreds of hours of human labor. While labor-saving equipment is very useful to the present-day farmer looking to earn a livelihood, rice culture can exist perfectly well without such devices.

This brings me to my last and most difficult point. The growers of staples, in the broad scope of human experience since the dawn of agriculture, have been key figures in the survival of their communities. The fact that they have been almost entirely marginalized by the global commodity trade in the last several decades does not, in my view, diminish this historical truth. A society that depends on a house-of-cards system for its most basic requirements is in deep trouble. I am personally motivated to provide staff-of-life grain for my immediate neighbors using genetics and technologies that I as a farmer can maintain and control, because I can make a living at it right now, and because I enjoy it right now. I also do this because I want my neighbors, and therefore myself and my family, to stay out of trouble in a future that I cannot see but which worries me very deeply. Seen in this way, farming with the community in mind is both a selfless and a selfish act.

In Japan, much of aesthetic and spiritual experience is based on blocking out extraneous information. As a Westerner, it is easy to point out perceived flaws in this mentality—for instance how a beautiful landscape of mountains, rice paddies, and sea is marred by massive concrete high-speed train trestles and ugly high-tensile power lines all over the place. The Japanese people somehow manage not to notice these things.

But, in the rice paddy, pulling weeds, feeling the mud beneath my feet, I begin to understand. Bullfrogs, green frogs, and toads croak and trill around me. A sandpiper pips on the paddy dike. The wind rustles the silky leaves of the rice. Keeping their distance from me as I work, a flock of ducks forages for bugs, quacking and splashing softly. There is much outside the rice paddy that is beyond my experience and control. Here and now is labor, meaning, and beauty. ∆

Notes

1. Akaogi, Takeshi and Linda Akaogi. 2009. *Rice Growing Manual for the Northeast US*. http://www.uvm.edu/vtvegandberry/Crops/Rice%20GrowingManual%20for%20the%20Northeast.pdf

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Rice produces panicles, or ears, beginning in July and continuing through September. When most of the panicles are brown, the rice is ready for harvest. From planting to harvest, the crop requires about five and a half months.

The Dream of the Suburbs

Who Am I to Farm?

Peter Bane

TODAY ONLY 0.3% OF AMERICANS and 2.2% of Canadians derive their primary income from farming.(1) This is the smallest proportion of the population devoted to farming in the history of either nation or in the history of the world. No other societies have made our basic connection to the earth and the garnering of sustenance such a marginal specialty. Are we, as economists and prophets of progress proclaim, more evolved and more efficient, freeing up labor from the drudgery of farming to perform more complex and rewarding tasks in industry or the creative professions? Or have we so lost ourselves in thrall to the logic of the machine, that we will sacrifice everything to it, the quality of our food, our health, the land, even our very souls?

The dynamic of the modern economy, by which large-scale production became dominant through the subsidy of fossil energy, has indeed made farming a marginal occupation at the bottom fringe of the system—a dirty and dangerous primary industry, akin to mining, logging or fishing. The vast prairie expanses of the United States and Canada have lent themselves to mechanized farming so that only a few individuals are needed to manage holdings of hundreds or thousands of acres.

Are we happy to be eating industrial food? Are we flourishing in our post-agricultural careers?

Of course the statistics about farming as an occupation mask many ways in which the work of millions of people is hidden, so the "efficiency" and "progress" of our high-tech societies may be seen as an artifact of ideology as much as a sign of social evolution. More and more food is imported to North America from elsewhere in the world, where it is grown by Asian, African, Latin American, Caribbean or European farmers, usually on smaller farms and with more labor input. Even within our borders, the real food grown here, that is, the nutrient-dense food that sustains our health, such as fruits and vegetables, is picked and processed by an immigrant labor force of Mexicans, Jamaicans, Salvadorans, Haitians and other dispossessed farmers from the South. Many of these are undocumented workers whose labor and whose lives don't officially exist. Even in our wealthy societies, we have many millions more farmers today than we acknowledge.

But what about most North Americans? Are we happy to be eating industrial food? Are we flourishing in our post-agricultural careers? Do we gladly forsake the countryside for city culture?

North American suburbs occupy some very good agricultural land. The land is irrigated; labor and markets are near at hand.

Back to the land?

Certainly millions seem content or may never dream of asking these questions. But there is ample evidence that many of us have never completely relinquished our attachments to a more agrarian way of life. The American Frontier, and the opportunity for anyone to claim a piece of land from the government and homestead it, closed in 1890. Yet every wave of urbanization since World War I has been accompanied or followed by the resurgence of agrarian ideals. Thomas Jefferson's vision of the United States as a nation of yeoman farmers continues to echo down the ages. In the 1930s, M.G. Kains wrote a manual for erstwhile farmers, *Five Acres and Independence*. He introduced the book with a quotation from Henry Ford extolling the virtues of the land—which may be more than ironic.(2) Already by 1935, the manic ups and downs of the capitalist business cycle were familiar enough that "return to the land" was a recurrent and well-recognized impulse in society.

Even after microbiology and engineering made cities less acutely unhealthy, industrial production, with coal as a primary fuel, made them dirty and often noisome places from which the better heeled residents sought relief at summer resorts and in "garden suburbs" where the amenities of a quasi-rural settlement could be combined with the convenience of swift rail transit to the centers of commerce. Long before use-based zoning began to sort out industrial from residential sectors within the city, the dream of the suburbs had taken root.

An even more radical critique of industrial civilization arose from the lives and writing of Helen and Scott Nearing. Their 1954 book *Living the Good Life* and subsequent titles extolled the virtues of simple living close to the land. The Nearings not only turned away from the hubbub and clamor of city life but proposed an unconventional response to economics as well. After Scott, who was trained as an engineer and an economist, was blacklisted from academia after World War I for his socialist and antiwar views, the couple retired to the Vermont frontier, reduced their consumption of industrial goods, and adopted a vegetarian diet based on home-grown food. They built their own house from local materials and disciplined themselves to divide their days equally between "bread labor"—or work for sustenance, intellectual pursuits, and socializing. Working six weeks a year in the late winter to make maple syrup and sugar afforded them enough cash income to pay taxes and even to travel. Not only did their forest farming and designed approach to living inspire a whole generation in the 1970s seeking a way back to the land, but they appear to have lived healthy, principled, and successful lives without compromising their values. Scott lived to 100 years of age and ended his life by fasting in 1983, while Helen, a generation younger, survived him some 12 years in their second homestead on the Maine coast, surrounded by friends and admirers. Their legacy is perpetuated in part by their writings and in the dreams of millions of their readers, and also through the work of the Good Life Institute in Harborside, Maine. (3)

Vegetarianism and concern for wholesome food free of chemicals grew in direct proportion to the expansion of "get big or get out" agriculture...

A pastoral ideal

While not agrarian by design, the post-World War II suburban boom appealed to the unrealized dreams of millions who left the countryside for war and better wages, but from whom the pull of a pastoral life had never entirely vanished. Men continued to enact, in mechanical and often neurotic ways, the rituals of making hay as they cut lawns into perfect green squares every weekend. Women organized ice cream socials and birthday parties like the collective celebrations of harvest that had ennobled the hard lives of their ancestors. Children were the real crop here. During the 1950s this patchwork of farm fields, forest remnants, and village-scale neighborhoods, peopled by the children and grandchildren of factory workers, immigrants, ex-farmers and other groups newly enriched by the war economy, became the dream landscape of the boomer generation, the largest in history. Small herds of children roamed this bucolic terrain, secure in the privilege their parents extracted as world conquerors until, of course, the next development took down a totemic patch of woods or replaced a mysterious meadow with a cul-de-sac of new houses. Perhaps it should come as no surprise that as it reached adulthood this age cohort sought meaning in nature amidst a world seemingly mad with the designs of human dominance: corporate conformity and mutually assured destruction from nuclear weapons.

Well into the 1970s, when energy crises began to call into question the wisdom of a commuting way of life, the suburbs continued to afford a new generation of children the same glimpses of a comfortable life embedded in nature. But the suburbs were changing too, as they grew to become the dominant habitat for North American societies. (4) City centers and their surrounding neighborhoods, under assault by highway builders, redlining, and white flight born of racism, hollowed as their outer fringes spread.

The agrarian way of life found its greatest contemporary philosopher in Wendell Berry whose political views on farming, land use, and culture reshaped the national debate. If the Nearings had offered moral inspiration and economic guidance, Berry's critique of urban civilization provided an intellectual foundation for the Vietnam-era pulse of return-to-the-land. Driven less by economics than it had been during the 1930s and more by cultural alienation from the turmoil of decaying cities and a general rejection of the values of industrial capitalism and war born of empire, this broad wave of hippie communes and homesteaders brought lifestyle issues into public consciousness. Vegetarianism and concern for wholesome food free of chemicals grew in direct proportion to the expansion of "get big or get out" agriculture with its emphasis on vast grain monocultures and the feedlot finishing of livestock.

Migrants harvest and process most of the real food eaten in the US and Canada.

A perfect storm

Economic opportunities in the countryside continued to be constrained, however. The agrarian ideal struggled against industrial consolidation. The US economy began its long-term contraction about 1973 following the peak of national oil extraction. Farmers continued to be squeezed by the relentless logic of the market—overproduction leading to large surpluses and low prices—while input costs rose with the inflationary price of oil, now set in the international markets and no longer by the Texas Railroad Commission. A second oil shock and double-digit inflation piled on top of too much farm debt led to a severe depression in rural America in the early 1980s. Many farmers sold out. Not a few committed suicide. (5)

Crisis is also opportunity to re-envision and give a new purpose to land and housing within and around our cities.

The traditional household pattern of life eroded as millions of women moved into the workforce in the 1970s and beyond, largely to compensate for falling incomes and inflating costs of living. While energy concerns and economic hardship during the 1970s put a temporary brake on the expansion of suburban housing, military Keynesianism under Reagan combined with loose banking laws led to a glut of suburban housing and office developments occupying the new niches created by the federally-funded interstate highway system. Flight from center cities, which had begun as a backlash against racial integration in the 1960s and 1970s, accelerated. A generation of sprawl had begun whose end we viewed in 2008 and 2009 as the so-called "subprime mortgage crisis." In truth, the near collapse of the nation's banking, automobile, and housing industries is tied directly to the energy excesses of the preceding 30 years.

The depression of the 21st century, outwardly visible from 2008 onward, has been the occasion of much writing on the link between energy supply, settlement patterns, and the shaky basis of the American economy. Social critic and geographer James Howard Kunstler has called the suburbs, "the greatest misallocation of resources in the history of the world." (6) There can be little doubt that paving over much of the nation's best agricultural land and cutting old growth forests to frame shoddily-built McMansions was a tragedy of epic proportions, but the question is not whom to hang but what can be done with it now? However disreputable its causes, the emptying out of many American cities and the spreading of the population over broad metropolitan regions marks a necessary and inevitable turn toward a state of lower social and technological complexity that will develop progressively as energy supplies decline.

Creating a new yeomanry

The contraction of oil and other fossil fuel supplies must translate into a contraction of the economy and of industrial food production. We cannot expect to see a sustained increase in economic output ever again. Indeed, sustaining present levels of output may be barely possible with a full-scale national mobilization of resources to transform energy systems, transport, and other infrastructure. This is, frankly, unlikely to be achieved. Many workers in the developed world will become permanently unemployed as farmers in the developing world have been in the past generation with the growth of global trade; food prices will rise with transport and energy costs. The stage is set for a new Agrarian Revolution, though whether this turns into a fulfillment of Jefferson's vision or a new feudalism depends on how we the people respond.

The stage is set for a new Agrarian Revolution, though whether this turns into a fulfillment of Jefferson's vision or a new feudalism depends on how we the people respond.

It turns out that land ownership patterns matter a great deal, not only to the structure of society, but to the economy's ability to create wealth. The stars of the post-World War II economic boom were the east Asian Tigers: Japan, South Korea, and Taiwan. Each of them either had land reform imposed upon it (in the case of Japan by the American occupying administration of General MacArthur), or adopted it early on in their rise to prosperity, and economists generally acknowledge that redistribution of land to many millions of farmers was essential in providing the broad-based access to wealth that sustained each nation's rise to the first ranks of the international economy. (7)

A new vision is needed

The epic "misallocation of resources" created in North American suburbia a fabric of many small land holdings packed close around our centers of population. In a clumsy, expensive, and still incomplete way, we have created a pattern for a democratic yeomanry. Many potential garden farms are located on some very fine former farmland: northern New Jersey, northern Illinois, the south end of San Francisco Bay and the Lake Ontario lowlands.

And even where the soil was not originally well developed, the land is usually flat to rolling. These territories have been supplied with extensive road and water networks, and both labor and a rich array of resources, biological and industrial, lie all around. The largish houses, especially those built after 1980, may be poorly configured at present, but they could accommodate the extended families and larger households that will be needed to grow food and manage land with lower energy resources and technologies.

The emergence of garden farms is at hand. Under the pressure of necessity as unemployment rippled through the economy, millions of North Americans turned to gardening or expanded their gardens in 2009 as evidenced by a 40% increase in vegetable seed sales. (8) Urban homesteading is spawning its own literature as energy descent forces more and more households to adapt in place. With income constrained and energy and materials shortages looming, the only resources capable of filling the gap in livelihood are imagination, information, and knowledge, in particular a deeper understanding of the material cycles and energy flows of nature. For that understanding, we look to permaculture, a language derived from the patterns of the world around us. Δ





The emergence of garden farms is at hand. Under the pressure of necessity...

Peter Bane is the publisher of this magazine and the author of The Permaculture Handbook: Garden Farming for Town and Country, *forthcoming from New Society Publishers in 2012, of which this essay is an excerpt. Used here with the permission of the publisher. All rights reserved.*

Notes

1. EPA [online] Citing 1997 USDA Census of Agriculture, "…less than 1% claim farming as an occupation (and about 2% actually live on farms." www.epa.gov/agriculture/ag101/demographics.htmlor www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/demographics.pdf. The U.S. had 2.2 million farms in 2007. Counting one principal operator per farm (and most did not make their principal living from farming) that constitutes about 0.7% of the US population. And also, www.statcan.gc.ca/ca-ra2011/index-eng.htm, "In 2006, Canada's agriculture industry has (sic) 2.2% of Canada's total population…," both cited September 7, 2011.

2. M.G. Kains. *Five Acres and Independence, 2d. ed. revised*. Garden City, 1940. Kains quotes Henry Ford: "The land! That is where our roots are. There is the basis of our physical life. The farther we get away from the land, the greater our insecurity. ... It is there waiting to honor all the labor we are willing to invest in it, and able to tide us across any local dislocation of economic conditions. No unemployment insurance can be compared to an alliance between man and a plot of land."

3. Helen & Scott Nearing. *Living the Good Life: How to Live Sanely & Simply in a Troubled World.* Schocken, 1954.

4. US Census 2000 Special Report. Demographic Trends of the 20th Century. November 2002. [online] www.census.gov/prod/2002pubs/censr-4.pdf, cited August 29, 2011. Suburbs overtook central cities about 1965 at about 1/3 of total US population each. By 2000, suburbs held half the US population, center cities 30%. Throughout the century, rural areas both lost population through migration and were annexed or incorporated into metropolitan regions.

5. *The New York Times* [online] www.nytimes.com/1991/10/14/us/farmer-suicide-rate-swells-in-1980-s-study-says.html, cited September 6, 2011. More than 900 male farmers committed suicide in Wisconsin, Minnesota, North and South Dakota, and Montana in the 1980s. The peak rate occurred in 1982. Seventy-one female farmers, 96 farm children, and 177 farm workers also committed suicide in this region between 1980 and 1988. Study by the National Farm Medicine Center, Marshfield, Wisc.

6. James Howard Kunstler. *The Long Emergency: Surviving the End of Oil, Climate Change, and Other Converging Catastrophies of the 21st Century.* Atlantic, 2005. Also [online] www.kunstler.com/spch_Vermont%20Oct%2005.htm, cited 9/6/11.

7. Re: Japan [online] www.ide.go.jp/English/Publish/Periodicals/De/pdf/65_04_06.pdf, cited Sept. 6, 2011. And also, http://siteresources.worldbank.org/INTARD/825826-1111148606850/20431879/Zimbabwe.pdf. Experts agree that land reforms in Japan, Korea, and Taiwan have made a major contribution to overcoming the legacy of colonial (sic) development (King, 1973).

8. *The Washington Post* [online] www.washingtonpost.com/wp-dyn/content/article/2009/06/14/AR2009061402741.html, cited Sept. 7, 2011.

Staples locally grown and locally sold

Working Out a New Farming System

Harry MacCormack

IN THE EARLY 1970s, a social activist part of the WWII generation returned to the land. We built gardens in this maritime climate. We soon learned how to garden year round. As part of that gardening we learned some of the design principles that became known as permaculture.

Harry MacCormack harvesting quinoa.

We got really good at growing living landscapes as integral parts of what became market gardens and then farms based on those principles. But one of the basics of diet for both humans and animals was mostly left without concern. That is, until about six years ago, as the second wave of Locally Grown began organizing, and data became available regarding the role of grains, beans, and edible seeds as the basis of a local food system.

The data I used in starting the Southern Willamette Valley Bean and Grain Project, a joint venture of Ten Rivers Food Web, Willamette Farm and Food, and at that time about ten farmers, came from work done by Dr. Jason Bradford as he looked at an "emergency food system" for Willits, California.

There are some pretty funny stories from the farmers who have been participating in this project. For instance, how do you know when a bean is ripe?

His research showed that fully 90% of that emergency system would rely on grains, beans, and edible seeds. These staples would sustain humans and the animals that are part of the human diet. I had just finished reading Kunstler's *The Long Emergency* and considered that for many people worldwide the conditions of emergency were already upon us. Because of our work with vegetables, fruits, and permaculture landscapes, which included perennials like nuts, berries, fruit trees, and tightly controlled pasture rotations, I lowered Jason's figure to 80% for our project.

That left those of us involved in the project with a new series of questions regarding our local food system development.

• How would you grow grains, beans, and edible seeds for the populace of about 700,000 people in our area?

• How much land would be needed?

• Could we convert land from grass seed production to grow some of these crops?

• Could such a conversion be done using known processes for transitioning to organic production?

• How would we get farmers to sell what are generally seen as commodity products in a local market?

• Would essential crops such as hard red wheat and a variety of beans and edible seeds even grow in this climate?

• Are there any staple crops that are perennial?

For a permaculturist reading this article, the list of questions is daunting. It pushes the limits of all we have learned about creating a biologically resilient agriculture.

Then consider that we have to create a local economy of consumers willing to buy these products rather than the normal grocery store fare, much of which comes from outside our country, let alone our region. You can read the entire history of how we attacked these issues by following the chronicle of the project at mudcitypress.com.

There are some pretty funny stories from the farmers who have been participating in this project. All kinds of questions kept popping up. For instance, how do you know when a bean is ripe? What kind of spacing between rows of beans do we need to keep in this maritime valley climate? Do we plan on windrowing beans (cutting them to let them dry in the field before combining), or do we combine them straight up? When do we plant hard red wheat?

Can it be over-wintered and still form protein enough for bread makers? Is protein (nitrogen) even the main concern in well-grown organic wheat? We have hard data that organically grown vegetables and fruits have loads more minerals and vitamins than their conventional counterparts. (See the nutrition section of my book *The Transition Document: Toward A Biologically Resilient Agriculture.)* Who would buy wheat berries? Who would buy beans? Who would purchase transitional products over the three years required to move turf seed fields into organic certification? Can enough product be moved to make the whole process of converting grass seed or other crop land into staple foods for local consumption economically viable?

From a permaculture perspective, think about transitioning 100-300 acres of land at a time. Many of these acres have been in sod. We can't use herbicides. We have to use really good rotations. What are good rotations in the Northwest? How can we use food crops to build healthy soil while year after year producing staple foods of ever-higher quality?

Look at what is the actual permaculture of this valley. What likes to grow here is grass, particularly grass that is either perennial or fall planted. Broadleaf crops love to grow here and make millions of pounds of seed. In both cases what really likes to grow in this valley is what food farmers have to deal with as weeds. And we have to do this without the crutch of herbicides.

The Oregon State University research papers done on hard wheat, beans, and many of the edible seeds were, to say the least, not encouraging. Much of that research was done in the 1960s and early 1970s when the weather here was not what it has been over the last 20 years. We were fortunate to begin growing these staples in that 20-year warm period. But, as I point out in great detail in my new book *Cosmic Influences On Agricultural Processes* (available at sunbowfarm.org or at the ACRES USA .com bookstore), climate cycles change. They change in a direction. Warmer eventually becomes cooler. The last two seasons are the beginning of a long period of cooling which will get even more severe around 2020-2030. We now face the challenges cited in the OSU papers from a previous period. Stripe rust in wheat is raising havoc with all varieties under both conventional/chemical and organic production methods. Lodging, or grain being knocked flat in the field, has suddenly become the condition in our perennial rye and our tall varieties of wheat and triticale bred for organic production. Their height allows us to combine above the weeds. The planting season for beans, corn, and warm weather seed crops has shortened. We rely on dry-down during August or no later than the first two weeks of September. We've been pushed into October harvests, which means fighting wet weather, molds, mud.

We are experimenting with a tactic that has worked for grape growers, namely the use of compost tea at specific points of plant development to speed up leaf and fruit growth. It appears that, as with grapes, we can get beans to the dry down stage a full week to two weeks ahead of the same beans not treated with compost tea. We only have one year of success in one situation to show us the way. This year we should have several more examples.

One of the successes in our project is that we now have large chemical farmers growing organic crops, learning the value of getting intensive biology into their fields, learning that with five-year rotation plans their soils and yields actually keep getting better and better, while their expenses eventually go down compared with their chemical production. Because of the international economic downturn there have been times when some of these farmers have seen more income from their locally sold organic crops than from their chemically grown grass seed and white soft wheat.

One of the aims of the project is to generate economic stability by creating a local market that is relatively stable year after year. To do this we've used a lot of the direct marketing techniques we learned from growing vegetables, fruits, nuts, etc. One of these is to keep local prices consistent with actual costs and a fair wage living standard. To this end we do not sell by the bushel. We sell by the pound. We have urged all our farmers to look at their actual expenses with one crop, say red wheat, as a part of the expenses of a five year rotation. We have organized as farmers to do our own processing. The group now has two working flour mills. The mill I'm involved with pays farmers 50 cents a pound for their clean grain. That would be $30 a bushel by the old style of reckoning. On the international market they would be lucky to get $5-$8 a bushel. Our mill provides fresh flour. Our customers can see on the bag which farm grew the grain, where it was milled, and the date it was milled. To enhance nutrition and accompanying flavor we recommend that customers buy milled products when they are fresh.

...there have been times where some of these farmers have seen more income from their locally sold organic crops than from their chemically grown...crops.

This whole project to grow staples reflects our effort to design a local food system that involves growers and food consumers in a partnership, and not just a one-time point of purchase. Our intent is to change the way we all think about food, and to see ourselves participating fully aware in a transparent food community. Most of the staples of this community are annual crops, renewed from year to year. But with them, the design and interactive relationships of the community have a chance to endure. Stable community-based staples are the biggest challenge we've undertaken in our 40-plus years of building a health-promoting food system. ∆

Harry MacCormack has been growing organic fruits, vegetables, grains and beans at Sunbow Farm since 1972. He is a co-founder of Oregon Tilth, an activist and teacher, and a board member of Ten Rivers Food Web and the Southern Willamette Valley Bean and Grain Project. Contact him at sunbow@peak.org. or write 6910 SW Plymouth Dr., Corvallis, OR 97333.

What the world needs now

Perennial Staple Crops - Part I

Eric Toensmeier

This is a companion piece to "Climate Stability with Permanent Agriculture," which appeared in the Summer 2011 issue of Permaculture Activist *(#80). That article laid out the potential for perennial farming systems to sequester carbon while providing multiple social and ecological benefits. This article reviews perennial staple crops, a little-known group of species with tremendous potential to address world problems. Part I presents an overview of perennial staples, compares them to annuals, and provides tables of yields. Part II will appear in the next issue and provides profiles of the most promising crops.*

PERENNIAL STAPLE CROPS ARE SOURCES of protein, carbohydrate, and fat that can be harvested repeatedly without killing the plant or preventing future harvests. These include grains, pulses (dry beans), nuts, dry pods, starchy fruits, oilseeds, high-protein leaves, and more exotic products such as starch-filled trunks, sugary palm saps, and aerial tubers.

Trees, palms, grasses, and other long-lived crops offer human food while simultaneously sequestering carbon, stabilizing slopes, and building soils. No-till perennial systems seem the most likely of all regenerative farming practices to approach the carbon sequestering capacity of natural forests, because they can most closely mimic the structure of a forest.

Perennial crops are resilient in the face of extreme weather, surviving drought, flooding, and storms better than most annuals. Food forests can be long-lived, no-till, and low-maintenance—which sounds like a rather utopian base of subsistence. Some of the plants, however, present harvesting and processing challenges. For example, most peach palm varieties have tall, very spiny trunks that must be climbed for harvest (both dwarf and spineless forms have been selected, but not yet one with both qualities). Note that these benefits apply particularly to polycultures of perennials. Monocultures (single-species plantations) appear to sequester less carbon, are more fragile in the face of pests and extreme weather events, and certainly provide fewer additional social and ecological benefits (see "Climate Stability with Permanent Agriculture," *Permaculture Activist* #80).

Cold temperate climates... have the least number of staples ready for commercial development...

Most of the species profiled here are still under development. Though they may have been grown for millennia, none has received the kind of breeding attention from which the yields of annual grains and oilseeds have benefitted. Nonetheless, even in their undeveloped state, many perennials already outyield annual staples. Others, notably perennial grains, are part of active breeding efforts and are showing great promise. Globally, a massive effort to fund breeding work, particularly providing additional resources to individuals and organizations already at work on perennial crops, should be an important component of climate change mitigation.

Ricardo Romero of Las Cañadas in Mexico with perennial staple food forest featuring peach palm, air potato, macadamia, banana, chipilin, chaya, edible leaf mulberry, and avocado.

Perennial crops by climate type

The **lowland humid tropics** are rich in productive, starchy perennials. Bananas, breadfruit, sago palm, peach palm, air potato, and Tahitian chestnut all give very high yields. These ecosystems are also well-supplied with perennial oil crops such as oil palms, Brazil nuts, and avocados. Perennial proteins are less available, with only a few, such as breadnut, ready for expansion.

For **arid and semi-arid tropical** zones, the situation is also fairly promising. Carbohydrate crops include the date palm and the mesquite for its edible pods. Protein crops include perennial lima beans, buffalo gourd seeds, the leaves of moringa, baobab, and chaya, and the pods of some very drought-tolerant acacias.

In the **highland tropics,** several unique crops offer great promise. Carbohydrate crops include lucuma fruit, mesquite pods, and the starchy trunks of enset. The remarkable chachafruto tree is a perennial bean with phenomenal production. Several other perennial beans, including runner beans, are suited to this climate regime.

Mediterranean climates can produce carbohydrates from carob, date palms, and chestnuts. Protein sources include avocado, almond, and pistachio. The olive is, of course, among the world's finest and most productive oil crops. This is also the only region with an oak (*Quercus ilex*) that is cropped for food.

Cold temperate climates present an interesting situation. We have the least number of staples ready for commercial development, but by far the most breeding work being done. Chestnut and hazel are perhaps the best carbohydrate and protein crops (respectively) we have now, with pecan our best oilseed. Edible-leaf mulberry is also a fascinating and productive candidate. However, perennial grain development is moving ahead rapidly, and the outlook for cold climates is excellent. These grains may someday join mesquite in cold arid regions as the basis of human sustenance.

Giant acorns of Quercus insignis show the potential for breeding staple crop oaks.

Perennial carbohydrate yields

Perennial carbohydrates come in the form of starchy fruits, seeds, nuts, dry pods, aerial tubers, dried fruits, and starchy trunks. The species are ranked by potential productivity and compared with annual crops, which are highlighted and marked with an asterisk (note that cassava is a perennial grown over a 1-2 year period).

Latin Name	Common Name	Climate	Yield (tons/ha)	Product
**Manihot esculenta*	cassava	tropical	10-90	tubers
Musa acuminata	banana	lowland to highland tropics	3-60	fruit
Musa paradisica	plantain	lowland to highland tropics	8-50	fruit
Bactris gasipaes	peach palm	humid tropics	20-30	fruit
**Solanum tuberosum*	potato	humid worldwide	20-30	tubers
Artocarpus altilis	breadfruit	humid tropics	16-30	fruit
**Colocasia esculenta*	taro	humid tropics	5-30	tubers
Inocarpus fagifer	Tahitian chestnut	humid tropics	4-30	nuts
Metroxylon sagu	sago palm	humid tropics	15-25	dry starch
Dioscorea bulbifera	air potato	humid tropics to highlands	1-19	tubers
Phoenix dactylifera	date palm	arid tropics	11-17	fruit
Pouteria lucuma	lucuma	highland tropics	14-16	fruit
Gleditsia triacanthos	honey locust	temperate	3-15	pods
Artocarpus heterophylla	jakfruit	subtropics	6-12	fruit
Ceratonia siliqua	carob	Mediterranean	2-12	pods
Prosopis spp.	tropical mesquites	arid tropics	10	pods
Treculia africana	African breadnut	humid tropics	5-10	nuts
**Zea mays*	corn, maize	worldwide	4-10	grain
**Oryza sativa*	rice	humid worldwide	3-9	grain
**Triticum aestivum*	wheat	cold temperate, Mediterranean	3-9	grain
Brosimum alicastrum	Mayan breadnut	humid tropics	7-8	nuts
Ensete ventricosum	enset	highland tropics	5	dry starch
Castanea spp.	chestnut	cold temperate, Mediterranean	3-5	nuts
Prosopis spp.	cold-tolerant mesquites	cold arid	2-4	pods
**Sorghum bicolor*	sorghum	arid worldwide	3	grain
Quercus ilex	ilex oak	Mediterranean	1-2	acorns

Barriers to change

Why are these crops not better known and more widely grown? Our global food system focuses primarily on annual grains, beans, oilseeds, and tubers. These crops provide quick yields. There are several challenges in converting to perennials.

For one thing, the supply of seed and plants is limited. In any given region, few are available. Access to improved varieties is even more restricted. A network of nurseries would be a prerequisite to getting this plant material into the right hands. This will require navigating phytosanitary permits and paperwork to bring seeds and cuttings across national boundaries.

Secondly, for any individual farmer, establishing new perennial plantings is a major hurdle to be overcome. Crops are delayed for three to five years while the plantings mature. Where farmers must subsist on what they grow, subsidies would be required to bridge this income gap. Climate change funds should be tapped to make it possible for farmers to survive while establishing perennial crops. A lack of long-term land tenure poses a third obstacle—who would plant and care for trees on rented or otherwise insecure land?

Market adoption of new crops is also a barrier. People like to eat what they are accustomed to, and won't necessarily eat something new just because it's good for them, grows easily, or helps to fight climate change. Fortunately, many perennial staples are already tasty and appealing.

This obstacle can also be partially overcome by replacing annual livestock feed crops with perennial ones. Hogs and cattle are a lot less picky about their foods than people!

Perennial staples, not unlike corn and wheat, often require specialized equipment or infrastructure for harvesting, processing, and storage. This can be low- or high-tech. To implement a mass conversion to perennial staple crops would require the development and distribution of new equipment.

Much research is needed. Even in cases where selection and breeding work is relatively complete, we don't know which species and varieties are best suited to which regions, nor what agronomic practices work best. We need to know how perennial staples can be integrated with nitrogen-fixing species, livestock, and annual crops. This kind of research should be funded as a priority of carbon sequestration efforts.

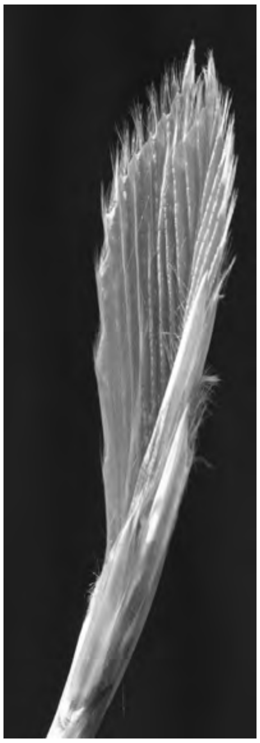
Perennial vs. annual yields

The yield figures used to compile these admittedly inadequate tables do

Perennial protein crop yields

Perennial protein is somewhat rare, particularly in colder climates, and often comes in the form of nuts, which are not ideal because of the frequency of food allergies. Perennial beans are wonderful, and some areas of the world have good ones, though most of us have only limited perennial bean options in serious need of breeding work. Annual protein crops are provided for comparison and are highlighted and marked with an asterisk.

Latin Name	Common Name	Climate	Yield (tons/ha)	Product
Erythrina edulis	chachafruto	highland tropics	13	beans
Artocarpus camansii	breadnut	humid tropics	11	nuts
Phaseolus coccineus	runner bean	tropical highlands	3-5	beans
Phaseolus lunatus	lima bean	tropics	3-5	beans
**Cajanus cajan*	pigeon pea (as annual)	tropics	1-5	beans
**Glycine max*	soybean	cold temperate, tropical	1-5	beans
Juglans regia	walnut	cold temperate, Mediterranean	4.5	nuts
Prunus dulcis	almond	Mediterranean	4	nuts
Corylus spp.	hazel	cold temperate, Mediterranean	2-4	nuts
Cucurbita foetidissima	buffalo gourd	arid cold to tropical	0.5-3.4	seeds
Carya illinoiensis	pecan	cold temperate, subtropics	3.0	nuts
Pistacea vera	pistachio	Mediterranean	3.0	nuts
**Arachis hypogaea*	peanut	cool temperate, tropical	1.0-3.0	tuber-nuts
Sclerocarya birrea	marula	arid tropics	2.0	nuts
**Phaseolus vulgaris*	common bean	cold temperate, tropical	1.0-2.0	beans
Acacia spp.	edible acacias	arid tropics	1.2	beans



Hazelnut shoot. Photo by Sylviane Moss.

not give an accurate comparison, for several reasons: a) some are measured in fresh weight, while others are dry weight, b) some, mostly the annuals, are fertilized and cared for, while others are virtually unmanaged and could have substantially higher yields, c) the crops are grown in different climates with humid tropical species dominating the charts, d) some of these crops are fully domesticated, others virtually not at all, and many are in between, e) some yields include nutshells or inedible pits, f) yield data on a few of the perennials is extrapolated from smaller land units, and g) in some cases the indicated yields vary widely due to a host of variables. Some of these variables favor annuals, and others favor perennials, but these tables at least give us a starting point. Yields throughout are given in metric tons (1000 kg) per hectare (ha). One metric ton/ha is equivalent to 892 lbs./acre.

A brief review of the tables shows that many perennial staple crops are powerful food producers. Especially in the tropics, these species should be central to carbon sequestration efforts. Δ

High-protein perennial leaf crops

This chart compares protein yields per hectare, not total crop yields, as comparing leaves to beans and nuts is not very helpful. Annual crops, soybean and spinach, are provided for comparison and are marked with an asterisk—note that perennial leaf crop protein/ha is very competitive with annual yields.

Latin Name	Common Name	Leaf Yield (tons/ha)	Protein (%)	Protein Yield (tons/ha)
Crotolaria longirostrata	Chipilin	5-11 dry	38% dry	2.0-4.2
Morus alba	Mulberry	16-52 fresh, 8-13 dry	15-27% dry	1.2-3.8
Moringa oleifera	Moringa	10-50 fresh	5.5% fresh	0.5-2.7
**Glycine max*	Soybean	1-5 dry beans	35% dry	0.3-1.8
Cnidoscolus chayamansa	Chaya	20-30 fresh	5.7% fresh	1.1-1.7
**Spinacea oleracea*	Spinach	10-35 fresh	2.5% fresh	0.2-0.9

Edible perennial oilseed yields

In the tropics, perennial oil plants already dominate. In colder zones, pecan oil yields 150% of rapeseed, the highest-yielding annual oilseed in the table. Note in particular the many palms. Annuals are provided for comparison and are marked with an asterisk.

Latin Name	Common Name	Climate	Oil yield (tons/ha)
Elaeis guineensis	African oil palm	humid tropics	5.0
Acrocomia aculeata	macauba palm	semi-arid tropics	3.7
Caryocar brasiliense	pequi	semi-arid tropics	3.1
Caryodendron orinocense	inche	semi-arid to humid tropics	3.0
Mauritia flexuosa	buriti palm	humid tropics	2.7
Cocos nucifera	coconut palm	humid tropics	2.2
Persea americana	avocado	humid, semi-arid, highland tropics	2.2
Bertholletia excelsa	Brazil nut	humid tropics	2.0
Macadamia ternifolia	macadamia	humid tropics and subtropics	1.8
Attalea speciosa	babassu palm	humid tropics	1.5
Carya illinoiensis	pecan	temperate to subtropics	1.5
Attalea funifera	piassava palm	humid tropics	1.1
Olea europea	olive	Mediterranean	1.0
**Brassica napus*	rapeseed	cold temperate	1.0
**Papaver somniferum*	poppy	cold temperate, Mediterranean	0.9
**Arachis hypogaea*	peanut	worldwide	0.8
**Helianthus annuus*	sunflower	worldwide	0.8
**Oryza sativa*	rice	humid worldwide	0.6
Cucurbita foetidissima	buffalo gourd	cold to tropical arid	0.6
Corylus spp.	hazel	cold temperate	0.4

Runner Beans. Photo by Richard Smedley.

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Chestnuts

Staple Food Crops Do Grow on Trees

Frank Salzano

The greatest tree food crop of the world—the chestnut—is not grown within the United States, except very little. We can grow it. We will some day. It is a crop that would pay on our eastern hill farms. It would change much of our so-called "marginal land" from unprofitable to profitable farming land. Just now only a few people, regarded as cranks, are trying to grow it.
—Carroll D. Bush, *Nut Grower's Handbook,* 1946

THESE WORDS WERE PUBLISHED a few months after the end of World War II. Imagine if all the human energy that went into that era's victory gardens and domestic re-organization of society had been used to create groves of chestnut trees integrated into forest gardens and agroforestry plots. Dare I say we would have found our way back to the Garden of Eden by now? The World War II mobilization metaphor stresses the need for urgent social change on a massive scale. From peak oil and climate change to overpopulation and global food scarcity, it's clear that we can't go another 65 years living the pretense of the industrial-growth narrative. I'm not sure when, or how severely, the consequences of that narrative will come to fruition, but I'm certain of one thing: throughout the temperate zones, the chestnut is one of the best plants with which to create permaculture systems. It will allow human cultures to create a regenerative post-industrial livelihood.

A food powerhouse

Let's put the potential yields in context. Chestnut trees can produce two tons of nuts per acre—that's 4,000 lbs. from 80-100 trees. Typical US wheat production is 1,800-3,000 lbs. of grain per acre. And you can't create a medicinal and edible understory in a wheat field. Depending on the species, variety, and care, chestnuts will start to bear at 4-5 years of age, much earlier than other nut trees. Some Japanese varieties can fruit as early as their second year. By year 10, chestnuts can yield 55-110 lbs. per tree; mature Chinese chestnuts yield 150-300 lbs. The largest-yielding chestnut tree ever recorded produced over 1,100 lb. of nuts in one season. Staple food crop? There is a reason why the chestnut has been called "the bread tree" in Europe for centuries, and why the Romans called the chestnut "the acorn of Zeus."

Cultural and ecological history of Castanea

The chestnut was an important food crop to ancient societies and indigenous cultures throughout the Northern Hemisphere, and besides oak, is the only temperate-zone tree to have been used as human staple food. In Japan, archaeological sites from 8,000 BCE reveal evidence of centralized processing and consumption of the nuts, and the Japanese have been breeding chestnuts *(C. crenata)* for over 1,000 years. China, today the world's largest commercial chestnut producer *(C. mollissima),* also has a rich chestnut orchard tradition dating back 3,000 years.

Chestnuts flowering at the Urban Edible Park in Asheville, North Carolina, with City Hall in the background. In the foreground are female flowers and newly forming hulls.

Europeans began breeding chestnuts *(C. sativa)* during the classical era of ancient Greece. Finding the tree useful not only for its nuts, but also as timber for vineyard supports, the Romans spread chestnuts throughout Europe. Chestnuts found their way into the stories and mythologies of the time. In Greek mythology, Artemis, the goddess of forests and the chase, escaped Zeus by shape-shifting into a chestnut tree and hiding in the forest. In the mountainous regions of Italy, there is a folk tradition of telling children that babies come from chestnuts. During the Middle Ages, a mountain culture in present-day Italy had a liturgical calendar that began with the chestnut flowering, and in the literature of the time, one can find frequent references to the *castagnatores:* skilled horticulturists who specialized in farming chestnuts on the hillsides. Chestnuts even had their place in fighting fascism. When the republican guerrilla armies of Spain retreated into the forests, local farmers supported the resistance by sharing their nut groves with the anti-fascist soldiers.

The significance of the American chestnut *(C. dentata)* in native forest ecosystems can hardly be exaggerated. It was the dominant canopy species in eastern forests from the time of European settlement until its 20th century demise. Many ecologists believe that 25% of the trees in western North Carolina were once chestnuts. The chestnut tree was a significant member of many eastern forest communities, including the northern hardwoods, pine-oak-heath communities, rich Appalachian coves (enclosed valleys), oak-hickory forests, and piedmont river-bluff forests, and was once the co-dominant species in both the high-elevation red oak and low-elevation chestnut-oak communities. Within these communities, chestnuts were by far the best and most reliable nut for wildlife, including turkey, black bear, raccoon, deer, squirrel, and passenger pigeon. Innumerable accounts attest to the devastating effects of the chestnut blight on eastern wildlife. The trees were an important part of the phosphorus cycle—migrating passenger pigeons, fattened on chestnuts, dropped their fertilizer on the land below. Chestnuts also dropped their nitrogen and potassium-rich leaves into the forest litter. The leaves can recycle 24 lb. of nitrogen and 10 lb. of potassium per acre.

Native peoples were intricately connected to the rich native forests of the Eastern US. As the central member of those forests, the chestnuts provided food, hunting grounds, shelter, medicine, bark for tanning hides. The Cherokee used the leaves to treat heart ailments, sores, coughing, and typhoid; they used the bark to stop bleeding after birth. The chestnut made its way into indigenous American mythologies, as it did in Europe. There are many native stories from the Iroquois territory in New England down to the Natchez lands in Louisiana that revolve around the chestnut. Native peoples may have expanded the range of this species, as they did with the paw paw and the black walnut.

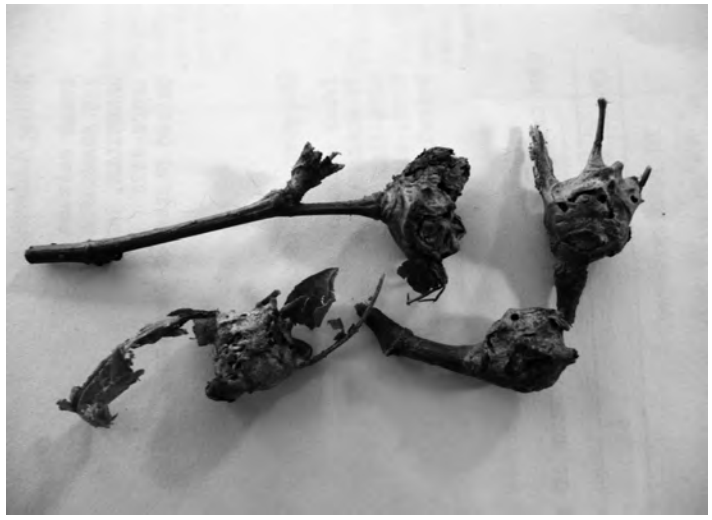
Settlers from the Old World also found the chestnut to be a key part of life in eastern North America. The rot-resistant chestnut wood was used for everything associated with building, including timber framing, shingles, and fence posts. The nuts were fed to hogs and other livestock. I have personally talked to old-timers in North Carolina who remember their grandparents talking about how the hogs and black bears didn't taste as good after the chestnuts died. Like the natives, they also used the tree for medicine, food, and bark tanning. The nuts were also harvested and sold for supplemental income to nearby cities in the fall. Many Appalachian communities maintained a "chestnut commons." The settlers ran animals and harvested nuts from these stands of thinned chestnut forest in the fall mast season. This commons was particularly beneficial to slaves, sharecroppers, and the poor who didn't own enough land to support their animals.

In North America, the reign of the chestnut was interrupted in 1904, when the chestnut blight was found in the Bronx zoo. It spread up and down the mountain ranges of the East in less than one generation, and by 1940 had wiped out virtually all the American chestnuts in their native range, leaving only stump sprouts, outlier populations, and one of the biggest disturbances to Eastern forests in recent history.

The botany of Castanea

The genus *Castanea* includes four tree species and several shrubs from Asia and North America, among which is the Allegheny chinkapin *(C. pumila). Castanea* is a member of the Beech Family (Fagaceae) which embraces more than 600 species around the world, including the oaks and beeches.

Chestnut trees bloom about two months after their spring growth begins. Appalachian folk described the chestnut flowering season as "the whitening" because the hillsides in early summer would be absolutely covered with white chestnut flowers. Like most nut trees, chestnuts are monoecious, meaning the male and female flowers are borne on the same tree, but in separate flowers. Their catkins can be seen long before the flowering stage, and though they flower relatively late in the season, the immature catkins can be damaged by frost.



Galls from a chestnut in western North Carolina infested with Japanese Gall Wasp, the main pest of chestnuts in the Southeast.

Chestnuts have two types of catkins. Unisexual catkins at the base of the new shoots produce staminate (male) flowers and pollen, while bisexual catkins, toward the tip of the shoot also produce pistillate (female) flowers and eventually burs. This organization is one reason why chestnuts need a good amount of light to produce abundant flowers. Branch tips with more vigorous growth are more likely to produce female flowers. As the shoot grows beyond the catkin-bearing area, it forms vegetative buds in the leaf axils: these contain the next year's flower buds. The trees also have a natural Plan B. Not all buds break with the first flush, so if a late frost does cause damage, a reserved set of buds allows the tree to produce at least some nuts. Lght, water, and soil fertility are all important to achieve vigorous shoot growth and thus, lots of flower buds.

As flowering begins, the staminate flowers start to shed their pollen; within a few days, pistillate flowers open and become receptive. Later, the bisexual flowers open and shed even more pollen. Even though the pollen-shed period is longer than the receptivity period, and they may overlap somewhat, chestnuts are not generally considered self-fertile, so cross-pollination is strongly recommended. Warm, dry, windy days are best for good wind pollination, but bees, butterflies, and beetles all help, especially when the weather isn't ideal for wind pollination. Chestnut honey is another benefit from maintaining beehives near a chestnut orchard. Because chestnuts benefit from cross-pollination and wind pollination, plant several varieties—not many clones of one tree, and space at no more than 30m/100' apart.

From flowering to nut ripening takes ten weeks or longer. The last two weeks are vital, as the nut kernels put on half of their mature weight in that brief period. Strong autumn winds can knock off undeveloped nuts—windbreaks are helpful in windy areas—and drought or cold weather can slow growth in the critical last weeks. A single tree can drop nuts over a period lasting from a few days to two or more weeks. One can usually harvest nuts for 4-6 weeks from trees in the same area.

Growing and caring for chestnut trees

Chestnuts like well-drained, slightly acidic soils (pH 5.5-6.5). They are fairly drought-tolerant once established, although moist sites are also good, as long as soils are not waterlogged. Heavy clays and limestone soils are problematic. Sloping ground is good for water and air drainage. Avoid frost pockets. Chestnuts need 450-650 chilling hours, and are very cold-tolerant once fully dormant. In places with very hot summers, they will tolerate partial shade. They are generally planted 40' apart, but it is not uncommon to plant closer and thin them later. This can be a great way to start a seedling nursery; once you've thinned the stand, plant nitrogen-fixers or other edible plants in between the established chestnuts.

The rot-resistant chestnut wood was used for everything associated with building...

After planting chestnuts, you'll want to encourage root growth to get the tree off to a healthy start. They are tap-rooted, so don't like being transplanted. Plant where you won't need to move them. During the first year, use a fertilizer that promotes root growth: minimize nitrogen. Water the trees well and irrigate them if necessary. Mulching to suppress weeds and hold water is a good idea, but keep the mulch off the trunk to protect the trees from critters that might girdle them.

Pruning technique should be appropriate to the species and variety, and to the goal for the orchard. Traditional orchard trees are pruned to an open-vase form. The contemporary Italian/French method of pruning for European chestnuts and hybrids is to create an upright pyramidal structure with a central leader, but this is a strategy for commercial production aimed at maximum yields through higher tree density. This method may be appropriate for small permaculture sites. Asian species will want to spread out, so it is best to give them as much space as possible. Prune in the early summer when it is hot and dry to minimize the chance of infection. Prune saplings by pinching buds to encourage a good whip and upright growth pattern. This also helps get the trees out of the range of deer as early as possible. Once the trees are established, pruning should be minimal unless required by a particular space configuration.

On less than ideal soils, a well-designed fertilizer strategy helps young trees get established, bolsters disease resistance, and fosters higher yields. Fertilize in early spring to encourage vigorous shoot growth. Avoid nitrogen-rich fertilizer the first year. Apply a seaweed solution or similar amendment to reduce after-planting or transplant shock. Nitrogen shortage can lead to a lack of vigor and poor seed production, while excess nitrogen can result in small nuts, an increased chance of anthracnose, and a delay in tree maturity. An easy rule to follow is to apply one pound of organic 5-10-5 fertilizer for every year of growth on a vigorous tree, or every inch of tree-trunk diameter on less vigorous trees. Martin Crawford, director of the Agroforestry Research Trust, has written an informative pamphlet on chestnuts which covers various organic fertilizer strategies. He mentions intercropping nitrogen-fixers, such as *Elaeagnus spp*. and Italian alder *(Alnus cordata),* with chestnuts at a ratio of one nitrogen-fixer to two chestnuts. I am currently setting up a similar system on an Appalachian homestead, using goumi *(Elaeagnus multiflora)* and black locust to fix nitrogen. Black locust is an ideal candidate as it has a thin canopy and good coppicing potential. Comfrey mulch or compost tea is an easy way to supply potassium. Crawford also explains a comfrey-mulching system in which each chestnut has five or six comfrey plants to meet its potassium needs.

Disease and pests

In addition to blight, chestnuts are susceptible to a few other pests and diseases. Anyone who has ever harvested them has come across chestnut weevils. These lay their eggs in developing nuts, eat their way out, and over-winter in the leaf litter. A good way to suppress their numbers is to run poultry under the trees. You can also treat the nuts for storage by giving them a water bath at 120ºF for 20 minutes to kill the larvae; this leaves the seed viable. The Oriental Chestnut Gall Wasp has spread throughout the Southeast and into parts of the Midwest. The wasps lay their eggs in the tree buds, and developing larvae cause the shoots to become stunted. The Japanese chestnut is the most resistant species, and research in both Asia and the US promises natural control methods. For many people, the biggest problem with attempting to establish trees will be deer. I have witnessed deer in the winter eating every single chestnut in a stand of dozens back to the ground! Use tree guards, fences, dogs, shooting and eating them—whatever it takes—to protect your trees from deer.

Ink disease is a root-rot fungus that attacks European chestnuts and also killed off many of the American chestnuts in their southernmost range during the late 1800s. The fungus attacks the root bark, starting at the smallest feeder roots and eventually works its way to the base of the trunk. It causes the roots to stop growing, crack open, and release a sap that turns black from oxidation of the tannins. It is not necessarily fatal. Preventive measures include planting trees in well-draining soil and inoculating seedlings with mycorrhizal fungi of the *Basidomycetes* group, like *Leucopaxillus cerealis*.

Chestnut blight has been by far the most devastating problem in chestnut forests and husbandry. As mentioned above, blight has nearly eradicated the American chestnut. It attacks the trees via wounds on branches, works its way under the bark, secretes toxins, and causes the cambium cells to collapse, eventually killing the trunk. In Europe, blight-infected trees are treated with hypovirulent strains of the blight. These outcompete the deadly strain, allowing the trees to form a barrier of cells to defend themselves. The American Chestnut Foundation has been crossing the American with the Chinese chestnut to create a blight-resistant American tree to use in reforestation. They are having good results with their latest BC3F3 hybrid, whose genetics are very similar to the American chestnut and which displays good blight resistance so far. For now, planting Chinese and hybrid chestnuts is the best bet to avoid blight.

I am currently setting up [an intercropping] system on an Appalachian homestead, using goumi and black locust...

Seed starting and propagation

Starting chestnut trees from seed isn't difficult. Collect the seeds as soon as they fall from the tree—they lose viability quickly from drying out or from weevil damage. Soak them for two days in water before stratifying. If weevil infestation is suspected, process them with a warm water bath, as described above. They need to be cold-stratified for 30-90 days between 32-36ºF. Make sure they don't freeze, dry out, mold, or rot. Store them in the refrigerator or another temperature-controlled space in peat moss or any other medium that keeps them moderately moist. Sow them directly in the ground in the fall, placing hardware cloth around them to deter animals. Mulch to insulate them against freezing and thawing during the winter. Plant at a depth of 5cm. Place the nut on its side, not right-side-up, to promote straight growth. The ideal germination temperature is 69ºF at night and 86ºF during the day.

Chestnut varieties have been selected and bred for various traits, especially nut size, but also disease resistance, growth structure, pollination, and flavor. Vegetative propagation is usually by grafting or mound-layering. Graft incompatibility limits the choice of rootstocks. Graft once the rootstock has fully leafed out, between mid-spring and mid-summer. Store the scion cold and dormant, and graft on a warm, dry evening. Chestnuts can be grafted using the whip-and-tongue, splice, or kerf grafts, and they can also be top-worked by T-budding or chip-budding in the late summer or early fall.

A few more Castanea cranks

Today, more people are growing chestnuts than in 1946 when Carroll Bush published the *Nut Grower's Handbook,* but we could always use a few more chestnut "cranks," especially from the cutting-edge world of permaculture and agroforestry. The American Chestnut Foundation is currently selling their most recent American hybrids (two trees for $350), and has a program to plant the tree in experimental orchards for private landowners who have the space and interest. Several generations of scientists, hobbyists, nursery people, growers, and others have been working with the chestnut. They have found improved ways to grow them, selected and bred new varieties, created organizations to share knowledge and practices, and promoted the value of the chestnut all over the temperate-climate world. The chestnut—maybe more than any other nut tree—has an important role to play in our future in promoting wildlife habitat, forest restoration, climate change adaptation, experimental forest gardens, public edible plantings, and as a staple food crop that can feed not only our stomachs, but our hearts and our connection to the more-than-human-world. Δ

Frank Salzano lives on his homestead, Chestnut Hill, in Madison County, North Carolina, where he is establishing a chestnut-based forest garden. He is hoping to launch an organization this year to promote experimental forest gardens in southern and central Appalachia. He can be reached at franksalzano@riseup.net. This article appeared in similar form on Frank's blog: http://appalachiansouthforestgardening.blogspot.com.

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Acorn: the Perennial Grain

Kyle Keegan

OAKS, OF THE GENUS *QUERCUS*, are widely distributed over the temperate parts of Europe, Asia, North Africa, and North America. Their edible nuts, acorns, were a reliable staple food of many cultures before the beginnings of agriculture. Even today, acorns are sold in the markets of Korea, China, North Africa, and in some major cities of the US.

Growing staple crops on marginal land has been an age-old struggle. Carbohydrates, the source of basic energy, drive many of life's processes and are a basis for survival. However, most agricultural practices that rely on annual plants contribute to the destruction of fertile soils. Over-tillage as practiced by modern farmers results in the loss of soil carbon and soil biodiversity. In contrast, long-lived oak trees provide not only sustenance, but also stabilize soils and climate while offering shade, shelter, fuel, and medicine.

Thus, a perennial-based agriculture should be the aim for any civilization seeking solutions to the problems of excess tillage and fertilizer inputs—problems long associated with annual crops. Some evidence suggests that modern annual agriculture may be directly related to the past mismanagement and destruction of oak woodland ecosystems worldwide. (1) Remaining oak woodlands may provide the most elegant model for a perennial polyculture in temperate North America.

Dana and Kaliana prepare tan oak (Notholithocarpus densiflorus) *acorns, Fall 2010, Salmon Creek, Humboldt County, California.*

…oak woodlands may provide the most elegant model for a perennial polyculture in temperate North America.

Unlike corn, barley, wheat, or rice, acorn requires no tillage, and neither fertilizer inputs nor irrigation. Acorns are relatively simple to collect, store, and process, and they provide a nutrient-rich source of food for humans. The trees sequester carbon, moderate climate, build soil, stabilize hillsides, and provide essential habitat for hundreds of species of animals. (2) Oaks can be grown on steep or unstable land where annual crops would lead to erosion. Most species of oak can be grown in arid or semi-arid landscapes where annual grain crops would be problematic.

The yields of acorn compare well with those of many grains; established oak woodland has been recorded to yield up to 6,000 lbs. of acorn per acre. (3) Sadly, the health of many oak woodlands is impaired by the loss or lack of indigenous management (including prescribed burning). As a consequence, acorn production has declined and crop yield has become less consistent. (4, 5, 6)

Acorn nutrition

Acorn was a staple food for most of California's indigenous cultures. It is a rich source of carbohydrate as well as protein, essential amino acids, trace minerals, and vitamins (especially A and C). California *Quercus spp* range from 3-5% protein, 4-9% fat, and 38-69% carbohydrate. (7) Producing acorn flour takes time and energy, but the processing input is probably less than that for a cereal crop, while the nutritional value of acorn compares favorably with wheat or barley. The quality and flavor of acorn oil is reportedly comparable to olive oil, and the residual nut meal can still be used as animal fodder after the acorns have been pressed for oil.

What were we thinking?

Thirteen years after moving onto our rural land, my family began to focus attention on the staple food crop that had sustained native Californians for over 10,000 years. It now seems silly that for over a decade we walked a narrow winding path through a thriving perennial polyculture (oak woodland), stepping on or over an exceptional food source (acorns), to get to our cultivated crops!

This past fall, thousands of tan oak (*Notholithocarpus densiflorus*) acorns fell on our driveway. Out of respect, and with a willingness to receive the trees' offering, we reached out to the local community for knowledge of how to process, store, and prepare food from the nuts. At first, most of the responses we got from neighbors and old-timers regarding the use of acorn ended in comments like, "It's too darn much work!" or "They're just too bitter!" Luckily, an experienced neighbor provided the inspiration and support we needed to get started.

Collecting and cracking

With two pairs of hands, we were able to collect 50-60 lbs. of acorns in an hour just by picking them up from beneath the trees. We dumped the acorns into a large container filled with water—good ones sink, bad ones float. Next, we poured the acorns onto a large wooden board. Using a rock pestle we found here many years ago, we cracked as many as we were ready to use. Removing the hard shell, we set aside less desirable pieces for our chickens. One might want to cover the acorns with an old towel or cloth while cracking them to keep the pieces from scattering. Another possibility is to put handfuls of acorn on a solid piece of wood on the ground, cover them with a cloth, and then crack the nuts open with a square-bottomed soil tamper. We'll try this technique to speed up the process in the fall. A hand-cranked nutcracker reportedly works quite well for acorns. (8)

Acorn meal just feels right to eat. Last fall, I found myself snacking on tablespoons of raw acorn meal as I went...

Leaching

After shelling the acorns, they must be leached to remove bitter tannins. (9) To do this, we grind the acorns roughly in a blender, then put the chopped nutmeats into 1/2-gal. jars fitted with screened (sprouting) lids. We cover the nuts with cool water and keep them in a refrigerator (or outside, during cold weather). We change the water and rinse a couple of times a day for 5-6 days. As part of this process, we skim off any floating acorn skins. When the acorn meal is no longer bitter to taste (5-6 days), we dry it for storage. Any remaining acorn skins can be winnowed when the acorn has been dried.

Bitterness can be removed more quickly by pouring boiling water over the acorn meal a few times, but this tends to change the color of the meal and may decrease its nutritional value. We prefer the cold-water method. Others have leached acorn meal by placing crushed acorn in a mesh or burlap bag and submerging the bag in a clean stream of moving water for some days to remove the tannins.

One of our batches was finely ground in a hand mill after chopping and drying, and then placed in a fine mesh bag used for making nut-milk and set outside in a basin of water. It froze and thawed a few times in the cold weather. When we rinsed the meal, it was the least bitter we had processed for the least amount of effort. Grinding the acorn more finely increased the surface area for leaching; the freeze-thaw process further broke down the cell walls. We'll experiment more with this technique.

Storage and use

After the tannins have been removed, acorn meal can be dried and stored in the refrigerator, freezer, or potentially outside if the weather stays cold enough during the winter. Uncracked acorns can be stored up to a year (native tribes stored them for two years or more). Be sure to do the float/sink test and cull any rotten or wormy ones. Then dry the unshelled acorns and store in a rodent-proof bin in a cool, dark place. They can be processed as needed. Acorns can also be sprouted before processing. As with other nuts and seeds, their nutritional value increases with germination.

Acorn meal just feels right to eat. Last fall, I found myself snacking on tablespoons of raw acorn meal as I went about my fall chores. When we are ready to use our acorn, we put the roughly ground chunks through a hand-cranked grain mill, turning it into a meal or fine powder which can be incorporated into soups, breads, and breakfast cereals. Recipes abound for the use of acorn. It can also substitute partly or wholly for corn flour in recipes that call for that.

Fodder

Our chickens eat the nut meats after the shells have been cracked. We keep a covered container of acorns near our flock. When needed, we place a handful into a bucket and then use the blunt end of a cut fir pole to crush them before throwing the pieces out to the fowl. Their willingness to consume the acorn increases after the tannins have been removed, but we save the majority of processed acorn for ourselves.

Acorns can be fed to pigs and other livestock as a supplementary grain. They are a favorite food of deer, black bear, squirrels, some birds, and rodents. We pick up only what we are able to use and leave the rest for the non-human residents of the land.

A long-lasting perennial polyculture

In permaculture, we create guilds of plants that are mutually beneficial in order to increase the sum of all yields, and to minimize labor and external inputs. We understand that, in our designed systems, resiliency is dependent upon diversity. The synergy between interdependent parts forms strong bonds that can survive and adapt to changing conditions. A mature oak woodland embodies the essence of our most demanding design criteria—a resilient and long-lasting foundation of complexity, reinforced by the species it supports and is supported by.

Foraging in filtered light under the canopy of black oak *(Q. kellogii)* and Oregon white oak *(Q. garryana),* a diverse polyculture unfolds, revealing foods such as miner's lettuce *(Claytonia*

Grandmother white oak (Quercus garryana) provides food, shelter, shade, and beauty. Photo by Kaliana Keegan.

perfoliata), chanterelles *(Cantharellus cibarius),* black trumpets *(Craterellus cornucopioides),* serviceberry *(Amelanchier spp.),* wild strawberry *(Fragaria vesca),* numerous edible species of geophytes (perennial tubers, corms, and bulbs), and licorice fern *(Polypodium glycyrrhiza),* an edible epiphyte that grows on the mossy trunks of shady oaks. Along the woodland edges and in

During days of wild-food gathering, we are often serenaded by neotropical and resident songbirds overhead.

sunny openings, we have collected wild rose hips *(Rosa californica),* gooseberries *(Ribes spp.),* and blackcap raspberries *(Rubus leucodermis).* If one choses, there are California quail, mule deer, and wild turkey.

Here on the North Coast, a tan oak *(Notholithocarpus densiflorus)* polyculture can yield huckleberry *(Vaccinium ovatum),* thimbleberry *(Rubus parviflorus),* chanterelles, boletes *(Boletus spp.),* oyster mushrooms *(Pleurotus ostreatus),* Oregon grape *(Mahonia spp.),* redwood sorrel *(Oxalis spp.),* and hazelnut *(Corylus cornuta)*—just to mention a few choice foods. During days of wild-food gathering, we are often serenaded by neotropical and resident songbirds overhead. As they forage on the abundance of insect biomass, their fertile guanos fall to the forest floor in return.

A reintegration revival

Ecologists use the term *trophic cascade* to explain the negative consequences of changes that stem from often misunderstood linkages among various species within a food web. In a top-down induced trophic cascade, the removal of a key predator from an upper trophic level (wolf, grizzly bear, cougar) may set off a cascade of events that later reveals interdependent bonds intrinsic to the ecosystem. Species in lower feeding levels that once appeared to be disconnected from the larger predators are shown to be quite dependent. One such example is the extermination of the wolf in Yellowstone National Park. This was followed by the strange disappearance of songbirds and beaver in the park's valleys. Biologists were stumped by the troubling phenomenon until wolves were reintroduced, after which the birds and beaver returned. An over-simplified explanation is as follows: no wolves = lazy elk = overgrazing of riparian habitat in valleys = no willows = no birds and beaver = overall decline in ecosystem health and vibrancy.

Here in California and across the entire continent, we are experiencing symptoms of a multitude of trophic cascades that have reduced the carrying capacity of entire landscapes. Perhaps as important as the loss of key predators is the loss of the human connection to the landscape. The removal of humans from direct participation in the natural order has resulted in a profound trophic cascade.

The forced removal of indigenous peoples from their native lands has disrupted and displaced over 10,000 years of embedded knowledge and connection to place. This loss, coupled with modern society's belief that "nature" is best left alone, has caused the separation-induced stagnancy of many of our ecosystems, complicated and diverse natural communities that have co-evolved with the careful tending, harvest, and propagation practiced by deeply connected human hands.

The oak woodlands, savannas, and chaparral have grown lonely, and we will have to overcome our separation consciousness with a reintegration revival! As students of permaculture, we should seek not only to design food forests, kitchen gardens, and animal-forage systems close to home, but also dare to venture into what we have come to mistakenly call “wilderness” to find our place as an integral part of natural systems. In order to accomplish this, we will need to seek out the traditional ecological knowledge of the native people who once tended the land. It will take a commitment to staying in the place we choose to sink our roots. The transient nature of our culture continues to sever the land-human connection, a bond that depends on prolonged observation and knowledge passed on by the people of that particular place. In Gary Snyder's words, “Find your place on the planet, dig in, and take responsibility from there.”

Recovering and protecting oak woodlands

An acorn falling from the boughs of an ancient mother oak comes to rest on a very different landscape than it would have centuries ago. The perennial bunchgrasses that once carpeted the earth beneath the oak canopy have been replaced by annual grasses introduced from other lands. The park-like feeling described by early explorers who walked into oak woodlands kept clear for thousands of years by indigenous burning is being lost. The woodlands are now being invaded by the succession of Douglas fir *(Pseudotsuga menziesii).* The loss of large predators such as the mountain lion and grizzly bear has altered the ability of woodland ecosystems to regenerate due to the unchecked proliferation of browsing deer. In California, large areas of oak woodland have been converted to monocultures for the fast-growing wine industry. The introduced pathogen *(Phytopthora ramorum),* otherwise known as Sudden Oak Death, has devastated entire oak forests, altering species composition on tens of thousands of acres of once plentiful oak-dominated polycultures. (10)

The health and resilience of oak-woodland ecosystems are closely connected with the co-evolutionary presence of low-intensity fires. Of all the negative forces contributing to the conversion of oak woodlands, the ongoing suppression of fire may pose the most serious threat to their long-term survival.

The health of human cultures and oak-woodland ecosystems requires a reciprocal act of reconnecting. Perhaps we should view “wildlands” more as “cultural landscapes,” places where we can learn to tell a new story of now that begins as we re-enter our food webs responsibly. As we design more productive and accountable food-production models, those of us fortunate enough to live in acorn territory must not forget the potential of the life-giving oak. Δ

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Of all the negative forces contributing to the conversion of oak-woodland habitat, the on-going suppression of fire may pose the most serious threat to their long-term survival.

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Movement Musings

Reflections on Disturbance and Resilience

Onagawa

Creighton Hofeditz

I HAVE ALWAYS FEARED CHAOS. A childhood filled with moves reconciled me to change, and the unpredictable challenges of travel can easily be filed under "adventure." But chaos? How could the screams, the carnage, and the upheaval I often saw from a safe distance on TV be cast in a positive light? Likewise, as I first learned more about climate change, peak oil, the credit crisis, and the chaos they will almost certainly bring, I was inundated with a deep dread and pervasive worry. Five days in a town called Onagawa helped to change my perspective and give me a new kind of hope.

From July 2009 to July 2011, I taught English in two junior high schools in Kanazawa, Japan. One afternoon in the early spring of 2011, all my classes were cancelled, and I spent much of the day on the computer wandering the Internet. After hours of screen time, my spongy brain and tired eyes were suddenly compounded by a bout of dizziness, and I decided it was time to get up and walk around. I closed my laptop and stood up to stretch, thinking for the seven thousandth time that I needed to spend less time online. Fifteen minutes later I learned that my dizziness was actually caused by the local reverberations of the largest earthquake in Japan's recorded history.

Kanazawa is on the western coast of Japan, more than 300 miles from the epicenter of the Tohoku earthquake. The 9.0 tremor registered only as a 3.0 in my area. The outpouring of concern from friends and family was sincere but needless; my daily life was essentially unaffected. In fact, the quake and tsunami happened the day before my school's graduation ceremony. Most of the Japanese teachers were busy preparing, and in an impressive display of the-show-must-go-on, they continued to bustle around the staff room with news of the disaster on the TV in the background. From afar, Japan can seem like a tiny country, but it's large enough that my initial experience on March 11th and the days following was in many ways similar to what it would have been in America.

Earthquakes are extremely common in Japan, and it took some time before the scale of what was happening became apparent. Every hour and day brought an escalation of damage estimates and casualties. On Saturday the 12th, my third-year students happily walked out into sunshine, while on the other side of the country, thousands of other students woke up to a shattered landscape.

A tragedy unfolds

The days in Kanazawa were soon filled with innumerable, unbelievable pictures and video of the tsunami damage and ensuing humanitarian crisis, all underscored and at times over-

Two battered but living sakura *(cherry) trees.*

shadowed by the meltdown of the Fukushima Daiichi nuclear reactors. Refugee camps, empty shelves, and gas lines dominated the news—even the famed (and perhaps media-inflated) Japanese stoicism broke down as men wept openly on camera for their lost families. It was chaos, breakdown, and carnage, and yet my first and surprising instinct was to gravitate toward it.

Because of the difficulty of obtaining significant time off and the interruption of national holidays, it wasn't until July that I was finally able to travel to the tsunami zone to volunteer. Fundraisers, charity concerts, and blood drives were wonderful and constructive ways to engage with the disaster, but I felt a strong need to be there in person, to do some kind of physical labor to help the country that had welcomed and hosted me so generously for almost two years. After securing the time off from work, I planned to travel alone to meet a journalist friend named Stephen who was spending a month in Onagawa, Miyagi prefecture. He was both volunteering and gathering interviews for a possible book project.

Onagawa lost almost 10% of its population of 10,000 to the tsunami, the highest percentage of any affected town. While running water was available, I had to carry a tent and five days' worth of food on a series of buses until I reached Onagawa to register with the volunteer center there. This was four months after the earthquake. Though some trains had started running again in Miyagi, improvised bus routes were the only way to get out to the more rural coastal areas.

I experienced a progression of infrastructure degradation as I travelled. There were some small signs of seismic damage in Sendai, the metropolis capital of Miyagi prefecture, but otherwise it appeared to be like any other large Japanese city: full of businessmen, crowded public transport, convenience stores, and massive shopping areas in full flow. The next stop was Ishinomaki, a large city where a third of the homes were damaged in the tsunami. As the bus wound through the city, damaged houses alternated with beached boats and razed lots.

I dozed off briefly as the bus made its way through the forested hills beyond Ishinomaki, and woke to find the trash heap of a town that Onagawa has become. Many of the buildings left standing after the waves had been brought down by the military and construction crews, and the degree to which the town was wiped clean was startling and unlike anything I've ever seen. Gray concrete foundations covered in bleached dust and dirt stretched up into the hills and down to the waterfront, where a few condemned buildings still stood.

After the deluge

All the life in Onagawa had been moved to the edges. Refugees, the military, and volunteers were centered around an old sports center on a hill, while others lived and worked as best they could in the higher areas farther up the valley. I approached the volunteer center tent with some uncertainty, but was quickly welcomed with easy smiles and a quick registration. I set up my tent and went out with a volunteer crew that first afternoon to clear rubble.

Something I hadn't realized was that there would be no rebuilding yet—there was still too much trash. The tsunami left behind dead fish, crushed houses, and trees killed by salt water—twisted metal girders, slashed wall hangings, soggy tatami floor mats, shoes, stuffed animals, toys, bikes, boats, refrigerators, vending machines, power lines, doors, windows, ceiling tiles, computers, and streetlights. Almost everything that made up the daily life of Onagawa had to be pulled apart, sorted, and piled into heaps to be disposed of, before any new construction could take place.

The actual volunteer work was varied and often heavy. I cleared buildings, sorted boxes of donations, moved hospital beds, and cleaned boxes of recovered family photos.

From the margins toward an empty center

The Japanese volunteers were an odd and compelling collection of people: a musician and part-time teacher, a scruffy college student, a self-employed carpet installer who shut down his business to come and stay for months, and a sinewy leather-skinned retiree of at least 70 with flinty eyes. Some days, a quiet and eccentric middle-aged man in an all-pink work suit joined us and attacked the work with an almost dangerous ferocity. He had lost family in Onagawa. Some were locals, but many came from all over the country—these people from off the beaten path of successful society were the backbone of the volunteer effort.

One of the more discouraging things about life as a foreigner in Japan is how difficult it is to integrate into communities, to be accepted as a person instead of a novelty. The displaced people of Onagawa and the Japanese volunteers I met never failed to say hello or to welcome me naturally and generously. The town had been decimated and relocated, but it was striking to see the way the community reformed itself around a new situation. Old men sat outside the refugee center, smoking and telling stories, while junior high students played improvised games of baseball and soccer on the grounds. Families walked together to the tennis courts, where the military ran the traditional public baths for men and women in the evening. The soldiers seemed to know all the children, and long lines of clothes hung out to dry over the bleachers. The background and particulars had changed, but life pulsed on.

Aside from my own observations, my friend Stephen's contacts and interviews afforded me greater insight to the stories occurring all around. For the first time in the town's history there was a newspaper, created to disseminate news and events for the refugees. Several young local men had taken advantage of government funding to start a radio station, also a first for Onagawa. These had been socially awkward shut-ins who used to spend more time with their computers than out in the community, but now they were integrally involved in the relief effort. All around, people from the margins were stepping in to fill the voids and stem the chaos. People didn't talk about how to recreate the old Onagawa, but rather about how to make a better Onagawa for the future: a younger, more vibrant, more diverse, and accessible Onagawa. Stephen told me how one man pointed out the difference between Ishinomaki and Onagawa: in Ishinomaki much of the infrastructure remained intact, but in Onagawa, the scale of the destruction might enable a more complete rethink and reconstruction of systems.

A wall of recovered and restored photographs. Each picture is linked to an album so that survivors can find and retrieve family photos

Midway through my time there, Stephen took me to the improvised school where he taught some English classes. There we met with a national education activist who was working with the head of the local schools. She acknowledged that the tsunami was a terrible disaster, but that it was also an open door. Japan's school system is extraordinarily rigid, and change in any facet of Japanese society is a long time coming. New ideas are seen primarily as risks and unproven gambles, not innovation, but the catastrophe laid open possibility in a unique way. The activist had found little traction for some of her reforms elsewhere in Japan, but the head of education in Onagawa earnestly welcomed her efforts.

Despite the hum of activity and new life in Onagawa, the future of the town remains uncertain. Many of the refugees have been moved into temporary container homes, built to last two years, and at some point government aid will decline and run out completely. Unemployment is 50%, and in a town where the three main options for work were fishing, local government, and the neighboring nuclear power plant, the question of future livelihoods was heavy in the air. Everywhere I looked, I saw new life and people reaching to connect to meaning and purpose, to future regeneration.

A cultural anchor for regeneration

Stephen's main contact in Onagawa, a middle school science teacher named Fujinaka, is part of a group of men working to save two cherry trees. Cherry trees, or *sakura,* are a central part of Japanese culture. Their gorgeous but short-lived blossoms serve as a symbol of the fleeting beauty of life, and they inspire a virtual mania in Japanese and foreign spectators every spring. The Japanese school and business year ends in March and starts in April, as the sakura blossoms open across the country.

Everywhere I looked, I saw new life and people reaching to connect to meaning and purpose, to future regeneration.

Two cherry trees have lived for many years near the city hall of Onagawa, and they were severely damaged as the 60' wave swept over. However, they somehow survived, and only a few weeks later put forth several soft blossoms. Fujinaka and his friends bound them with cloth and put old tatami mats around their bases to protect the roots and mulch the soil. Elementary school children have come to plant marigolds around the edges. Eventually, the area will become a memorial park.

Even before I arrived, I had heard of the cherry trees from Stephen. From afar, it was difficult to understand the importance of a memorial park so close in time to the event. But as soon as I arrived, I understood. Apart from a few grasses and pioneer plants that have sprung up in the empty spaces, the trees are some of the only organic material left in the town. There is not even a town of Onagawa anymore—only a community in the hills, circling a trash heap of memories. Fujinaka hopes that the trees will serve as a rallying point around which to anchor the spirit of the destroyed Onagawa and that of the Onagawa to come.

Chaos and opportunity

I had enrolled in a permaculture design course in Colorado before my volunteering trip, and I brought the preparation materials with me. I remember goosebumps rising on my arm as I lay in my tent one night and read, "In chaos lies unparalleled opportunity for discovering or structuring creative order." I can't imagine a better example of that idea than Onagawa.

A cherry blossom sprouting in early April from the ravished trees.

There was unimaginable tragedy in Onagawa, to be sure, and the trauma will last for a long time. Rows upon rows of recovered photos line one of the sports center's walls, giving small glimpses into the daily life of the town and its people; occasionally someone will come upon their own water-stained photo and link it to one of many painstakingly indexed albums. I don't have any way to identify with that kind of loss, but the lack of self-pity and the cheerful hard work I saw going on at the same time gives me hope that perhaps the same resolve and ability to rebound and work and create in the face of disaster lies in me, too.

Like many of my generation, I've ached for meaning and purpose. One evening, Stephen and I sat on the grassy hill above the sports center and talked about the surprising pleasure we got from the work in Onagawa. It seemed somehow inappropriate to declare the work "fun," but it often was, and I can't help but think that a powerful blend of manual labor and simple, obvious value made it that way.

I don't have any doubt that I will live to see enormous upheaval, but living amidst the reality of chaos and destruction while seeing the opportunity and new life that can come from it has helped me to quiet some of my fears. The experience helped me to realize the practical truth of some permaculture principles that might not otherwise have been as convincing. Destruction and rebirth are necessarily interconnected, and I think we may just all surprise ourselves in the end. ∆

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More Calories Per Square Foot

Larry McAuliffe

THE ANNOUNCEMENT in *Permaculture Activist* of an upcoming issue (this one) on Raising Staple Foods inspired me to take another look at my gardening plans for 2012.

Kate and I are raising our family on a laughably low income (about one-third the national poverty level for a family of our size). What income we do have is primarily from Kate's two part-time jobs. Both are with non-profits, neither of which is making budget, and one of the jobs is threatened. Our car is old and we're 11 miles from town. When it goes, Kate may not be up to biking 22 miles a day. Most of the rest of our financial situation is lean. But we have a nice house and are better off than many. All this is not to 'cry poor,' but to underscore the importance we feel of growing as many of our calories as we can for ourselves.

Note that I said 'calories' and not pounds of food.

With these factors in mind, I pulled out my copy of *How to Grow More Vegetables Than You Ever Thought Possible on Less Land than You Can Imagine* by John Jeavons, and started going through the master charts. There's a ton of information there, such as potential yields (in lbs./100 square foot bed), seed needed, average consumption, and a little nutrition information like kcal/lb. for most crops. But as I worked with the charts, I realized that several items critical to our situation are not there, although some could be derived from the charts. We need to know area nutrition density. How many calories can each crop provide per square foot?

We have a lot of space at our farm, but the less we need to use, the better. Some people don't have much land at all. So I multiplied possible yield (lbs./100 sf) by nutrition data to get nutrition/sf.

For instance, protein is listed in grams/pound. Yields are listed in pounds/100sf. Multiplying these factors gives protein density in grams/100sf. My interest is really in square feet as opposed to 100 sf beds. So I divided the results by 100 to get protein density in g/sf. Similarly, I derived calories/sf and calcium yields in mg/sf. Using the data from Jeavons, I've built a spreadsheet listing the crops we are likely to grow at each of the yield values provided. I'm using the minimum yields until I can collect my own data. An excerpt from the spreadsheet shows some interesting things:

But as I worked with the charts, I realized that several items critical to our situation were not there...

Area Density of Nutrient per sq. foot from highest calories to lowest. Protein and calcium in grams per sq. foot.

Crop	Protein	Calories	Calcium
garlic	14.9	405.6	69.6
corn, flour	7.7	349.0	26.0
celery	12.7	175.2	453.6
onions	6.2	172.0	111.0
zucchini	8.3	102.4	193.6
butternut sq.	2.2	85.5	51.0
sunflower seeds	2.7	64.6	13.6
beans, dry	4.0	61.5	20.0
wheat, red wint.	2.2	59.3	8.4

(By the way, we plan to raise far more crops than these and may not raise some of these.)

Strictly from the viewpoint of calories per square foot, garlic kicks butt. We can't eat that much garlic, however, even though we love it. What's striking here is how poorly wheat fares in calorie density measured against the area required to grow it. While it's number 10 on this list, it's number 29 on my larger list and is beat out by crops such as cabbage, tomato, and watermelon! Considering the investment in labor or machinery to thresh and clean wheat, I'm not going to dedicate any precious garden space to it. Flour corn is another storable grain that's easier—much easier—to process and has a higher area calorie density. When we want wheat flour, we'll buy it or trade for the grain.

Area calorie density is not the only factor we're considering. Crop diversity is essential for resilience and for managing a decent rotation. I've already mentioned storability as a factor, and let's not forget our need for a varied and diverse diet.

Out of my longer list, the top ten crops sorted by calorie density are:

1. garlic
2. potatoes
3. horseradish (can't base diet on this!)
4. carrots
5. corn, flour
6. celery
7. kale
8. onions
9. brussels sprouts
10. collards

But what about protein? Beans have got to be up there, right? Dry beans are actually number 20 at the minimum yield, but do better in the higher fertility rates. Plus, they're easily stored and not bad to process. And, they're legumes, so they're in our plan.

The top ten by protein density:

1. collards
2. garlic
3. brussels sprouts
4. celery
5. kale
6. horseradish
7. squash, zucchini
8. potatoes
9. onions
10. cucumbers

Zucchini is usually considered a summer-only crop, but this year we grew Costata Romanesco zucchini, which convinced us otherwise. The fruit is very large, dries nicely and makes great pickles. I used the sour dill recipe from *Wild Fermentation,* sliced the zukes into wedges and scooped the seeds out. Fantastic!

The top ten crops by calcium density:

1. collards

2. horseradish
3. kale
4. celery
5. lettuce, leaf
6. squash, zucchini
7. cabbage
8. cucumbers
9. beet greens
10. spinach

This is a work in progress. There are crops (like mustard greens) that aren't on the list yet for one reason or another. But they'll make it in time. Looking at the crops this way is helping me to sort out which ones to grow as staples. Some may not be considered such by most people. As of today, my list of staples includes these crops:

- garlic
- potato
- corn, flour
- onion
- squash, zucchini
- squash, winter (butternut, etc.)
- beans, dry
- cucumber

Some factors these crops share: they're easily storable using low-energy techniques, we eat a lot of them, they fill empty bellies, and are at least reasonably nutritious. They also fit well into my crop rotation scheme. I've specifically not included fruits and nuts here because our fruit and nut plants are not yielding sufficiently yet, although we have high hopes for the future. We also have hopes to keep bees for honey and to process our own cooking oils, both foods I consider staples. But I can't tackle everything at once! I've also not included milk from our cow, or meat, or eggs, but all of these are part of our diet. All currently require purchased feed, such as hay in the winter, pig food, and chicken feed. But I hope to work these out in time.

In conclusion, I'm glad I looked anew at staple crops. In some cases the results surprised me, in others they confirmed my gut feelings. Δ

Larry McAuliffe is a retired automotive engineer living in rural southern Michigan. He and his wife Kate shared their story of practical energy descent and shrinking carbon footprints in Permaculture Activist *#74. He can be contacted at LawrenceMcAuliffe@gmail.com. Be patient for an answer, the account is monitored weekly.*

Reviews

A Family Album
Review by Peter Bane

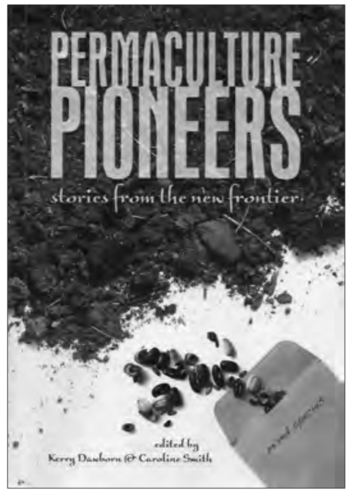
KERRY DAWBORN & CAROLINE SMITH, Eds.
Permaculture Pioneers
Stories from the new frontier
Meliodora Publishing, Hepburn, Vict., Australia. 2011.
364 pp. paper. illustrated. $34.95

As PERMACULTURE, NOW in its fourth decade as a social movement, begins to gray, the fond reminiscences and ribald stories that have lubricated its far-flung personal bonds begin, like yellowing newspaper clippings in a dresser drawer, to take on an evanescent quality. Their delicacy is palpable. No longer mere place markers of a rich experience held firmly in memory, they may soon be the only links to important elements and characters of the past who shaped our world.

It is to the credit of David Holmgren and Su Dennett, the moving force behind Meliodora Publishing, as well as editors Dawborn and Smith, that they have seized this moment on the edge of epochal change to collect these treasures of memory in an album for the whole tribe, indeed for the world. Permaculture remains at the margins of society, but the center of that society is crumbling, and the margins may soon be all that hold. In the coming decades, the import of Permaculture will either become universally self-evident or the planetary community that might be able to recognize it will have been splintered beyond hope of repair.

Unlikely as it may seem nearly 40 years from its inception, Permaculture's co-authors are both still alive: Bill Mollison in retirement, David Holmgren on a vigorous rise to prominence in middle age. So are many, though by no means all, of its leading lights. This book makes no attempt to span the globe except through its globetrotters themselves; it profiles Australian pioneers—of whom there are many—because permaculture was born there and has achieved its greatest density in that thinly scattered society. Teachers, lecturers at university, national politicians, members of the professions have all been colored by the imprint of permaculture thinking. I believe David Holmgren is right in calling it Australia's greatest intellectual export. The editors and the publisher are, of course, based in Oz, and know their subjects well. That said, enough of the men and women in these pages have become internationally prominent that American, European, and other permaculture readers will find opportunities to connect the life stories told here with their own.

The 24 profiles offered include some



obvious and widely known candidates: David Holmgren, Max Lindegger, Robyn Francis, Rowe Morrow, Geoff Lawton, Ian Lillington, Ross Mars, and Robin Clayfield, all published authors or international teachers. The lives and contributions of the others are not less important, but have perhaps impacted the developed world outside Australia less. The most prominent Australian permaculture pioneer not telling his story in the book is Bill Mollison. I can imagine the reasons why. The editors merely say they are "personal."

The rift between Permaculture's co-authors is seismic and goes to the heart of the framing of this book. Not merely nostalgic or historical—though both of these purposes are legitimate—Permaculture Pioneers is a deliberate effort to address what Prof. Stuart Hill in his Afterword and the editors in their opening remarks call "inner permaculture." Wags told the story of Mollison, famously averse to New Age cultural trappings among his students, proclaiming that he'd 'had his chakras surgically removed.' Maybe that's what the 1991 heart attack felt like, but David

Holmgren, who's known Bill longer than anyone else on these pages, avers. He has a great deal to say about his co-author, including that the man's deeply spiritual but, at least in his 60s was afraid of that reality. Coming from a fellow who stayed out of the public eye for nearly 20 years after *Permaculture I* was published, the stories of early years working with Bill Mollison seem revelatory. His respectful discretion and deep patience having earned him a serious audience, David Holmgren's insights into Mollison's role as guru will be a subject of discussion for some years to come.

The editors have allotted a generous amount of space for each profile—they are miniature biographies—and we get some quite revealing self-reflection. I enjoyed greatly connecting with the life stories of friends and colleagues—a bit like sitting down for a pint and palaver with a mate—you don't know just what might come up. A common thread that surprised—two really—were the predominance of working-class background and the frequency of religious traditions for social betterment. Families were Catholic or Quaker or Marxist or Salvation Army, but in most cases there was some evidence of a history that ran to care for all. Many, exceptionally for their time, were deeply involved in farming or gardening from an early age. For others, the cultural milieu of the land was pervasive if ignored. Jill Finane, who worked extensively in Sri Lanka and Vietnam, writes of growing up with her grandparents who farmed, and never as a child asking about 'compost,' that stuff that was associated with the bucket under the sink. She went on into early married life with children, still ignorant of the mysteries of the soil. Even raising chickens, she confesses to hauling their manure, and every other bit of organic matter from the lot, off to the tip before eventually learning to follow in her grandparents' wise footsteps.

As a social history, this series of profiles works very well. It allows the reader space to reflect and compare the stories, drawing inferences about the society, with all its cross currents and contradictions, from which these men and women emerged. The editors say their piece, but the strongest voices are those of the book's subjects. Because of permaculture's history, its early adherents, mostly young when they took it up, are now middle aged, and the bulk of those featured in the book belong, unsurprisingly, to the postwar generation. A few are older—Vries Gravenstein is in his 80s, born in Holland, a teenager during WWII, emigrated to Australia where he had a long career as an agriculture teacher and adviser before coming to Permaculture after 50—others barely 40 year of age.

The span of ages and experience itself is revealing. Morag Gamble grew up in Melbourne in the 70s and was introduced to permaculture by her father, who designed and built their passive solar suburban home. She was offered Fritjof Capra, E.F. Schumacher, Ian McHarg, and Masanobu Fukuoka has heroes and exemplars of right thinking and action. If you doubt that change has happened or you despair that good things can still emerge from the present era of crisis, read these stories. Powerful tides are at work in the world. Much will be swept away, but much is coming forward, rising up, being born and growing tall.

As natural scientists, permaculture people have to embrace evolution, adaptive change over generations. The evolution that matters most in the current state of the world is the evolution of consciousness, the growth and spread of healthy memes, and the inner awakening of every individual on the planet to her or his divine purpose. Permaculture has done a great deal to abet that evolution, and could do much more, says Stuart Hill. Three things he holds important about permaculture are 1) its ethics, a simple, holistic basis for testing our own actions against the needs of the world, 2) ecology-based design and management systems, applicable to everything, and 3) that it is an accessible, collective endeavor, a 'cooperacy' he calls it, beyond democracy. These three things give rise to a fourth quality or phenomenon he holds dear: that permaculture generates an upward spiral of learning and change that grows out of a dialectic between small, grassroots actions and engagements with cutting edge territory and the unknown (from which we learn the next basis for action).

A common thread that surprised—two really—were the predominance of working-class background and the frequency of religious traditions for social betterment.

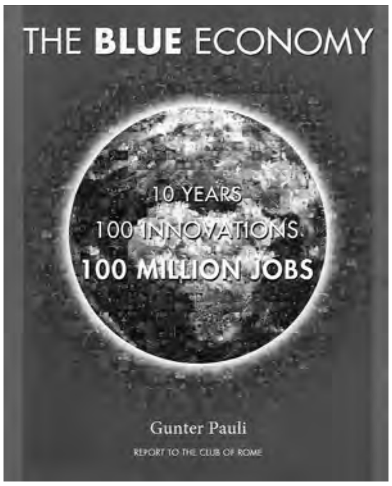
There are some very old stories here, some surprising new ones, and a great deal of comfort and inspiration to be found in the ordinary heroism of men and women of great heart at every stage of life. Dip your hand into this stream and drink deeply. Δ

Spinning a Silken Tale
Review by Peter Bane

GUNTER PAULI
The Blue Economy
10 Year 100 Innovations 100 Million Jobs
Report to the Club of Rome
Paradigm Publications, Taos, NM 2010.
308 pp. paper. illustrated. $29.95

GUNTER PAULI has been trying to sell nature to businesses and governments for decades. He may just have found a wedge that lets him get more than his foot in the door. Known for his work with ZERI (Zero Emission Research and Initiatives), Pauli is a brilliant business designer with big vision. He was educated in the finest European schools and has a passport into the upper echelons of global society, but for many years he has seemed to be something of an orphan, or a man without a country. As often puddle-jumping into the Columbian *llanos* to tour passive cooling systems at Gaviotas as presenting to boardroom meetings, he has accumulated a vast database of examples of what has elsewhere been called *biomimicry.* It has not yet become clear how this grand vision would manifest.

In *The Blue Economy,* Pauli appears to have hit his stride and perhaps have found the range. The book is a concept report commissioned by the Club of Rome (of *Limits to Growth* fame). It consists of a recapitulation of core ZERI concepts such as the cascade of nutrients through the five kingdoms of life (Plants, Animals, Fungi, Monera, Protoctista) illustrated with promising opportunities for large-scale business investment. Permaculture readers will recognize much in Pauli's palette that has parallel roots in permaculture design: Waste into Food being perhaps the central principle around which ZERI rotates. Pauli is well aware of the importance of soil-building, carbon capture, and generating



jobs, and points to their benefits incessantly. But his primary arguments in this book are for the capture of value from waste streams or from the substitution of biological for mineral inputs to industry.

An example is the silkworm. Down tenfold from a million metric tons of production in the mid-19th century, silk's 100,000 tons annual output is still worth $20 billion. The unrealized profit centers in silk lie not, however, with more high-end clothing, but in medical and consumer substitutes for titanium, an energy-intensive metal valued for its hardness and resistance to corrosion. Silk fiber has greater strength to weight than the most high-tech and expensive metallurgical alloys. It has potential applications in everything from sunscreen and cosmetics to artificial joints to razor blades—the discard of which alone contributes 250,000 tons of waste to landfills each year. This is steel subject to the most exacting and energy-intensive manufacturing processes that can be automated. Silk also, in its production yields large amounts of topsoil from the frass of silkworms, building a millimeter of soil a year under mulberry trees. The trees can, after a decade of life support on arid lands, sustain polycultures of other useful species. So they also form the basis for wasteland reclamation.

From refrigeration by bacteria to industrial process chemicals from fungi to tomato waste reprocessing for UV proteciton to electricity from fish metabolism, the rainbow of possibilities in this book is as dazzling as its erudition. We fly from the jungles of Panama to the cafes of Paris, drop into conversations with inventors and diplomats and captains of industry. Bringing together technologies that are relatively well known (John Todd's Living Machines, The Land Institute's perennial grain research, Simon Velez' bamboo housing) with much more esoteric endeavors, such as food-grade fire retardant and recycled glass blocks for building, Pauli assembles a prospectus for a new industrial economy. The organization of data in this book exceeds that of earlier works I've seen by the author, and the language is far more fluent, though still peppered with MBA and business jargon, quite deliberately I am sure. The 100 innovations are summarized and ranked as to ecological and economic importance as well as job-creating potential. The sheer panoply of innovation, the panorama of discoveries on display, carries this book to a level not seen before.

The sheer panopy of innovation, the panorama of discoveries on display, carries this book to a level not seen before.

The offerings here are aimed at the global elite, presumably the more enlightened members thereof. The likes of Lester Brown, Elie Wiesel, and a host of UN nabobs have endorsed it. However, there's little technology reported, let alone detailed here that could be exploited at the household level, though the patterns of trophic cascade and resource linkage might well be applied in parallel systems by small operators. It will take scientific and technical resources and capital on the order of tens of millions up to tens of billions in most of these cases to move products from concept to market. This is definitely a book for the Plan B community—green/blue innovation if you will. Whether there is time to implement much of this scenario before economic collapse forestalls further innovation and investment and whether these new businesses can overcome political pushback by petrochemical and other entrenched interests are questions the book does not attempt to answer. In that way it remains naive, or if you prefer, optimistic.

The kind of thinking in which Pauli engages in *The Blue Economy* underpinned much of the technical innovation that arose in the 1970s in response to the energy crises of that decade. Had good ideas been enough then, we wouldn't be facing a global calamity today. Are they enough today? I doubt it. Brother, can you spare a negawatt?

Still, the book deserves a wide audience. Science and technology geeks and green thinkers of all stripes should be excited, informed, and entertained by the buffet of new uses from old forms laid out between its covers. The next time you get invited to a power lunch with billionaires or media moguls, take it along. Δ

EVENTS

Permaculture Design Course

Nicaragua

Dates: February 3-17, 2012
Location: Isla Ometepe, Nicaragua
Description: Join us at Project Bona Fide on the amazing Isla Ometepe this winter for a permaculture design course! If you've been thinking about doing something to make the world a better place and having some fun in the tropics while you're at it, here's your chance! The course will cover a wide range of topics including: ethics and principles, site analysis and design for various regions, landscape master planning and pattern recognition, resiliency building, renewable energies and biofuels, plant propagation and planting, local and regenerative economics, urban and suburban permaculture strategies, ecovillage design and community building, and design for climate change.
Instructors: Douglas Bullock, Chris Shanks, Dave Boehnlein, guests and local instructors.
Cost: $1,250; $400 nonrefundable deposit is required.
Contact: Jackie Pitts
jackie.pitts13@gmail.com
projectbonafide.com/courses.html

Permaculture Design Course

Trinidad, West Indies

Dates: November 4-13
Location: St. Ann's, Trinidad
Description: Join us for our 5th annual course at WaSamaki Permaculture. We are condensing this course into an intensified 10 days to meet the needs of those who cannot take two weeks away. Students come together on a permaculture farm or site and live there for the duration of the workshop. Course lectures include all of the traditional design course components along with specific information for our region.
Cost: $1,000
Contact: John Stollmeyer
868-624-1341
Erie Rahaman-Noronha
868-673-4180
www.wasamakipermaculture.org

Permaculture Design Course

Pacific Northwest

Dates: April 21-May 5, 2012
Location: Flathead Lake, MT
Description: Join Michael Pilarski, one of the pre-eminent permaculture teachers and practitioners in the Interior Northwest, to undertake an intensive study of permaculture design along with guest speaker Sepp Holzer. Michael is well-known for his work with forestry, herbal wisdom, ethnobotany, and knowledge of the Interior Northwest landscape.

Sepp Holzer, visiting from his world-renowned farm in the Austrian Alps, promises to give students a new vision for working with landscapes to create regenerative, productive places. This course will cover the standard material and present much of it in a new and exciting synthesis.
Instructors: Michael Pilarski with guest Sepp Holzer
Cost: TBD
Contact: Michael Pilarski
509-486-4056
friendsofthetrees@yahoo.com

Permaculture Design Course

Pacific Northwest

Dates: June 17-30, 2012
Location: Ashland, OR
Description: Held on a working permaculture farm, the Southern Oregon Permaculture Institute PDC offers a unique, hands-on experience. Restoration Farm surrounds you with inspiring permaculture design examples from the backyard to the farm-scale. You will learn many types of design including urban, homestead, and farming formats. Participants gain real-world design and presentation experience with their group design project and from being on a working farm. All of this blends together to give you a complete, holistic view of how to do it yourself and how to make a more sustainable livelihood from the land and your community. A typical day is about half classroom and half outdoor activities. Bring your kids with you to take the Farm to Kids summer camp while you enjoy your PDC.
Instructors: Chuck Burr and Larry Korn
Cost: $1,450; $1,600 after May 17. Discount for couples.
Contact: Chuck Burr, SOPI
541-201-2688
courses@sopermaculture.org
www.sopermaculture.org

Permaculture Design Course

Pacific Northwest

Dates: Weekends, February 11-March 18, 2012
Location: Ashland, OR
Description: Held on a working permaculture farm, the Southern Oregon Permaculture Institute PDC gives you unique hands-on experience. Restoration Farm surrounds you with inspiring permaculture design examples from the backyard to the farm-scale. You will learn many types of design including urban, homestead, and farming formats. Participants gain real-world design and presentation experience with their group design project and from being on a working farm. All o fthis blends together to give you a complete, holistic view of how to do it yourself and how to make a more sustainable livelihood from the land and your community. A typical day is about half classroom and half outdoor activities.
Instructors: Chuck Burr and Larry Korn
Cost: $690; $800 after January 11. Discount for couples.
Contact: Chuck Burr, SOPI
541-201-2688
courses@sopermaculture.org
www.sopermaculture.org

Social Forestry

Advanced Design Course

Pacific Northwest

Dates: Oct. 21-23 and Nov. 11-13
Location: Little Applegate, OR
Description: This course introduces students to social forestry, a field of ecosociology that connects villages and communities to their forested water catchment basins. Here in a developed industrial empire, the forests are lonely. We have lost our sense of living with forests as friends. This course will explore reconnecting with forests through ecological knowledge, the use of hand tools and woodcrafts, seasonal festivities and work cycles, children's stories, pilgrimages, and covenants.

We will learn ecological assessment, carbon sequestration methods, restoration forestry, and the crafts and products that can be enjoyed while we are re-establishing our heart space and wonder in the woods.

The PDC is a prerequisite for getting an advanced certificate for this course, however, you may have the certificate held until PDC completion in the future. The course is open to all who have a working knowledge of permaculture.
Instructor: Tom Ward
Cost: $420 if paid in full by 9/25; $500 after. Includes camping. Meals are not provided.
Contact: Siskiyou Permaculture
541-482-7909
www.siskiyoupermaculture.com

Send Event and Calendar Listings for Issue #83
The Economy of Wood
for the December 1st deadline to:
Address: pcaeditor@comcast.net

21st Annual

Permaculture Design Course

Pacific Northwest

Dates: December 1-14
Location: Lost Valley Education Center, Dexter, OR
Description: Permaculture is a design system for sustainable human settlements based in the unique characteristics of each place. Permaculture design offers ways for you to create a prosperous culture by conscious, sustainable use of resources in all aspects of living. The time to plan for a resilient and abundant future is now.

Course topics include: ethics and principles; mapping and design exercises; natural cycles and pattern recognition; garden design and establishment; useful plants and planting strategies; water harvesting, management and conservation; soil building and ecology; animals in the system; forests, agroforestry, and tree crops; eco-building and appropriate technology; urban permaculture and village design; and cooperative economics.

Instructors: Marisha Auerbach, Dave Boehnlein, Kirk Hanson, Kelda Miller, Jenny Pell, Rick Valley, Leonard Barrett, Mark Lakeman, Michael Pilarski
Cost: $1,250 includes meals and accommodation.
Contact: Marisha Auerbach
360-273-7117
queenbee@herbnwisdom.com

Permaculture Design Course

Northern California

Dates: October 2011-September 2012
Location: Bolinas, CA
Description: This course is a great opportunity to take a permaculture design course over a full year of nature's rhythms. You will learn how to observe and use the same principles that make ecological systems self-sustaining, and apply them to integrated homes and gardens. In addition, you will learn how to apply these principles to energy systems and water supplies, healthy communities, meaningful and fulfilling work, ecological economies, and global political movements for change. The four-season format also allows you the oppotunity to implement permaculture principles at home and bring your exeriences and questions back to the class for feedback and discussions.
Instructors: Penny Livingston-Stark, Lydia Neilsen, Lauren Dalberth, David Hage, John Valenzuela, and special guests.
Cost: $1,100; $975 if paid in full by September 9
Contact: Regenerative Design Institute
415-868-9681
info@regenerativedesign.org

Advanced Permaculture Course

Forest Garden Design

Pacific Northwest

Dates: July 16-23, 2012
Location: Ashland, OR
Description: Forest Garden Design expands where the Permaculture Design Course (PDC) leaves off. This is a professional course covering the complete forest garden design process from goal setting, site assessment, concept development, design, implementation, and maintenance. We go in-depth about how to plan for patch succession, select the appropriate plant species, build guilds, and how to establish your forest garden. You get hands-on design and input on a case study that you bring to the course. This course is ideal for landscaping and agricultural professionals. Computer automated design (CAD) skills will be introduced. Save $100 by taking w/ the Teacher Training course.
Instructors: Chuck Burr and Larry Korn
Cost: $850; $950 after June 16. Discount for couples.
Contact: Chuck Burr, SOPI
541-201-2688
courses@sopermaculture.org
www.sopermaculture.org

Permaculture Design *and Earth Building Course*

Southern California

Dates: November 8-19
Location: Hesperia, CA
Description: Cal-Earth and Midwest Permaculture are offering permaculture design and earth building certification in one course. Learn the timeless art of using arches, domes, vaults, and apses to enclose space with a sense of permanence, economy, safety, and beauty.

The permaculture course weaves together the built environment with the surrounding systems so that the beauty and function of all aspects create a complementary whole which nurtures and regenerates.

Portions of the course are completed before coming to the in-person intensive.

Instructors: Bill Wilson, Wayne Weiseman, and guests.
Cost: $2,500; application and $400 deposit required.
Contact: Becky Wilson, 815-256-2215
becky@midwestpermaculture.com, or Cal-Earth, 760-956-7533, elements@calearth.org
www.midwestpermaculture.com

Teacher Training Course

Pacific Northwest

Dates: July 9-13, 2012
Location: Ashland, OR
Description: Permaculture design and implementation is vital and building and honoring your skills as a permaculture teacher is an investment not only in your work, but in the communities you will work with. Learn how to teach permaculture concepts and practical applications to a variety of students with diverse learning styles. Prerequisite: PDC course. It is recommended tht new teachers take the Forest Garden Design course with their Teacher Training course to give them stronger overall design and teaching skills, save $100.
Instructors: Chuck Burr and Larry Korn
Cost: $650; $750 after June 9. Discount for couples.
Contact: Chuck Burr, SOPI
541-201-2688
courses@sopermaculture.org
www.sopermaculture.org

Permaculture Design Course

Northern California

Dates: January 7-21, 2012
Location: Cazadero, CA
Description: This two-week residential intensive at Black Mountain Preserve offers a broad-brush overview of the regenerative design principles of permaculture. From inoculating mushrooms and digging swales to building with natural materials and sheet mulching the land, students have ample opportunity to experience these principles firsthand.

Throughout the course, students work in small groups to incorporate what they are learning into real-world permaculture design projects. The course culminates in the presentation of each group's design project—which earns each students a certificate (required for advanced courses of study).

This is Earth Activist Training, a rich array of solutions, tools, and strategies to redesign our world. Immerse yourself in this richness through classroom theory, hands-on practice, inner experience, and community. Don't forget that it's fun, too. Many find it life changing.

Instructors: Starhawk and Erik Ohlson.
Cost: $1,600-$1,900 sliding scale.
Contact: Michelle Collier
1-800-381-7940
earthactivisttraining@gmail.com

26th Annual

Permaculture Design Course

Central Colorado

Dates: July 29-August 11, 2012
Location: Basalt, CO
Description: Two weeks that will change your life! Please join us at the Central Rocky Mountain Permaculture Institute (CRMPI) for our 26th Annual PDC. This is the longest running consecutive design course in one location in the world. CRMPI has a 20-year-old demonstration forest garden—one of the oldest on the continent, as well as four greenhouses including one tropical and one mediterranean at 7,200' above sea level. This is a great place to get hands-on learning about high-altitude food production using various methods as well as to get all curriculum required for the permaculture design course. We will eat papaya, passionfruit, and figs from the greenhouses; apples, cherries, greens, and much more from the forest garden. This course will cover the whole recognized curriculum and will focus on high altitude and long winter techniques. Topics include: ethics and design principles, mapping and design projects, pattern lnaguage, soil building, animals in the system, forest gardening, PV system, and many more topics. Advanced Training Course coming in September 2012, dates TBD. Check the website for further information.
Instructors: Peter Bane, Jerome Osentowski, Adam Brock, and Kelly Simmons
Cost: $1,475, early-bird special and couples discounts available. Price includes materials, instruction, food, and camping.
Contact: Jerome Osentowski
970-927-4158 • jerome@crmpi.org • www.crmpi.org

Permaculture Design Course

Colorado Front Range

Dates: March 10-October 14, 2012
Location: Boulder, CO
Description: Sixth annual locally-based 8-weekend design certification course. Observe the seasons unfold in Front Range cities, high plains, and mountains through the lens of permaculture, giving depth and perspective to design work. Participants will tour sites, engage in hands-on seasonal projects, create designs for resilient local systems, explore perennial culture, and take tangible steps towards regenerative food, shelter, energy, and community. The extended length of the course allows time to digest concepts and creates a foundation for community projects.
Instructors: Sandy Cruz, Barbara Mueser, and Lynn Duguay.
Cost: $950 by 1/10; $1,100 by 2/10; $1,200 after.
Contact: Sandy Cruz, 719-539-7685
hialtpc.org

Back Issues of *The Permaculture Activist*

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I,2 Nov. '85 **Fruit & Nut Trees**
II,1 Feb. '86 **Garden Design**
II,2 May '86 **IPC-2** & Pc Courses
II,3 Aug. '86 **2nd Int'l Pc Conference**
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IV,3 Aug. '88 **Social Forestry,** Gabions, Jap. Org. Ag., Producer/Consum. Coops
IV,4 Nov. '88 **Multi-Story Tree Crops,** Greening Dominican Repb., Runoff Gdns
V,1 Feb. '89 *Permaculture: A Designers Manual,* Tree Bank, Water in Pc
V,2 May. '89 **Plant Guilds,** Roof Gardens, Small Livestock
V,3 Aug. '89 **Rainforest Conservation** in Ecuador, Gaia, Weed Gardens
V,4 Nov. '89 **Earthworks** & Water Conservation: Small Dams, Ponds, Keyline
VI,1 Feb. '90 **Household Greywater** Systems, Soil Imprinting ($5 each to here)
VI,2 May. '90 **Insectary Plants,** more Greywater, Land Use for people "
VI,3 Aug. '90 **Water:** Forests & Atmosphere, Catchment, Pond Design
VI,4 Nov. '90 **Urban Permaculture:** EcoCity Conf., Soil Detox, Suburbs & Pc
#23 May '91 **Politics of Diversity,** Greenhouse Market Gdn, Pc in Nepal
#24 Oct. '91 **Creativity in Design:** Case Studies; **Index to Issues #1-23**
#25 Dec. '91 **Design for Community:** CSAs Restoring Forests; Garden Ecology
#26*May '92 **Soil:** Our Past, Our Future; Fertility, Worms, Cover Crops
#27*Aug '92 **Integrating Pc:** Deconstructing Utopia, Grassroots Organizing, Garden Polyculture, Pattern Learning, Living Fences
#28*Feb. '93 **Structures:** Comm'ty Dsgn, LETS, Industry, Strawbale/Timber-frame Bldgs.
#29/30* Jul.'93 **Networks:** Media Revw, Rural Reconstruction, Leaf Concentrate, Comm'ty Food Inits, Palestine Pc, Do-Nothing Educ, Feng Shui, Pc Academy
#31*May '94 **Forest Gdng:** Energy & Pc, Mushrm Cultvn, Robt.Hart's F.G., Spp for No. Cal., Alders, Agroforestry in Belize & China, Honeylocust, N-fixers
#32*Apr. '95 **Animals & Aquaculture:** Animal Polyculture, Small-scale Cattle, Goat Dairy, Keyline, Feral chickens, Bee Plants, Constructed Wetlands
#33 Dec. '95 **Cities & Their Regions:** Green Cities, L.A. Ecovillage, MAGIC Gdns, CoHousing, Micro-Enterprise Lending, Suburban Conversion
#34 June '96 **Useful Plants:** Bamboo Polyculture, Medicinals, Pest Control, Root Crops, Oaks, R. Hart's F.G., Russian Plants, Regl. Plants, Sources
#35 Nov. '96 **Village Design:** Pattern Language, Consensus Democracy, Conflict, Historic & New Villages, Planning for Tribe, Village Economics
#36*Mar. '97 **Climate & Microclimate:** Climate Change, Windbreaks, Low-Tech Sun Locator, Drylands, Cool Slopes, Straw-Clay Bldg. Round Beehive, Water Catch.
#37 Sept. '97 **Tools & Appropriate Technology:** Dowsing, Workbikes, Scythes, Japanese Saws, Nursery, Ferrocement, Greywater, A-frame & Bunyip Levels, Ram Pump, Solar Toilet, Log Yoke, Cookstoves
#38*Feb. '98 **Economic Transformation:** Speculation, No Middle Class, Coops WWOOF, Global Warm'g, Hol. Fin. Plan'g. Land Use, Adopt-a-Hive
#39 Jul. '98 **Knowledge, Pattern & Design:** Pc Way of Seeing; Native Consvn Sand Dunes, Language-Worldview-Gender, Patterning Process, Land-Use Planning, Teaching Pc, Vietnam, Holmgren on Pc
#40*Dec. '98 **New Forestry:** Regl. Devl., Horselogging, Menominee Reservation, Forest Investing, Restoration, Old Growth, Homestead Tenure, Forest Soils, Forest Farming, Woody Agric., Rainforests, Windbreaks, Coppice
#41*May '99 **Natural Building:** Oregon Cob, Cordwood, Bamboo, Thatch, Ethics, High Winds, Origins of Conflict, Greenhouses, Ponds, Adobe, Road Bldg, MicroHydro, Bldgs. That Live, Under $20K Houses, Dreams
#42 Dec. '99 **Self-Reliance & Community Cooperation:** Co-Intelligence & Self-Orgn., Archetype Design, Sovereignty, Samoa, Mondragon, Natural Hous'g, Comm. Gdns., Zone Zero, Solar Electric Tractor, Beekeeping
#43*June '00 **Food & Fiber:** Hunger, Ferments, Seasonal Salad, Heirlooms, Fencing Self-Fertile Gdns, Rice Revolt'n, Cold-Climate Food, Edible Insects, Chilies, Food Origins, Garlic, Ethnobotany, Wild Food, Bamboo, Hemp
#44 Nov. '00 **Earthworks & Energy:** Spreader Drain, Horse Swales, Earth Dams, Machinery, Carpet-lined Ponds, Constr. Wetlands, Biogas, Windmills
#45 Mar. '01 **Medicine & Health:** World & Self, Healthy Home, Designing Care, Ayurveda, Agents of Decay, Comn. Health Centres, Women Trad. Med. 4th World Apothecary, Healing Weeds, Medicinal Crops, Hawaiian Bot'ls
#46 July '01 **Good Work & Right Livelihood:** Pc Golf Course, Downsize Cost of Living, New Forest Economy, Energy Currency, Buddhist Mktg, End Wage Slavery, What's Surplus?, Urban Community, Enterprise Facil'n
#47 June '02 **Watersheds:** Water4Sale, Basins o'Relations, Watershed Devl, Gabions, Urban Runoff, Beavers, Skywater Ctr, Consvn. Investmt, Peat Bogs, Rabbits
#48*Sept '02 **Making Changes:** Co-Intelligent Activism, Webs of Power, Urban Food, How to Change, Teaching for Change, Global Transform'n, City Repair, Escaping Job Trap, Argentine Recovery, Costa Rica Pc
#49 Dec. '02 **Where is Permaculture?** Land-Rent Reform, 10 N. Amer. Sites, Cuban Ag, Rainbow Vall. NZ, Cacti/Succulents, Animal Self-Meds, Challenge to Pc
#50 May '03 **Ecosystems:** Holmgren on Pc Mvmt, Hazelip & Syng. Ag, Chestnuts/ Pigeons, Oak Savannas, Root Crop Polycultures, Alders, Fungal Ecosys. Humans & Wilderness, Indoor Ecosystems, Humid Tropics
#51 Jan '04 **Trad'l. Knowledge & Regeneration:** Cataclysm & Collective Memory Genome Wisdom, *Waru Waru,* Biosculpture, Inuit Medc, Ferment'd Stimulants
#52 May '04 **Aquaculture:** EcoAquac, Fish4Health, Dowsing, Pond Design, Greywater Biotreatment, N. Amer. Polyculture, Manage for Native Spp, Integrated Village Fisheries, Vietnam
#53 Aug. '04 **Education:** Lifelong Learning, Edge-ucation, Albany Free School, Indigenous Ed. & Ecology, Ecocentric Pedagogy, School Gardens & Dances, Ecology of Learning, Brain Gym
#54 Nov. '04 **Fire & Catastrophe:** Design Beyond Disaster; New Opportunities; Globalization; Invasion Biology; Street Orchards; Community Food Security, Floodwaters Rising, Disrupted Climates

Permaculture Teaching Training

Colorado Front Range

Dates: Weekends January 28-29; February 11-12; Saturday, June 23, 2012 Plus three days at spring events and a personal conference with instructors

Location: Various venues throughout the Front Range of Colorado

Description: Regionally-based, five-month program for Permaculture Teacher's Certification, providing classroom work, support, and opportunities to present at public events with experienced instructors. Winter classes will focus on developing teaching and organizational skills, with hands-on exercises that build confidence and ease. In spring, participants will assist at diverse programs offered to the Front Range communitiy and have an individual conference with the instructors. On the closing day of the course in June, we'll explore possibilities for future collaboration among participants. Course size is limited. Please call before registering.

Instructors: Sandy Cruz, Becky Elder, and guests.

Cost: $700 if paid in full by 12/20/2011; $850 after.

Contact: Sandy Cruz
719-539-7685
www.hialtpc.org

Permaculture Design Course

Midwest

Dates: May 20-June 3, 2012

Location: nr. Terre Haute, IN

Description: Stretch into the practice of permaculture with this dynamic and skillful team of instructors. Meld powerful conceptual tools and world-changing perspectives with hands-on design work. Offered in a rich setting of historic community, organic farming, and social activism in conjunction with the White Violet Eco-Justice Center. The course may be taken for college credit through Indiana Univ. or affiliated area schools.

Instructors: Peter Bane, Keith Johnson, Rhonda Baird, and guests.

Cost: TBD, includes meals, dormitory lodging, and instruction.

Contact: Rhonda Baird
812-323-1058
rk.baird@yahoo.com

Back Issues of *The Permaculture Activist* (continued)

#55 Feb. '05 **Learning from Our Mistakes:** Petrol Dependcy, Village Design, Austral. Lessons, RTFM!, Trial&Error, Forestry Expmts, Owner-Bldr, 10 Mistaken Ideas in Pc

#56 May '05 **Tree Crops & Guilds:** Pine Nuts, Tree Vege, Acorns, Am. Chestnut, Honeylocust Silvopasture, Broadscale AgroFor, Bamboo, Willow, Socl. For.

#57 Aug. '05 **20th Anniv.:** Challenges & Changes, USA Pc, Hawai'i Retrospect; Permatecture; Pc's Soft Edge; Gaia U; PINC; Oil Depl; IPC-7; Retrofit Suburbs

#58 Nov. '05 **Urban Pc:** Urban/Rural Futures; City Zones & Sectors; Growing Food; Detroit Visionaries; Rebldg. New Orleans & Everywhere; Transforming a Military Base; Workers Co-op; Energy Descent.

#59 Feb. '06 **Peak Oil:** Eco-Collapse & Trauma; Thom Hartmann; Pathways for Energy Descent; How Cuba Survived; Oil & Food; Biofuels; Algae for Fuel; Relocalize!

#60 May '06 **Land Use Past & Present:** Sust.Ag an Oxymoron?, Negev Bedouin, East. Woodlands AgroForestry, Pc Heals in India, Arocsanti Land Plan, Pop. Growth/Land Hunger, Mex. Reforestation, Rocky Mtns.

#61 Aug. '06 **Unseen Kin-doms:** Observation as Design Tool; Soil Food Web, Bees, Mycelial Internet, D-I-Y Mycorrhizal Inoculum, Cover Crops as Bee Forage, Earth Energies, Local Currencies, Dead Zones, Birds at Risk

#62 Nov. '06 **Art of Permaculture:** Painting, Writing & Pc; Ecoartists; Art, Activism & Cmty; Street Theatre; Art & Bioremediation; Living Willow, Body as Zone 0; Art of the Found; Water Magic; Pc in Pop Culture

#63 Feb. '07 **Building & Technology:** How to Dwell? Natural Bldg & the Law, Bldg Code, Strawbale in China, Cob in Armenia, Integrated Solar Heating, Cooking, Pumping; Self-Build, Nation-Scale Pc in Brazil

#64 May '07 **Waste = Food:** Throwaway Econ, Strategy of Salvage, Peak Soil, Pigs & Waste Mgmt; Bikes, Soil & Garbage; Farm as Organism, Opportunistic Plants? Simple Biodigester, Waters of Spain, Vermiculture

#65 Aug. '07 **Climate Change:** Shrinking Seas, Forests' Role in Climate, Urban Forests, Making Trees Pay, Rainwater Harvst'g, Indoor Gdns, Water Filtration, Changing Human Climate, De-Stabilizing Climate

#66 Nov. '07 **Animals in Design:** Jumbo Shrimp, Pawpaw Patch, Alpaca, Insects as Food, Bees, Integrated NH Farm, Pastured Poultry & Rabbits, Urban Livestock, Predator Restoration, Complementary Animals, Agrichar

#67 Feb. '08 **Kids in Pc:** School as Ecosystem, Pc Education, Pc to H.S. Students, Tlaxcalan Kids Make Seedballs, Gardening Kids, Fostering Research Skills, Bottled Water Boycotts, Feeding 8 Billion

#68 May '08 **Plants on the Move:** Rethinking Non-Natives, Forest Migration, Black Walnuts, Saving Seed Savers, Grow a Cmty. Gdn, Neighborhood Greening, Healthy Honeybees, Biofuels & High Food Prices

#69 Aug. '08 **Permaculture at Home:** Hawai'ian Cmty; London Forest Gdn; Suburban Renaissance; Calif. Campus; Phila. Orchards; Drinking Roofwater; Floating Island Bioremed.; Bike Transport; Mississippi Pc

#70 Nov. '08 **Ethics at Work:** BAU is the Enemy; 13 Princ. of People Care; Pc in Business; Ecovillages; White Man in India; Uganda Boarding School, No Waste Principle; Qual. Control; City Farming w/Runoff; Amaranth

#71 Feb. '09 **Working w/Earth:** Hopewell Mound Water Mgmt, Belize, Road & Dam Bldg, Keyline, NW AgroFor, Pc&Landscape Arch, Earthbag Bldg, Low-Watt Fridge

#72 May '09 **The View from Abroad:** War, Oil & Snails in Nigeria; Green Tech Future, Ethiopian Water Mgmt.; Shrinking Forests; Food Exploration in Caucasus; Maya Agroforestry/Biochar; Pc to Trinidad; Bridging Cultures in Brazil & India, Pc Schools in Africa; BuggerBug in Liberia

#73 Aug. '09 **Bioregionalism:** New Paradigm; Rocky Mtn. Wildlands; Wild Elephants; Organizing Houston; Heirloom Seeds; L.A. Gdns; Reclaiming Commons; Transition Hohenwald, Tenn.; BioCongress Saga; Diversity at Home

#74 Nov. '09 **Energy Descen**t: In the Home; Transition Communities; Pc in Mexico; Biochar; US Consumption Dropping; Making Fuel Alcohol No More Throwaway Economy; EcoTechnic Future

#75 Feb. '10 **Local Food:** A City & Regl. Food System; Working Family on 5Ac; CSAs & Wild Foraging, City Backyd Gdng.; Food Bank Gardens & Orchards; Salt Collecting; Growing Regional Staples; City Grains.

#76 May '10 **Soil Fertility:** Permaculture Way of Soil; Biochar; Sheet Mulch; Hawai'ian Soil Farming w/ Worms; Demystifying Humanure; Urine Fertilizer; Crop Rotations; Mushrooms Build Soil

#77 Aug. '10 **Eco-Nomics:** Measuring Many Forms of Capital & Quality of Life; Bob Swann & Invisible Structures; Bioshelter Market Garden; Green Collar Economy; Pc & Finance; Pc Inst., Cert. & Diplomas

#78 Nov. '10 **Water Wise:** Restoration Engineering; Watershed Relations; Colorado Runoff Gdns; Cisterns in Saudi Arabia; Energy Use & Water; Trad'l. Mexican Catchment; Rooftop Garden; Home Water Conservation; Making Swampy Land Productive; Sunken Gdns in Nigeria

#79 Feb. '11 **The Urban Frontier:** Indoor Denver Farm; Rooftop Food; Return to Your Hometown; Urban Ecovillage; City Bees; Urban Pc Projects Start Pc Farming: Mark Shephard; Index to *PcActivist* issues 24-40.

#80 May '11 **Designing for Disaster.** Collapse Mitigation; Global Storming; Responding to Major Events; Stabilizing the Climate; Self-Care in a Disastrous World; Ensuring Food Supplies; Living through Drought

#81 Aug. '11 **Hidden Connections in the Garden.** Neighborhood Garden; Urban Ag on Empty Lots; Food=Land Access; Indigenous Practices; Hoarding Seeds; Deep Raised Beds; Greenhouses; Urban Wild Edib.

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*except the following: Vol. I,1-VI,2 & #33-35 -$5 each; #26-32 & 36, 41, 48 -$8 ea; #38, 40, 43 -$10 each. ^^Can/Mex. +$45, Overseas +$80

Permaculture Design Course

New England

Dates: July 27-August 5, 2012

Location: Ashfield, MA

Description: This full 72-hour course will be held at a rural residence located in the foothills of the Berkshires where you will be surrounded by abundant opportunities for nature immersion and recreation. The site was once part of a 200-acre New England dairy farm and is now ready to be transformed by your permaculture designs and numerous hands-on practical skill-building sessions. The natural beauty and powerful spirit of the site will form the basis of this experiential course.

The course will consist of a broad range of topics applicable to life anywhere on this planet, yet will be tailored to the needs of the students present as well as the location at hand. Particpants will help to co-create the design of multi-species food forests, permaculture-style gardens that integrate food, wildlife habitat, flowers, and medicinal herbs, as well as livestock, natural buildings, aquaculture, and aquaponic gardens.

Instructors: Mary Johnson

Cost: $2,000, supporter; $1,500, regular; $1,000, lower income; $500 registered volunteer.

Contact: wreinashfield@yahoo.com. www.terra-genesis.com

Permaculture Design Course

Southeast

Dates: January 13-16, 27-29; February 18-20; March 3-4, 2012

Location: Charlottesville, VA

Description: This course lays the foundation for understanding and working with natural systems to design sustainable environments that produce food, shelter, and energy. It also provides participants with models of community development and extension by which they can create networks of support for themselves and empower others to do the same.

Permaculture promotes land use systems that work with natural rhythms and patterns to create regenerative cultivated ecosystems. Participants will learn how to design and build gardens, homes, and communities that model living ecosystems. By understanding patterns in nature, students will learn how to grow food, manage water catchment and storage, utilize renewable energy, and restore ecological balance. The ecological design course covers themes such as: ecological systems understanding, organic food production, natural soil improvement, watershed restoration, water conservation and management, edible forest gardening, native medicinal plants, natural habitat restoration, healthy buildings and human settlements, community and consensus building strategies, renewable energy systems, sustainable community development, local economics, and much more.

Instructors: Emily Axelbaum, Christine Gyovai, Dave Jacke, Hub Knott, Terry Lilley, Dave O'Neill, and guests.

Cost: $895-$1,200 sliding scale if registered by 11/15; $995-$1,200 after.

Contact: Terry Lilley
434-296-3963
tygerlilley@gmail.com
www.blueridgepermaculture.net/courses.html

Calendar

October 31-November 13. Quail Springs, CA. Permaculture Design Course. info@quailsprings.org.

November 4-6. Spokane, WA. Inland Northwest Permaculture Conference. Michael Pilarski, 509-486-4056, www.inlandnorthwest-permaculture.com.

November 4-13. TRINIDAD. Permaculture Design Course. wasamakipermaculture.org.

November 8-19. Hesperia, CA. Permaculture Design Course and Cal-Earth Adobe Building Course. Becky, 815-256-2215, Becky@midwestpermaculture.com, www.midwestpermaculture.com.

December 1-14. Lost Valley Education Center, Dexter, OR. Permaculture Design Course. Marisha Auerbach. 360-273-7117. queenbee@herbnwisdom.com.

Janurary 7-21. Cazadero, CA. Earth Activist Training. 800-381-7940. earthactivisttraining@gmail.com. www.earthactivisttraining.org.

Jan. 13-16, 27-29, Feb. 18-20, Mar. 3-4, 2012. Charlottesville, VA. Permaculture Design Course. Terry Lilley, 434-296-3963, tygerlilley@gmail.com.

Jan. 28-29, Feb. 11-12, Jun. 23, 2012. Front Range, CO. Permaculture Teacher Training and Mentorship Program. Sandy Cruz. 719-539-7685. hialtpc.org.

February 3-17, 2012, Isla Ometepe, NICARAGUA. Permaculture Design Course. Jackie Pitts, jackie.pitts13@gmail.com, projectbonafide.com/courses.html

February 11-March 18, 2012, weekends. Ashland, OR. Permaculture Design Course. Chuck Burr. 541-201-2688. courses@sopermaculture.org. www.sopermaculture.org.

Mar. 10-11, Apr. 14-15, May 12-13, Jun 9-10, Jul. 14-15, Aug. 11-12, Sep. 8-9, Oct. 13-14, 2012. Boulder, CO. Permaculture Design Course Through the Seasons. Sandy Cruz. 719-539-7685. hialtpc.org.

April 21-May 5, 2012. Flathead Lake, MT. Permaculture Design Course. Michael Pilarski, 509-486-4056. friendsofthetrees@yahoo.com.

May 20-June 3, 2012. nr. Terre Haute, IN. Permaculture Design Course. Rhonda Baird, 812-323-1058, rk.baird@yahoo.com.

June 17-30, 2012. Ashland, OR. Permaculture Design Course. Chuck Burr, SOPI, 541-201-2688, courses@sopermaculture.org, www.sopermaculture.org.

July 9-13, 2012. Ashland, OR. Permaculture Teacher Training. Chuck Burr, SOPI, 541-201-2688, courses@sopermaculture.org, www.sopermaculture.org.

July 16-23, 2012. Ashland, OR. Forest Garden Design Course. Chuck Burr, SOPI, 541-201-2688, courses@sopermaculture.org, www.sopermaculture.org.

July 27-August 5, 2012. Ashfield, MA. Permaculture Design Course. wreinashfield@yahoo.com.

July 29-August 11, 2012. Basalt, CO. Permaculture Design Course. Jerome Osentowski, CRMPI, 970-927-4158, jerome@crmpi.org, www.crmpi.org.

September 2012. Ashland, OR. Advanced Permaculture Design Course. CRMPI, Jerome Osentowski, 970-927-4158, jerome@crmpi.org, www.crmpi.org.

Networking:

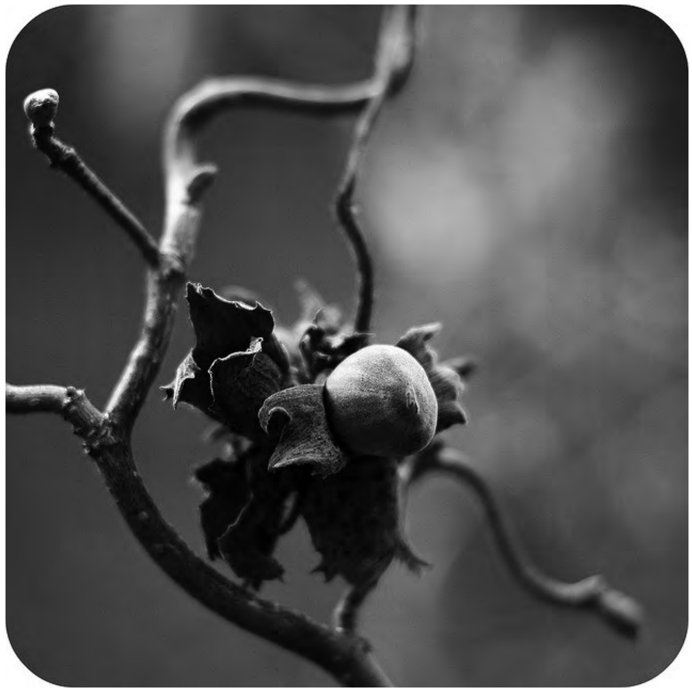
Hybrid Bush Hazels Can Outproduce Soybeans

Brandon Rutter

ON SEPTEMBER 22, 2011 the public was invited to observe the first machine harvest in Minnesota of a highly promising new crop; hybrid bush hazelnuts. The machine worked where visitors could watch up close and personal at Badgersett Farm in southeast Minnesota.

"We've been working toward this day for two decades. The dozens of growers who already have hazels planted have been counting on our prediction that we would be able to machine harvest these neohybrid hazelnut bushes. Now we've made the prediction come true: the machine is here—and it works." said Badgersett CEO and Chief Scientist Philip Rutter; "The reason it took two decades was not the lack of a machine; we needed big enough fields of big enough bushes to warrant the machine. We actually had the field ready last year, but weren't able to arrange a machine in time—the nuts mostly went to feed wildlife. This year, a grower came through, took the leap, and purchased a machine. He's already glad he did, and we're ecstatic."

Hybrid hazelnuts were developed and introduced to the Midwest by Badgersett Research Corporation (BRC). As early as 1994, major plantings of Badgersett hazels were installed at Fort Leavenworth, Kansas, and at Arbor Day Farm, Nebraska. Seen by many as an "oilseed" crop, the USDA recently awarded a $1.3 million grant to three universities to pursue development across the nation. "It's actually more than an oilseed. Sure; the oil is hugely important. The hazel kernel is about 60% oil, compared to 20% for soybeans. In addition, the hazel oil quality is fabulous. It's literally the exact chemical twin of olive oil. But these plants produce far more; every year, for example, they produce nutshell, which can be used as a fuel in a dozen ways; and don't forget they're woody plants. We harvest the wood as another crop." Rutter says. "That's more money in the farmer's pocket. Ask any farmer if he could use a little more," he grins. "Even the nut husk is going to be a money crop someday—wait and see!"



Hazelnuts. Photo by Mathias Erhart.

The machine being demonstrated is a used blueberry harvester, previously working to pick Michigan highbush blueberries. "Our goal from the outset was to develop a sustainable crop that real farmers; corn and bean row-crop farmers, could actually adopt. The neohybrid hazels are exactly that—you plant them just once in your lifetime; harvest now with a machine that drives like a compine; dry it in the grain dryer you already own; store it in the grain bin you already own, and in time you'll sell it at the elevator, just like corn and beans. The nut is similar enough to soybeans that we could convert a soybean crushing plant quite easily to hazelnut processing and not put anyone out of work," says Dr. Brandon Rutter, an engineer and BRC COO. "It's likely jobs will be added. As an industrial feedstock, the hazels are actually more versatile than soybeans. We know the soy people won't believe that, but we can prove it," he smiles. The company uses the term "neohybrid" to distinguish their plants from hybrid corn; "What's going on in the chromosomes of these plants is utterly, totally, diametrically different from what happens in hybrid corn. Both kinds of hybrid genetics have huge advantages; but they are completely unlike each other. Yes, it's going to be important for farmers to understand that, at least a little," says founder Philip Rutter.

Visitors and press who saw the work didn't catch a full-scale harvest. Philip said, "Most of our best bushes on this farm have already been picked, by hand; so we can gather the data on the individual bush performance. Everyone saw the reality, though. This machine picks hazelnuts just fine, and we already have specific modifications in mind. There were still plenty of nuts to be picked. We harvested a few plants and rows we haven't been able to get picked in other years; we just didn't have the time."

"The truth is, just before I left for Illinois, to use the machine there on that large experimental field, I was depressed. We have so many hazel plants here; thousands of them. We simply haven't had the time to collect the data we need and get them picked. I was thinking we should stop adding to our plantings, so we could evaluate the huge number of genetic variants we have already. But coming back from using the machine, it hit me. We need a lot more plants, a lot more fields. We just jumped the scale of the crop way, way, up." Δ

LETTERBOX

Permaculture: A Revelation

Hey Guys,
First off: KEEP UP THE GOOD WORK! Do you know that I had never even heard of permaculture before I stumbled upon your magazine one day and picked it up on a whim? And then all of a sudden, here I was exclaiming, "Oh my god! Such a thing actually exists??! I wouldn't have believed such a wonderful and common-sense-fulfilling practice could ever emerge from my western society!" I haven't looked back since. Lovely.
Michael Thys
Winnipeg, Manitoba

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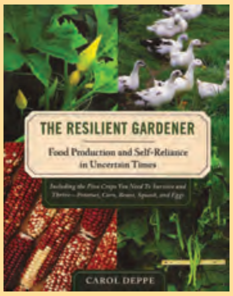

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Harvey Ussery
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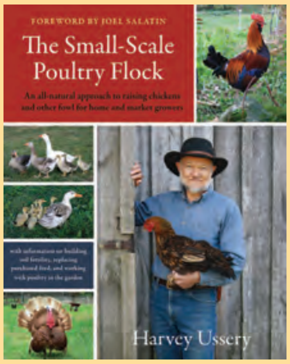
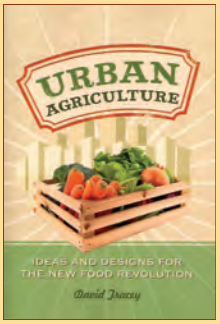
Carol Deppe. 2010.
illustrated. 323 pp. paper. $30





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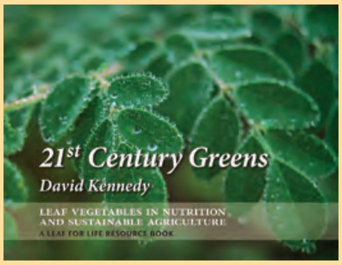

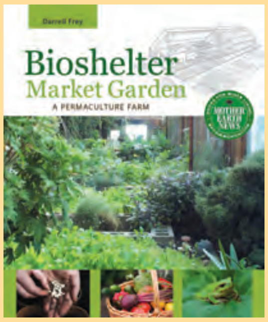

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