Resilience

A VOICE OF THE NEW AGRARIANISM

SPECIAL ISSUE:

2% SOLUTIONS FOR HUNGER, THIRST AND CO_2

- 2% increase in soil carbon, produced by only
- 2% of a nation's population, for only
- 2% of a nation's Gross Domestic Product

CAN MAKE ALL THE DIFFERENCE IN THE WORLD

Profiles by Courtney White

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Cover photo by Courtney White.

From the Executive Director

When Courtney and I sat down exactly one year ago to hammer out the details of Quivira's graceful leadership transition, we were jointly motivated by one goal: put Courtney's gifts as a storyteller to work. With 16 years of work for the organization under his belt, together with trips all over the world and thousands of hours in conversation with the most innovative land stewards and food producers on the planet, Courtney has accumulated a veritable treasure trove of knowledge, one that would make the Library of Congress jealous!

That collection of knowledge alone is impressive, but Courtney's true gift is his skill at packaging it all in ways that make it accessible, understandable and usable. These 2% Solutions describe massively complex processes distilled into straightforward purity. They can be pulled off the shelf and put to work on the ground this afternoon. From bats to pasture cropping, it's all right here and within our reach to implement.

With the publication of this special issue of *Resilience*, the Quivira Coalition is delighted to present our community with the first official publication from our new creative director. May this be the first of many more to come…

Enjoy,

Avery C. Anderson
Executive Director

Quivira Coalition Board Members*

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by Courtney White

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CAN MAKE ALL THE DIFFERENCE IN THE WORLD

These case studies highlight practices that soak up CO_2 in soils, reduce energy use, sustainably intensify food production and increase water quality.

www.carbonranching.org

These 2% Solution profiles are part of Quivira's Carbon Ranch Project, whose goal is to share land management strategies that sequester CO_2 in soils and plants, reduce greenhouse gas emissions and produce co-benefits that build ecological and economic resilience in local landscapes.

The 2% refers to: 1) the amount of new carbon in the soil needed to reap a wide variety of ecological and economic benefits, 2) the portion of the nation's population who are farmers and ranchers and 3) the cost to the nation to get this work done.

In other words: *only 2%*!

I began writing them because I believe the missing link in our collective effort to improve the world is storytelling.

Thanks to a great deal of hard work by a bunch of very smart and innovative people over three decades, we have an amazing toolbox of regenerative and resilient practices that improve the lives of plants, animals and people. Every one of these people has a great story to tell as well, but too often they don't get heard. My role is to share their stories with the world.

The Carbon Ranch Project began in 2010 with the Quivira Coalition's 9th Annual Conference, which was titled *The Carbon Ranch: Using Food and Stewardship to Build Soil and Fight Climate Change*. It was inspired by recent research on the role grasslands can play in sequestering CO_2 in soils. Strategies and co-benefits of a carbon ranch include: enriching soil carbon, no-till farming with perennials, employing climate-friendly livestock practices, conserving natural habitat, restoring degraded watersheds and rangelands, increasing biodiversity, lowering agricultural emissions and producing local food.

Other elements of the Carbon Ranch Project include:

- *Carbon Country*. This is my book-length expansion of the carbon ranch idea, based on the map from the 2010 conference, to be published by Chelsea Green Press in 2014.
- A carbon blog. I blog about the role of carbon in our lives at carbonpilgrim.wordpress.com *http://carbonpilgrim.wordpress.com*
- The Carbon Ranch website. In 2011, Quivira launched *www.carbonranching.org* to provide a virtual library of resources related to the carbon ranch idea.
- 2% Solutions Book. I am writing more profiles that will be bundled with those published here in a book to be released in 2014.

Thanks for Reading!

Courtney

What's In An Olive?

McEvoy Ranch Near Petaluma, Northern California

Can the carbon content of soil double in less than ten years? It has on McEvoy Ranch—a 500-acre organic olive operation—with benefits including increased soil fertility, water holding capacity and carbon sequestration.

Settled in the mid 1800's by Swiss Italian immigrants, the native hardwood rangelands that defined the area were well suited to small-scale dairying. In the early years, many of the abundant oaks and bays were harvested for firewood to help meet

Dr. Jeffrey Creque directs the McEvoy compost program.
© Courtney White

the growing demand for fuel in nearby San Francisco and for the needs of the ranch itself. Very little of the farm was actually tilled, due to the predominantly steep terrain, although hay and other field crops were grown on the more level meadow areas.

When Mrs. Nan T. McEvoy purchased the ranch in 1991, the infrastructure of the dairy was rundown, but the land itself was in good shape. The abundant water, extensive stands of native perennial grasses and mature woodlands that characterize the landscape were in good condition. Mrs. McEvoy, an Italian cuisine maven, soon decided that rather than continue with livestock production, her goal would be to produce one of the finest olive oils in the world. With a commitment not to remove any of the trees on the property, she planted olive trees on about 80 acres of the less-steep areas of the ranch.

Dr. Jeffrey Creque came to the project in 1997 to address the question of what to do with the waste products from the ranch's new olive oil mill. With a Ph.D. in rangeland ecology and decades of experience as an organic farmer, he set out to help Mrs. McEvoy accomplish her goal with a goal of his own: raise the carbon content of the soil from less than 2 percent to 4 percent.

Creque and his co-workers embarked on a soil-building strategy that included 1) applying lots of compost, made on the ranch from olive mill waste, livestock manures and landscaping debris harvested on the ranch, 2) no-till cultivation made possible by the maintenance of a permanent cover-crop beneath the olive trees, 3) seasonal rotational grazing of sheep through the orchard and 4) riparian area restoration to address downcutting gullies on the property.

Only 15 to 20 percent of an olive is oil, the rest is water and solids. Historically in the Mediterranean region, this organic material would accumulate at the milling site or be dumped into a nearby river or the sea. This practice was banned in the 1970s and today handling and disposition of olive mill waste remains a challenge for olive oil producers. Jeff's idea at McEvoy was simple: compost all of that material and return it to the soil of the olive orchards, increasing their fertility. In this way, a problem became a benefit.

"Olive oil is like butter," Jeff explained to me when I visited the ranch. "It is produced from the current season's photosynthetically-derived carbon. If the ranch exports only oil, it essentially removes noth-

ing permanently from the soil. By avoiding tillage and returning all residuals to the land, the olive oil agroecosystem takes in more carbon from the atmosphere than it emits. Done well, olive oil production can be an essentially permanent, regenerative form of agriculture."

Data backs Jeff up. Dozens of soil samples are taken every year from all over the ranch and sent to a laboratory for analysis. While results have shown year-to-year fluctuations in the organic matter content of the soil, mostly due to weather and sampling variables, the trend has been clear: upward. In fact, after ten years the carbon content in all samples began hovering around 4 percent. This means the olive ranch is sequestering more CO_2 than it did back in 1997. It's also more productive and its soils are holding more water.

Jeff doesn't want to stop there. With the restoration of the ranch's riparian areas, a new challenge—and carbon sequestration opportunity—has emerged: managing surplus riparian vegetation (especially willows) for compost production. As the overall productivity of the ranch has increased, the volume of carbon sequestered in standing biomass and soils, and potentially available for composting, has also increased.

"There's no reason to think that we can't increase soil carbon in our agricultural systems to levels above those that would occur without management," Jeff told me. "Besides, there are no downsides to trying and lots of upsides, especially for agricultural productivity, sustainability and climate change mitigation. If we can manage our soils to store more carbon, we'll also enable them to store more water, while reducing the volume of CO_2 in the atmosphere. That's a *big* upside."

Jeff notes that millions of tons of organic waste — food, grass clippings, branches, manures—go into landfills every year across the nation. Why not compost them instead and divert them to farms and rangelands where they could provide multiple benefits? Of course there's a cost to hauling this material around, but it could be offset by increased ecological productivity and potential carbon credits, not to mention benefits to the Earth's climate system.

McEvoy also employs renewable wind and solar thermal energy on the ranch. However, accomplishing energy self-sufficiency has proven more difficult to achieve than the carbon work. "Increasing soil carbon," Jeff said, "is relatively easy. Overcoming the bureaucratic challenges to installing sustainable energy systems has proven much more difficult."

As for the economics of it all, McEvoy olive oil and associated products (including a body care line) are high-end goods that have established themselves in the marketplace.

What's in a little olive? A lot.

Renewable energy and regenerative agriculture working together. © Courtney White

- **For more information on the McEvoy Ranch:** *www.mcevoyranch.com*

A Flerd Down Under

Gilgai Farm, New South Wales, Australia

In only seven years, Eric Harvey expanded the number of plant species on his farm from 7 to 136. How did he do it? With a flerd: a co-mingled flock of sheep and a herd of cattle.

To say that it is not traditional to run cows and sheep together would be a huge understatement. Not only do many in agriculture consider the two types of herbivores to be incompatible with each other from a grazing perspective, most sheep and cattle farmers consider each other to be incompatible as well. In fact, Australia has endured its share of range wars between sheepmen and stockmen over the decades, much like America did in the 19th century.

The flerd in action. Photo courtesy of Gilgai Farms.

Eric ignored all that and in 2005 he put together his first flerd, eventually comingling 5000 sheep and 600 cows on his farm, called Gilgai, located near Dubbo, in New South Wales, Australia. His goal was to use the different grazing behaviors of sheep and cattle to benefit plant vigor, diversity and density. Nature likes mixed-species grazing, Eric said, because animals often complement each other in what they will eat, the composition of their manure, and the way their hooves interact with the soil.

As Eric describes it, herbivory creates an organic "pulse" below the ground surface as roots expand and contract with grazing. This feeds carbon to hungry fungi, protozoa and nematodes, which in turn feed grass plants. The manure "pulse" above ground helps too, especially with nutrient cycling. His plan with the flerd is to make both "pulses" beat stronger and more steadily.

To accomplish this goal, Eric divided the 7000-acre farm into 196 paddocks, mostly with electric fencing, creating an average paddock size of 140 acres (the smallest is six acres). The flerd moves from paddock to paddock every few days, giving each paddock plenty of time to grow more grass. And with only one "mob" to watch, Eric is often back home by 10am. As further work reduction, Eric monitors the watering troughs remotely via sensors linked to the computer in his office which supply up-to-the-minute data. He also pays for a service that provides aerial infrared images of his farm daily, which allows Eric to monitor the growth rate in his paddocks at a seven-acre scale. He calls this service "pastures from space" and says it gives him an invaluable snapshot of forage conditions, which helps adjust his grazing schedule.

Eric also ground-truths the monitoring data he receives. That's how he knows he has been able to expand the number of plants on Gilgai from 7 to 136. This improvement has substantially enhanced the mineral content of the plants, since they can now access nutrients more widely, as well as deeper in the soil profile, and process them more effectively. And when these plants are eaten by animals, which are in turn eaten by us, the minerals enter our bodies, recalling the old farming maxim: "If it's in the feed, it's in the food." In a feedlot context, this might not be a

good thing, but on a farm like Gilgai, it's a great thing. That's because Eric and his family sell only grassfed products from the farm—from animals that have lived their entire lives on grass—which means soil minerals and other nutrients in the plants are available in the meat, finishing the maxim: "if it's in the food, it's in us."

As for the flerd itself, Eric has hardly had any trouble running sheep and cattle together. The key is to raise them as one family, he said, especially the lambs. Sheep will bond with cows at a young age and remain bonded for the rest of their lives. As a result, the sheep follow the cattle wherever they go, which means they'll move from paddock to paddock with the herd without much fuss. This is great news for a multi-paddock farm like Gilgai because it means Eric doesn't have to train any sheep to electric fencing, only the cattle.

"Needless to say, moving one herd of livestock is a lot easier than moving two," he said. "You just have to make sure there's enough forage and water ahead of them."

The only trouble he's had, other than an occasional grumpy cow who doesn't like sheep (quickly culled), happens during calving when mama cows become highly protective and might kill a ewe that comes too close. Eric solves this by separating the cattle from the sheep during their respective birthing seasons. "The only other conflict I've ever seen is over shade," says Eric. "And that's been minor. Otherwise, they get along great."

Another benefit to a flerd is protection from predators, such as coyotes. In the American West, coyotes are the scourge of sheep, lambs especially, which is one reason why sheep ranching has declined steadily over the decades. Experiments, however, have shown that when sheep are bonded to cattle they are protected from predation by coyotes (or dingoes in Australia), which are reluctant to take their chances with a closely-packed herd of bovines.

Experiments have also demonstrated that sheep gain weight faster when grouped with cattle compared with sheep that are managed as a separate flock. Wool production was also greater with the flerd than with sheep foraging alone—a fact that Eric said he could confirm. He attributed both improvements to the healthier soil and increased diversity of plants on Gilgai—a result of his careful stewardship.

Gilgai Farm shearing shed. © Courtney White

So why the centuries-old belief that cattle and sheep don't mix?

"It must be a paradigm thing with humans," Eric said. "It's not an issue in nature."

Eric Harvey. © Courtney White

- **For more information on the Gilai Farms:** *http://gilgaifarms.com.au*

Pasture Cropping

Winona Farm, New South Wales, Australia

Since the mid-1990s, Australian farmer Colin Seis has been no-till drilling a cereal crop into perennial pasture on his farm during the pasture's dormant period. This way he gains two crops from one parcel of land—a cereal crop for food or forage and wool or lamb meat from his pastures.

The practice is called "pasture cropping" and it is used in various locations worldwide and by more than 2,000 farms in Australia alone. Here's how it works.

The key to pasture cropping is the relationship between C3 (cool season) plants and C4 (warm season)

Colin Seis in his pasture cropped field. © Courtney White

plants—the difference being the number of carbon molecules and the way they affect the process of glucose production in a plant. C3 plants, such as wheat, rice, oats and barley, grow early in the season and then become less active or go dormant as temperatures rise and light intensity increases. In contrast, C4 plants, such as corn, sorghum, sugarcane and millet, remain dormant until temperatures become warm enough to "switch on" and begin growing.

Pasture cropping utilizes the niche created by C3 and C4 plants. When a C4 is dormant (during winter), a C3 plant seed is sown by no-till drilling into the C4 pasture. With the onset of spring, the C3 plants begin to grow. With proper management and the right amount of rain, the C3 crop can be harvested before the C4 plants begin the vigorous part of their growth cycle. The removal of the C3 crop will then stimulate C4 plant growth due to reduced competition. Also, because shallow and deep-rooted plants access water resources in the soil differently, overall productivity can increase.

A key is what's happening in the soil. C3 cereal crops provide sugars to soil microbes, such as fungi, nematodes and protozoa, during the time when the C4 plants are dormant and improves soil fertility faster than a C4 pasture alone might. This also speeds up nutrient cycling, promotes an improved water cycle, increases nitrogen content and adds organic matter to the soil which can build humus. Additionally, the no-till drill lightly aerates the soil, allowing oxygen and water to infiltrate.

Another key is using grazing animals to prepare the C4 field before drilling. Grazing animals hit the perennial pasture hard so that the C4 plants come up slowly and give the C3 plants a chance to grow. By hitting the pasture hard with a large mob of sheep in a time-controlled manner, Colin can keep the C4 plants from growing too tall, too early and thus prevent them from shading the C3 plants. Animals can also control weeds, create litter on the soil surface, supply a pulse of organic nutrients for the crops and remove dry plant residue from the pasture.

Advice from Colin: use grazing to create as much litter as possible; use no-till equipment to sow at the correct depth and row spacing; sow the correct crop for your soil type; conduct a soil test if possible; sow the crops up to two weeks earlier than usual because crops sown by pasture cropping are slower to develop; avoid fertilizer use as much as possible (it shouldn't be necessary).

Colin also cautions that crop yields are usually lower in the beginning than with conventional agriculture. This is more than offset by the ability to produce two or more products from the same land, as well as to increase the fertility that is being built up in the soil.

Here's a quick list of the benefits that pasture cropping has brought to Winona Farm:

- It's profitable. Colin and his son run around 4000 Merino sheep and pasture crop around 200 ha (500 acres) annually in oats, wheat and cereal rye.
- The farm has steadily improved its sheep-carrying capacity, wool quality and wool quantity.
- The farm is now almost entirely native grassland with over fifty different species of grasses, forbs and herbs.
- The farm saves around $60,000 annually in decreased inputs (fertilizer, etc.) in comparison to its former operation.
- Crop yields from pasture cropping remain about the same when compared to conventional cropping, with oat yields averaging 2.5 tons per hectare.
- Insect attacks and fungal diseases in crops or pasture are minimal.
- There has been a noticeable increase in bird and native animal numbers, as well as in species diversity.
- Soil microbial counts show that the Winona soil has significantly higher counts of fungi and bacteria now than before.
- According to a soil analysis, all trace minerals and nutrients have increased by an average of 150 percent.
- Perhaps most impressively, soil carbon has increased by 203 percent over a ten-year span compared to an adjacent farm (owned by Colin's brother). Dr. Christine Jones calculated that 171 tons of CO_2/hectare has been sequestered to a depth of one-half meter on Winona. This has contributed to a dramatic increase in the water-holding capacity of the soil, which according to Dr. Jones has also increased by 200 percent in ten years and is now more than 360,000 liters per hectare for every rainfall event.

In 2010, the University of Sydney conducted a research project on both Colin's farm and the neighboring farm in order to evaluate the effects of pasture cropping versus conventional management on soil health and ecosystem function. The project compared paddocks of comparable size on each farm. Here are some of the results of the research:

- Colin's paddock was 83 percent native perennial grass species.
- The neighbor's paddock was 88 percent annual weed species.
- There was greater ecosystem function on Colin's farm.
- The sheep stocking rate was double on Colin's.
- Crop yields were the same.
- Soil microbial counts showed that Colin's land had significantly higher amounts of fungi and bacteria than the neighboring farm.

In the study's conclusion, Dr. Peter Ampt and Sarah Doornbos wrote:

These results illustrate that the rotational grazing and pasture cropping practiced on the innovator site can increase perennial vegetative ground cover and litter inputs, compared to the continuous grazing system and conventional cropping practiced on the comparison site. Increased perenniality and ground cover lead to improved landscape function in the pasture through increased stability, water infiltration and nutrient cycling which in turn can lead to improved soil physical and chemical properties, more growth of plants and micro-organisms and an ultimately more sustainable landscape.

Pasture cropping. Photo courtesy of Winona Farm.

- **For a copy of the Ampt study:** *http://sydney.edu.au/agriculture/documents/2011/reports/Ampt_CiL_BM_CombinedReportSept-2011DRAFT.pdf*
- **For a longer version of this essay:** *www.awestthatworks.com/essays.html*
- **For Colin's farm:** *www.winona.net.au*
- **For Dr. Christine Jones's work:** *www.amazingcarbon.com*

Healing the Carbon Cycle with Cattle

JX Ranch, Tucumcari, New Mexico

In 2004, Tom and Mimi Sidwell bought the 7,000-acre JX Ranch, south of Tucumcari, New Mexico, and set about doing what they know best: earning a profit by restoring the land to health and stewarding it sustainably.

As with many ranches in the arid Southwest, the JX had been hard used over the decades. Poor land and water management had caused the grass cover to diminish in quantity and quality, exposing soil to the erosive effects of wind, rain and sunlight, which also significantly diminished the organic content of the soil, especially its carbon. Eroded gullies had formed across the ranch, small at first but growing larger with each thundershower, cutting down through the soft soil, biting deeper into the land, eating away at its vitality. Water tables fell correspondingly, starving plants and animals alike of precious nutrients, forage and energy.

Rancher Tom Sidwell on the JX's restored grasslands.
© Courtney White

Profits fell too for the ranch's previous owners. Many had followed a typical business plan: stretch the land's ecological capacity to the breaking point, add more cattle when the economic times turned tough and pray for rain when dry times arrived, as they always did. The result was the same—a downward spiral as the ranch crossed ecological and economic thresholds. In the case of the JX, the water, nutrient, mineral and energy cycles unraveled across the ranch, causing the land to disassemble and eventually fall apart.

Enter the Sidwells. With 30 years of experience in land management, they saw the deteriorated condition of the JX not as a liability but as an opportunity. Tom began by dividing the entire ranch into 16 pastures, up from the original five, using solar-powered electric fencing. After installing a water system, he picked cattle that could do well in dry country, grouped them into one herd and set about carefully rotating them through all sixteen pastures, never grazing a single pasture for more than 7 to 10 days in order to give the land plenty of recovery time. Next he began clearing out the juniper and mesquite trees on the ranch with a bulldozer, which allowed native grasses to come back.

As grass returned—a result of the animals' hooves breaking up the capped topsoil, allowing seed-to-soil contact—Tom lengthened the period of rest between pulses of grazing in each pasture from 60 to 105 days across the whole ranch. More rest meant more grass, which meant Tom could graze more cattle to stimulate more grass production. In fact, Tom increased the overall livestock capacity of the JX by 25 percent in only six years, significantly impacting the ranch's bottom line.

The typical stocking rate in this part of New Mexico is one cow to 50 acres. The Sidwells have brought it down to one to 36 acres and hope to get it down to one to thirty acres some day. Tom intends ultimately to divide the ranch into 23 pastures. The reason for his optimism is simple: the native grasses

are coming back, even in dry years. Over the past ten years, the JX has seen an increase in diversity of grass species, including cool season grasses, and a decrease in the amount of bare soil across the ranch. Simultaneously, there has been an increase in the pounds of meat per acre produced.

Tom considers soil health to be the key to the ranch's environmental health, and therefore he plans to leave standing vegetation and litter on the soil surface to decrease the impact of raindrops on bare soil, slow runoff to allow water infiltration, provide cover for wildlife and feed the microorganisms in the soil. He also plans for drought. That's how the JX has standing vegetation and litter on the soil; Tom adjusts his livestock numbers before the drought takes off, instead of during or after the drought has set in, as is traditional.

"I plan for the drought," Tom said with a wry smile, "and so far, everything is going according to plan."

There is an important collateral benefit to all this planning: the Sidwells' cattle are healing the carbon cycle. By growing grass on previously bare soil, by extending plant roots deeper and by increasing plant size and vitality, Tom is sequestering more CO_2 in the ranch's soil than the previous owners did. It's an ancient equation: more plants mean more green leaves, which mean more roots, which mean more carbon exuded, which means more CO_2 can be sequestered in the soil, where it will stay. Tom wasn't monitoring for soil carbon, but everything he was doing had a positive carbon effect, evidenced by the increased health and productivity of the JX.

There's another benefit to carbon-rich soil: it improves water infiltration and storage, due to its sponge-like quality. Recent research indicates that one part carbon-rich soil can retain as much as four parts water. This has important positive consequences for the recharge of aquifers and base flows to rivers and streams, which are the life blood of towns and cities.

It's also important to people who make their living off the land, as Tom and Mimi Sidwell can tell you. In 2010, they were pleased to discover that a spring near their house had come back to life. For years it had flowed at the miserly rate of one quarter gallon per minute, but after clearing out the juniper trees above the spring and managing the cattle for increased grass cover, the well began to pump water at six times that rate, 1.5 gallons per minute, 24 hours a day!

In 2011, the Sidwells' skills were put to the test when less than three inches of rain fell on the JX over a period of 12 months (the area average is 16 inches per year). In response, Tom sold almost the entire cattle herd in order to give his grass a rest. He had enough forage from 2010 to run higher cattle numbers, but he asked himself, "What would a bison herd do?" They would avoid a droughty area, he decided.

It was a gamble, but it paid off in 2012 when it began raining again, although the total amount was ten inches below normal. "It was enough to make a little grass," Tom told me. "We had some mortality on our grass and a lot more bare ground than before the drought, but I think the roots are strong and healthy and recovery will be quick."

"Grazing and drought planning are a godsend," said Tom, "and we go forward with a smile and confidence because we know we can survive this drought."

Tom and Mimi Sidwell. © Courtney White

- **For more information on the JX Ranch:** *www.leannaturalbeef.com*

Water for Bats and Cattle

It's getting harder to find a good drink of water in the arid West, especially if you're a bat.

Over the course of more than twenty years in the field, bat biologist Dan Taylor has watched creeks, ponds and other natural water sources shrink and decline across the region. By some estimates 80-90 percent of the West's riparian (water associated) habitats—by far the most important to wildlife—

A Townsend's big-eared bat swoops down to drink on the wing at a shallow pond. © Merlin D. Tuttle, Bat Conservation International.

have been degraded, mostly by human activity, including a lot of overgrazing by cattle. Taylor believes this downward trend in water availability will continue as climate change raises temperatures and alters precipitation patterns. This will hurt the chances of survival for wildlife and domestic livestock alike.

However, contrary to author Mark Twain's famous quip that in the West, "whiskey is for drinking and water is for fighting," Taylor and his employer, Bat Conservation International, have found a way for bats and cattle to coexist in a hotter and drier time. And not only coexist—but depend on one another for survival.

Bats, like most mammals, need water every day, especially during hot weather when they can lose 30 percent of their body weight in a single afternoon. Bats are the slowest-reproducing mammal on the planet for their size, averaging just one pup per year, which means reducing environmental stress is critical. They depend on free water for their survival—they don't get enough from the food they eat—and it must be pooled water. They drink on the fly and thus require a "swoop" zone, just like airplanes do at airports, of a sufficient length and free from obstacles. The depth of the pooled water isn't important, just the access for swooping.

Which is where livestock (and humans) come in.

Hundreds of thousands of water developments for livestock have been put in place across the West since the 1950s, many in the form of stock troughs. But most of these are not bat-friendly. Obstacles such as wire fences and cross-braces in the swoop path can prove deadly to a bat in flight. If it strikes one and falls into the water, it will drown unless there is an escape ramp provided for it. Some bat species can maneuver in spaces as small as 3 x 4 feet, but most need a pool at least ten feet long and a few require a path 50-100 feet long (a river or stock pond) to get a drink. Humans can enhance stock troughs for bats at minimal cost by 1) maintaining a steady water supply (i.e., don't turn the water off when the cows leave), 2) keeping the water's surface as free of obstructions as possible and 3) providing permanently installed wildlife escape ramps and ladders made from long-lasting material, such as expanded metal.

"As these livestock water developments increasingly replace or augment diminishing natural sources," said Taylor, "they have become crucial for many species, especially when animals are stressed by drought, high temperatures or rearing young. Without reliable sources of water, wildlife must either leave or die—to the long-term detriment of rangelands and forests."

Bats are essential to both healthy ecosystems and human economies. They pollinate plants and disperse seeds, for example. Some plants, including the wild agave, require bats for pollination and thus for reproduction. No bats, no wild tequila! Bats also eat tons and tons of night-flying insects, including beetles, moths, grasshoppers and crickets. Many of these, including army cutworm moths and leafhoppers, cost American agriculture billions of dollars annually. There are 45 bat species across the U.S., 25 of which are found in the Southwest. Improving their access to safe watering sources is thus critically important, especially in dry times.

Bat-accessible water also benefits birds that drink in flight, including swifts, swallows and nighthawks. Pollinators of all sorts like pooled water too, as do many other wildlife species, from javelina to cougars. It's not just troughs—enhancements to stock ponds are critical as well. The federally-listed Chiricahua leopard frog, for example, has come to depend on stock ponds for its survival in certain parts of the Southwest. Of course, enhancing this source of water is beneficial to livestock as well.

In fact, Taylor believes, well-developed stock ponds could be key to climate change adaptation for many species in the arid West.

"Stock ponds capture surface runoff and have been used to water livestock for more than a century," Taylor said. "They've also become an essential source of water for countless species of western wildlife, including big game, birds, bats, other small mammals and amphibians. But many are dry or degraded today. We can restore them, but do it in such a way that we create a kind of wetland pond, which will be good for all animals."

This restoration involves lining the bottom of the old stock pond with clay soil and compacting it, which will prevent water leakage; decreasing slopes and rebuilding spillways in order to reduce erosion and give the pond a more natural appearance; and installing large woody debris (such as logs) in small coves constructed along the water's edge and then planting coves with native species in order to create a diverse habitat for wildlife. Fencing is modified so that cattle have access to the pond at only one small area, which is hardened by gravel or other material to reduce erosion.

"The end result of these improvements is much higher quality water for livestock, more reliable water for livestock and wildlife, and the creation of high quality wetland habitat," said Taylor. "It's a classic win-win, especially as these areas get hotter and drier under climate change."

It's a classic case of coexistence as well. Helping bats means helping ourselves, to the benefit of all.

Placing bat netting over a completed pond, Valle Grande Grassbank, with double rainbow. © Courtney White

- **For more information on Bat Conservation International:** *www.batcon.org*
- **Download *Water for Wildlife*:** *www.batcon.org/pdfs/water/bciwaterforwildlife.pdf*

Organic No-Till Farming

Rodale Institute, Eastern Pennsylvania

Many farmers consider organic no-till to be the "Holy Grail" of regenerative agriculture because it combines the best of both worlds: reduced soil disturbance and no chemicals. Its development, however, came about as innovations so often do—by accident.

Conventionally, a modern farm requires a tractor and a plow in order to turn over the soil and furrow the land in preparation for seeding and fertilizing. In a no-till system a farmer plants the seed directly into the soil, usually with a mechanical drill pulled behind a tractor. The drill makes a thin slice in the soil as it moves along, but nothing resembling a furrow. The soil is not turned over and whatever is growing on the surface is left largely undisturbed. In fact, many no-till farmers plant a cover crop, usually in the fall, so that the soil will be kept cool, moist and protected from the elements as the cash crop emerges from the ground in the spring or early summer.

One of the major disadvantages of no-till, however, is its lack of weed control. Without a plow, the weeds say "thank you very much" for all that undisturbed soil and start growing vigorously, sometimes elbowing out the cash crop. To check weeds in a no-till system, many farmers apply synthetic herbicides to their fields. They also spray pesticides to keep the bugs in check. Additionally, many conventional no-till farmers use genetically-modified seeds, often in combination with chemical herbicides. Of course all of this is *verboten* in an organic farming system.

This is where the happy accident comes in.

One day, Jeff Moyer, the long-time farm director at the Rodale Institute, located north of Philadelphia, Pennsylvania, noticed that as he drove in and out of a field on his tractor, the wheels had crushed and killed a plant called hairy vetch along the field's edges. Vetch is a winter-tolerant legume that organic farmers often plant as a cover crop. Seeing that the vetch was still alive where he had not driven over it, Moyer realized he had "crimped" the plants with the tractor's wheels, causing them to die without causing them to detach from the soil, as cutting or harvesting would do. This intrigued Moyer because by remaining attached the dead vetch became a type of *in situ* mulch for the soil. Normally cover crops are harvested, composted and later returned to the field as mulch. Moyer's accidental discovery changed this equation dramatically: he could now crimp the cover crop instead!

However, no mechanical piece of equipment existed to do this job. Moyer took the initiative and after lots of trial and error, he and a colleague, John Brubaker, settled on a design for what they call a roller-crimper—a hollow metal cylinder to

The Rodale roller-crimper pushing a no-till drill. Photos courtesy of Rodale Institute.

which shallow metal ribs have been welded in a chevron design (like tractor tires). The roller-crimper is mounted in front of a tractor and as it rolls along through a field it crimps the cover crop, breaking plants' stalks and killing them. The weight of the crimper can be adjusted by adding or removing water from the cylinder.

As developed by Moyer and others, there are four basic steps to organic no-till:

1. To protect the soil and keep down the weeds, a winter-hardy cover crop is planted in the fall, such as vetch, barley, wheat or rye.
2. When the cover crop reaches maturity in the spring, the farmer knocks it down with a roller-crimper.
3. The farmer plants a cash crop with a no-till drill or planter, usually at the same time she or he crimps (crimper in front of the tractor, drill pulled behind) and the cash crop grows up through the crimped cover crop.
4. After harvest in the fall, the organic residue of both crops can be disked into the soil as next year's cover crop is planted.

Altogether, the use of a cover crop and a roller-crimper creates a dense mat of organic material on the soil surface that smothers weeds while providing nutrients, shade and moisture to the cash crop.

Voilà the Holy Grail!

The many benefits of organic no-till include:

- Soil is built by the decomposing cover crop.
- Erosion is reduced substantially.
- Nearly all annual weeds are smothered.
- Cover crop roots increase nutrient cycling in the soil, including carbon and nitrogen.
- Biodiversity is increased.
- Greenhouse gas emissions are reduced.
- Costs are low.
- The roller-crimper is easy to use and maintain. Better yet, if the tractor runs on farm-produced biodiesel or is pulled by horses, dependence on fossil fuels is eliminated, which creates a positive energy balance.

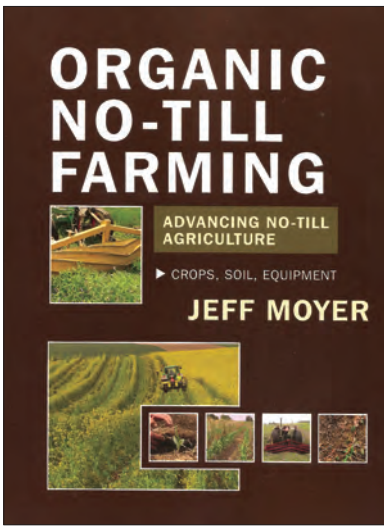
There are some downsides:

- Cover crops are extra work and an extra cost.
- They require water, sometimes a lot of it (which makes the practice problematic in arid environments).
- Perennial weeds can be a nuisance.
- Choosing the correct cover crop for your land and matching it to the needs of the cash crop can require a lot of experimentation.
- Rolling the crimper too early in the season can be a costly mistake if the cover crop doesn't die completely.
- Like anything new, success requires a great deal of patience.

However, the advantages far outweigh the downsides, which is why the practice is spreading rapidly. According to Moyer, there are now hundreds of roller-crimpers at work on farms and research stations across the nation.

One more terrific benefit: No-till farming sequesters carbon dioxide. Research at Rodale shows that plowing releases large amounts of stored carbon into the atmosphere, adding to the planet's greenhouse gas problem. When soil is turned over, the sudden access to oxygen speeds up the biological decomposition process, by which microbes eat up organic matter and "burp" carbon dioxide into the air. In contrast, organic methods sequester carbon by improving biological life in the soil. When combined with no-till, according to data, the system has the potential to sequester 1000-2000 pounds of carbon per acre per year—pulled directly from the atmosphere.

That's a Holy Grail that we can all appreciate!



- **For more information read *Organic No-Till Farming* by Jeff Moyer, available from Acres USA Press:** *http://www.acresusa.com/books/books.asp?pcid=2*

A Carbon Sweet Spot

Twitchell Island, Sacramento-San Joaquin River Delta, California

For a minute, I thought I had stepped into that scene from *Lawrence of Arabia* when T. E. Lawrence, approaching the Suez Canal, sees a ship sailing across the sand.

I had parked on a levee at the north end of Twitchell Island, in the middle of the great Sacramento-San Joaquin River Delta east of San Francisco. In front of me was prime farmland and just beyond a slight rise in the distance I saw a big cargo tanker plowing its way slowly across a field—plowing the middle of the San Joaquin River, of course.

I didn't drive to Twitchell Island to see farmland, however. I wanted to see a carbon sweet spot in action. Sweet spots are where big things happen in small places with a minimum amount of effort. On Twitchell, a whole suite of big things had happened on just fourteen acres in only a few years and with very little cost.

The Delta was once a vast freshwater marsh thick with Tule reeds, cattails and abundant wildlife. At least six thousand years old, the marsh caught sediment that washed down annually from the Sierra Nevadas, building up soil that eventually extended 60 feet deep in places. When the delta began to be settled in the 1860s, following California's famous Gold Rush, farmers couldn't believe their luck. Because the soil had often been submerged—a consequence of flat terrain, frequent flooding and tidal action—it had essentially become peat, rich in carbon and other organic minerals. Crops grew vigorously here and soon a new gold rush was on—to claim land in the Delta, drain it and grow row crops by the bushel-load.

Twitchell Island Boardwalk. © Mathew Grimm, Environmental Defense Fund

Fast-forward to today, and the Delta is in big trouble. Innumerable ditches and levees have broken up the marsh into 57 separate islands, 98 percent of which are now below sea level. Pumps work continuously to keep the roots of crops dry enough to grow and be harvested. Salt intrusion from the Bay is creeping inland, threatening not only the crops but the drinking water supply for two-thirds of all Californians and much of its agriculture. Not many people know that central California is a vast plumbing project, crisscrossed by a complex network of canals, ditches and pumping stations. And most of the water in this plumbing system originates in the southern part of the Sacramento-San Joaquin Delta.

But here the islands are sinking, sea level is rising and the 1,100 miles of levees that protect it all are feeling the stress, literally. It's called "subsidence" and it places tremendous hydrostatic pressure on the levees, requiring constant maintenance and creating perpetual anxiety. What if the levees were breached by a massive flood? What if salt water poured through, ruining crops and drinking supplies?

In 1997, in an attempt to alleviate these worries, a group of scientists with the U.S. Geological Service came up with a novel plan: employ nature, not technology, to reverse the subsidence. Here was their bright idea: when the early farmers drained the Delta they exposed the peat soil to the atmosphere,

causing organic material that was previously under water to oxidize rapidly. The carbon in the soil literally blew away, which caused the land to compact and subside over time. That's how the islands ended up below sea level—as much as 25 feet in some places. The USGS scientists wondered if this process could be reversed. In other words, would the land build up again if the marsh ecology, including periodic flooding, could be resurrected?

To find out they implemented an experiment on two 7-acre, side-by-side plots of farmland adjacent to a ditch that bisected Twitchell Island. They flooded the western plot to a depth of 25 centimeters, and the eastern plot to 55 centimeters. Tules were planted in a small portion of each plot. By the end of the first growing season, cattails had colonized both plots (the seeds arriving on the wind), which provided a screen for other plants, including duckweed and mosquito fern. Then things really took off. After just a few short years, and annual managed flooding, the western plot had developed a dense canopy of marsh plants, as had the eastern plot, though it also maintained some open water.

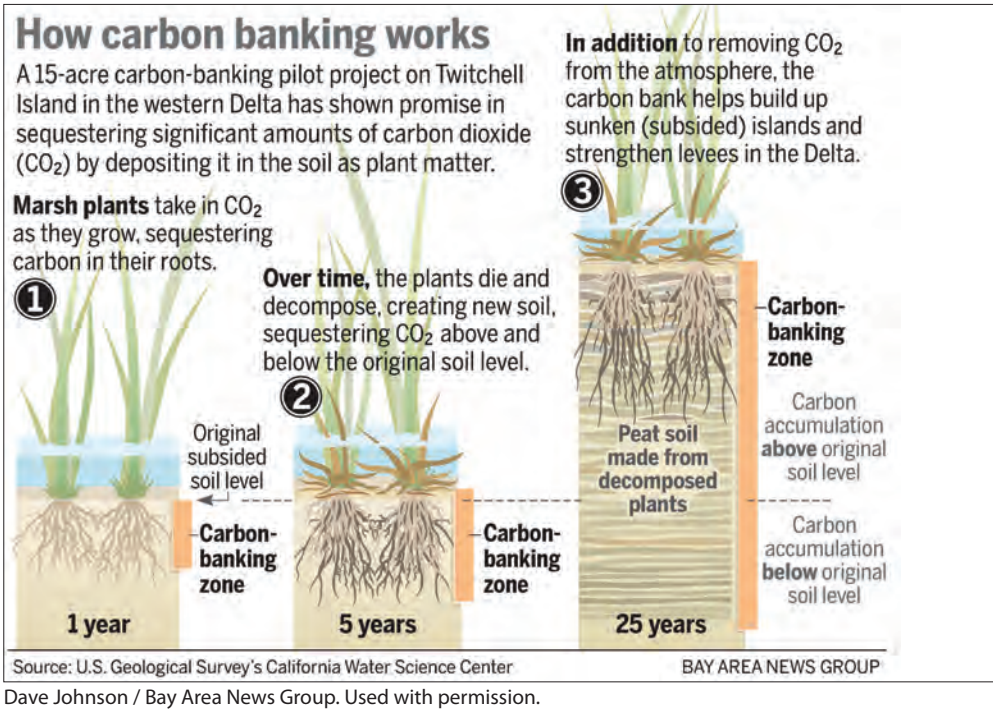
When the scientists took measurements, they were amazed to discover that after seven years the soil in both plots had risen 10 inches—the result of 15 tons of plant material growing and dying per acre per year. This answered their question: subsidence could be reversed by returning natural marsh processes to the land.

But the good news was just beginning. The researchers next tested the amount of CO_2 that had been sequestered in this new soil as a result of their experiment. They suspected that 10 inches of dense, carbon-rich peat soil likely soaked up a lot of atmospheric CO_2—and they were right. According to their analysis, as much as 25 metric tons per acre per year was sequestered in the study plots. In comparison, a typical passenger vehicle emits five metric tons of CO_2 per year. The 14 acres in the study plots sequestered the equivalent emissions of 70 passenger vehicles per year! And that didn't even count the CO_2 emissions eliminated by not farming the land. And it didn't count all the other ecosystem services generated by a functioning marsh, including water purification and wildlife habitat.

The researchers called what they created a "carbon-capture farm" and hoped that the project would demonstrate that it is highly feasible to use managed wetlands to sequester carbon and reduce subsidence simultaneously.

Although the specifics of this project are likely limited to the Sacramento-San Joaquin Delta, it is nonetheless a very good example of a sweet spot. On just fourteen acres, the project demonstrated how to 1) reverse subsidence, 2) reduce the risk of levee failure, 3) sequester a lot of carbon and 4) provide wildlife habitat, especially for birds on the Pacific flyway.

Sweet spots are literally and figuratively important for what they can do for the land and for what they can teach us. They're not a mirage, like a ship in a field. They're all around us, if we know where to look.



Dave Johnson / Bay Area News Group. Used with permission.

Rooftop Farming

Eagle Street Farm, Brooklyn, New York

I had never climbed three flights of stairs before to visit a farm.

That's what I did after emerging from a subway station in Greenpoint, Brooklyn and walking along Eagle Street to a warehouse owned by a television company called Broadway Stages. On the roof I saw hundreds of vegetables set in neat rows of dark, rich soil. Walking to the edge, I saw the East River and beyond it a sweeping view of mid-town Manhattan and the Empire State Building.

Wow.

I had come to Eagle Street Farm to see the nation's first commercial rooftop farm in action and meet Annie Novak, the farm's charismatic co-founder, a Chicago girl who grew up reading *Vogue* magazine with dreams of "being fabulous" in New York City, and then became a truly fabulous rooftop farmer.

One week after graduating college, Annie landed an internship that turned into a seasonal job at the New York Botanical Garden teaching children how to grow food. In the years that followed, she balanced her city job with farming upstate, starting a nonprofit organization and dabbling in the restaurant business. Eagle Street happened when the owners of Broadway Stages decided to install a green roof. Originally the plan had been to create an ornamental plant nursery, but Annie and co-founder Ben Flanner convinced the owners to give veggies a chance instead. They added compost to the soil mix, planted crops they knew were tolerant to heat and water stress, organized a small cadre of volunteers, studied weather forecasts and crossed their fingers. It worked.

Annie Novak at Eagle Street Farm.
© Avery C. Anderson

Today, the farm grows a wide range of crops, specializing in heat-loving and dry-tolerant chiles. The farm also keeps bees, rabbits and hens. It sells its produce on-site and to local restaurants.

It hasn't all been a bed of roses, however. At times, wind storms and unseasonable heat bedevil both the veggies and their handlers. Space is a limitation—Annie can't expand the farm even though she would very much like to. In the beginning, fertilizer was another challenge because it had to be to be hauled up the stairs. This challenged was solved when Annie brought in rabbits and chickens, which she calls "my little poop machines."

The economics of rooftop farming are a challenge as well. The for-profit farm relies on value-added products like its hot sauce (called Awesome Sauce) to raise the $1.50-$3 per square foot value needed to farm unprocessed crops. At 6,000 square feet with no room to grow, farming at that scale makes just enough income to support a few part-timers, management included.

Given the farm's small size, the most frequent question Annie gets is "Can New York City feed itself?" Her response is unexpected: "Does New York want to?" She thinks not. "The quality of our air and water is protected by upstate organic growers," she said. It's important to her that those farmers, and the watershed in which they work, be supported by New York City residents.

Eagle Street has inspired others to give rooftop farming a try.

In 2010, a group of young farmers formed a for-profit organization called the Brooklyn Grange and opened what has become the world's largest rooftop

farm, totaling 2.5 acres (108,000 square feet). They grow more than 40,000 pounds of organic produce a year. Their goal is to create a fiscally sustainable model for urban agriculture while producing healthy food from what they call the "unused spaces of New York City."

The work of Brooklyn Grange has quickly expanded to include: 1) egg-laying hens, 2) a commercial apiary and bee-breeding program (for city hardiness), 3) a farm training program for dozens of interns, 4) tours and workshops for thousands of New York City youth, 5) launching the New York City Honey Festival in 2011 and 6) providing a unique setting for corporate retreats, dinner parties and weddings.

The farm also tackles environmental challenges peculiar to metropolitan areas. With a grant from New York's Green Infrastructure Stormwater Management Initiative, Brooklyn Grange sited its second farm on the 65,000-square-foot roof of a building in the historic Brooklyn Navy Yard, which allows them to manage over one million gallons of stormwater a year.

There's another environmental benefit: the 2.5 acres of soil under the management of the Grange are soaking up atmospheric CO_2. It isn't much, but it's a start.

In 2013, rooftop farming spread to Boston with the launch of Higher Ground Farm, which occupies 40,000 square feet on top of the Boston Design Center, making it the world's second-largest rooftop operation. The brainchild of two young farmers, Higher Ground's mission is similar to what Annie Novak and the folks at Brooklyn Grange pioneered: 1) make a dent in the urban heat island effect with a green roof, 2) help with stormwater management, 3) reduce carbon in the air and improve air quality, 4) increase access to fresh, healthy food, 5) provide habitat for biodiversity and 6) provide educational opportunities, as well as many other community co-benefits.

"When I'm on a rooftop, all I'm doing is listening to the sound inside a tiny seashell and trying to hear a larger ocean," Annie said. "If you live in a city, take advantage of it. Soak up the street smarts and the rush of city living that also embraces outdoors and fresh tomatoes. You have to grow a small plot with a big picture in mind."

- **For more info see:** *http://rooftopfarms.org* **and** *http://www.brooklyngrangefarm.com*

Brooklyn Grange Rooftop Farm. © Cyrus Dowlatshahi.

Thinking Like a Creek

During my travels, I heard a story about a man who had put short fences across a cattle trail in the sandy bottom of a canyon in Navajo country. This forced the cattle to meander in an S-pattern as they walked, encouraging stormwater to meander too and thus slowing erosion. I thought this idea was wonderfully heretical. That's because the standard solution for degraded creeks is to spend a bunch of money on cement, riprap and diesel-driven machines. Putting fences in the way of cattle and letting them do the work? How cool.

The man was Bill Zeedyk, a retired biologist with the U.S. Forest Service reincarnated as a riparian restoration specialist. Was the story true? I asked him. It was, he assured me. Recognizing that water running down a straight trail will cut a deeper and deeper incision in soft soil with each storm, Bill talked the local Navajo ranchers into placing fences at intervals along the trail so that the cows would be forced to create a meander pattern in the soil precisely where he thought nature would do so in their absence. Water likes to meander, which is nature's way of dissipating energy, and it will gravitate toward doing so even when it's temporarily trapped in a cattle-caused rut (or human-caused hiking trail). Bill's fence idea was a way to move the process along.

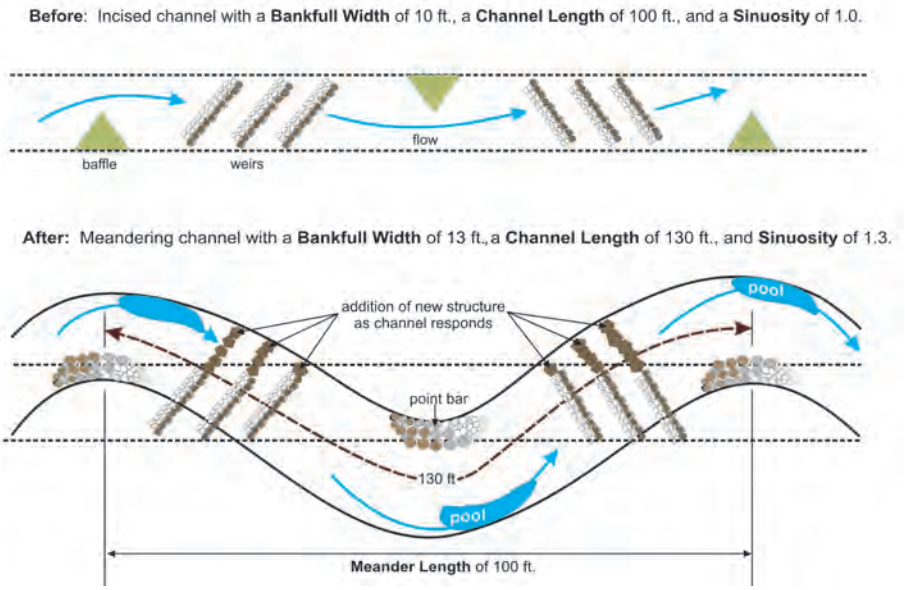
What happened after the fences were put in? The water table came up as vegetation grew back, replied Bill, because the water was now traveling more slowly and had a chance to percolate into the ground, rather than run off as it had before. Eroded banks began to revegetate as the water table rose, and more water appeared in the bottom of the canyon, which encouraged riparian plant growth.

"Nature did all the heavy lifting," Bill said. Then he added, with a warm, knowing smile. "It worked great, until someone stole the fences."

Over the years, Bill has developed a very effective set of low-cost techniques that reduce erosion, return degraded riparian areas to a properly functioning condition and restore wet meadows. This is important because a big part of the West exists in an eroded condition, generally the result of historically poor land management. This point was brought home to me in force one day when I walked under a barbed wire fence that stretched across a gully on a New Mexico ranch. The fence was five feet above my head. The rancher told me that the fence was built in 1937 and the fence posts originally rested on the ground! To repair this kind of damage, Bill has put together a toolbox designed to "heal nature with nature." It includes:

- One rock dams/weirs, grade-control structures composed of wooden pickets or rocks that are literally one-rock high and simulate a "riffle" effect in creeks.
- Baffles/deflectors, wedge-shaped structures that steer water flow.
- Vanes, a row of posts that project upstream to deflect water away from eroding banks.
- Headcut control structures/rock bowls, to slow or stop the relentless march of erosion up a creek and trap water so that vegetation can grow.
- Worm ditches, to redirect water away from headcuts in wet meadows.

These fence posts rested on the ground in 1937. © Courtney White



Graphic representation of the Induced Meandering Process. Schematic dimensions exaggerated (Zeedyk and Clothier 2009).

The goal of these structures is to stop downcutting in creeks, often by "inducing" an incised stream to return to a dynamically stable channel through the power of small flood events. Bill calls this "Induced Meandering." When a creek loses its riparian vegetation—grasses, sedges, rushes, willows and other water-loving plants—it tends to straighten out and cut downward because the speed of water is now greater, causing the scouring power of sediment to increase. Over time, this downcutting results in the creek becoming entrenched below its original floodplain, which causes all sorts of ecological havoc, including a drop in the water table. Eventually the creek will create a new floodplain at this lower level by remeandering itself, but that's a process that often takes decades. Bill's idea is to goose the process along by forcing the creek to remeander itself as the result of his carefully calculated and emplaced vanes, baffles and riffle weirs. Once water begins to slow down, guess what begins to grow? Willows, sedges and rushes!

"My aim is to armor eroded streambanks the old fashioned way," said Bill, "with green, growing plants, not with cement and rock gabions."

The employment of one rock dams typifies Bill's naturalistic approach. The conventional response of landowners to eroded and downcut streams and arroyos has been to build check dams in the middle of the water course. The old idea was to trap sediment behind a dam, which would give vegetation a place to take root as moisture is captured and stored. The trouble is, check dams work against nature's long-term plans.

"All check dams, big or small, are doomed to fail," said Bill. "That's because nature has a lot more time than we do. As water does its work, especially during floods, the dam will undercut and eventually collapse, sending all that sediment downstream and making things worse than if you did nothing at all."

"The trick is to think like a creek," he continued. "As someone once told me long ago, creeks don't like to be lakes, even tiny ones. Over time, they'll be creeks again."

Bill's one rock dams don't collapse because they are only one rock high. Instead, they slow water down, capture sediment, store a bit of moisture and give vegetation a place to take root. It just takes a little more time to see the effect.

"As a species, we humans want immediate results. But nature often has the last word," said Bill. "It took 150 years to get the land into this condition; it's going to take at least as long to get it repaired." The key is to learn how to read the landscape—to become literate in the language of ecological health.

"All ecological change is a matter of process. I try to learn the process and let nature do the work," said Bill, "but you've got to understand the process. If you don't, you can't fix the problem."

Over 15 years and across a dozen states, Bill has implemented hundreds of restoration projects, healing miles of riparian areas—all by thinking like a creek!

Bill Zeedyk. © Avery C. Anderson

Why Grassfed Is Best

"Eat less red meat."

That's the most frequent response I hear at conferences when a distraught member of the audience asks a presenter, "What's the one thing I can do for the planet?"

What the presenter should have said is "Eat less feedlot meat." A lot less, in fact. Actually, the correct answer is "Eat grassfed meat." It's the only kind of meat to eat—for our health, for the welfare of livestock and for the well-being of the planet.

That's what Joe Morris has been producing since 1991, when he became one of the first ranchers in California to offer grassfed beef to customers, predating the recent boom in grassfed production by a dozen years. Born and raised in San Francisco, Joe was inspired to give ranching a go by his grandfather, who owned and ran a ranch near San Juan Bautista, south of San Jose. Equally inspired by the writings of Wendell Berry, Joe decided to reject the industrial model of livestock production for a type of agriculture that worked with nature's principles. When he discovered the holistic grazing practices pioneered by Allan Savory, everything fell into place.

Morris grassfed cattle on the move. © Courtney White

Producing grassfed beef was an easy choice for Joe because it squared with his values. By definition, grassfed means an animal has spent its entire life, birth to death, on grass or other green plants. This contrasts with the feedlot model in which an animal finishes its life in confinement, fattened on grain and assorted agricultural by-products and pumped full of medication and other chemicals.

For Joe, grassfed was best initially because he knew that 1) cattle were designed by nature to eat grass, not grain, and had merely been doing so for millions of years and 2) humans were designed by nature to eat grassfed meat, not grain-fed animals, and had merely been doing so for millions of years. If nature knew best, then why raise livestock unnaturally?

However, when Joe and his wife Julie founded Morris Grassfed Beef in 1991, a big question on their minds was this: would they have any customers? The answer, as it turned out, was "Yes"—because people wanted a local source of pastured, humanely raised beef produced by a good steward of the land. Grassfed fit the bill.

Then came the science. Thanks to a lot of digging in the scientific literature by Jo Robinson, an independent researcher, the health benefits of grassfed over feedlot meat became widely known. They include:

- More omega-3 fatty acids ("good" fats) and fewer omega-6 ("bad" fats)
- Lower in the saturated fats linked with heart disease
- Much higher in conjugated linoleic acid (CLA), a cancer fighter
- Much more Vitamin A
- Much more vitamin E
- Higher in beta-carotene

- Higher in the B-vitamins thiamin and riboflavin
- Higher in calcium, magnesium and potassium
- Enhanced immunity, increased bone density and suppression of cancer cells
- Does not contain traces of added hormones, antibiotics or other drugs

As Jo Robinson likes to say "If it's in their feed, it's in our food"—which means it's in us. This is an important reason why grassfed is best. As for eating less meat, Jo said recently, "I'm not one of those who think that eating less meat is good. I think eating less of the wrong kind of meat is very good and very important. I think we can have up to 40 percent of our calories from meat, and that's fine as long as it's healthy meat."

In 2002, the case for grassfed expanded again when The New York Times Magazine published Michael Pollan's expose on the sins of our industrial food system in an article titled "Power Steer." By following a steer ("#534") from ranch to feedlot to slaughter, Pollan discovered a disturbing list of industrial troubles, including:

- Animal confinement, stress and abuse
- Air, land and water pollution
- The deleterious use of hormones and antibiotics
- Low-paid, stressful feedlot work
- Food with less nutritional value
- The invisible costs—antibiotic resistance, environmental degradation, heart disease, E. coli poisoning, corn subsidies and imported oil

"The only big advantage of feedlot beef," said Pollan, "is that it's remarkably cheap." While that makes economic sense—sort of—it makes no ecological sense. Pollan voted for grassfed beef. He concluded "Eating a steak at the end of a short, primordial food chain comprising nothing more than ruminants and grass and light is something I'm happy to do and defend."

In the past few years, another important advantage of grassfed has emerged: it has a smaller carbon footprint. By some estimates, meat from grassfed animals requires only one calorie of fossil fuel to produce two calories of food. In contrast, feedlot beef requires 5 to10 calories of fossil fuel for every calorie of food produced. The big differences include the fertilizer and other inputs used to grow the corn feed and the amount of transportation involved in placing feedlot beef in supermarkets across the nation.

The carbon footprint advantage has been challenged by some experts, however, who claim that methane emissions are higher with grassfed livestock and that the overall impacts on land health and water quality (due to overgrazing) are fewer with feedlots.

Disagreeing with these experts, a 2011 report by The Union for Concerned Scientists (UCS) claimed that the overall greenhouse gas impact of grassfed is positive. Well-maintained pastures and careful management of grazing animals can draw greenhouse gasses out of the air and store them in the soil, where they fuel plant growth. Feedlots have no living plants, the UCS noted, just bare dirt and manure. Instead of absorbing greenhouse gasses, as healthy grasslands do, they emit them.

It's a point that Joe Morris has been making lately with his customers. He also points out that conscientious stewardship has additional benefits:

- Well-managed pasture absorbs far more rain water than most other land uses.
- Well-managed grazing lands provide needed habit for wildlife and more abundant water for wildlife.
- Grazing lands are among our most picturesque.
- Holistic management encourages deep-rooted perennial plants, improving nutrient and carbon cycling.

For those who ask "What's the one thing I can do for the planet?" the answer is clear: if you eat meat, grassfed is best.


Joe Morris. © Courtney White

- **More at:** *www.eatwild.com* **and** *www.americangrassfed.org*

The Mobile Matanza

Taos County Economic Development Corp., Taos, New Mexico

A common complaint among grassfed ranchers, local food advocates and rural development entrepreneurs is the chronic lack of nearby slaughterhouses. Too often, producers must drive long distances to have their animals processed, raising their costs and reducing their profitability as a consequence—and jeopardizing the sustainability of their product.

Here's one solution: instead of driving to the slaughterhouse, have it come to you!

I was introduced to this idea on a sunny day in late September 2006, when I drove to Taos, New Mexico to attend a ribbon cutting ceremony for a mobile slaughtering unit (MSU), only the second one in the nation at the time. I joined a sizeable crowd of local ranchers, farmers and others at the headquarters of the Taos County Economic Development Corporation (TCEDC), a nonprofit co-directed for over 25 years by Pati Martinson and Terrie Bad Hand. Of mixed Native American ancestry, both women have extensive backgrounds in social justice work, education, economic development, youth leadership and civic engagement. This may be why they dubbed the MSU a matanza, a Spanish word for a communal celebration involving the annual harvest of a farm's livestock, an old tradition in the region.

TCEDC co-directors Terrie Bad Hand and Pati Martinson at ribbon-cutting ceremony. © Courtney White.

The idea of a mobile matanza is simple: a semi-truck carrying a self-contained slaughtering lab and cold-storage unit drives to a farm or ranch and processes the livestock on site. The truck then takes the carcasses to a local cut-and-wrap facility, where they hang for 14 to 21 days before being cut, packaged, labeled and frozen for sale or storage.

The idea of a mobile unit originated among a ranchers' cooperative in the San Juan Islands, which are located in Puget Sound near Seattle. Isolated on their respective islands, the ranchers were frustrated with the high cost and logistical difficulty of taking their animals to a slaughterhouse on the mainland, so they decided to build a ferry-friendly facility instead. In 2002, after a period of trial-and-error, they arrived at a design that met their needs and the needs of various regulators, and the nation's first MSU went to work.

The idea came to New Mexico in 2006, when the state Legislature, backed by Governor Bill Richardson, approved a $200,000 appropriation to purchase a mobile unit and entrusted the project to TCEDC. Shortly thereafter, Pati and Terrie made a field trip to Puget Sound to see how an MSU operated and were struck by its potential for northern New Mexico.

"The isolated islands we saw were like the isolated villages around Taos," Terrie told me. "It worked there and we thought it could work here."

It has—and well—as I observed recently.

Back in 2006, however, the mobile matanza faced a series of intimidating challenges, including:

- Meat Inspection. The USDA wasn't interested initially and the state inspection system had just been suspended by the governor.
- Bias. It was necessary to overcome long-standing prejudices by agencies and regulators against local, family-scale producers, which Pati and Terrie viewed as a civil rights issue.
- Adaptation. Built in Washington, the MSU had to be

adjusted to New Mexican conditions (higher ground clearance, bison slaughter), not to mention driving the unit all the way home to Taos!

- Money. The Legislature provided zero funds for staffing the MSU, maintaining it or advertising its services.
- Job Descriptions. They had to be made up from scratch.
- Cut-and-Wrap. Where was it going to be done? All the local options around Taos were going out of business or had scaled back substantially.
- Year-Round Supply. Ranchers had to consider slaughter beyond just the fall.
- Regulators. Before the matanza could open for business (and stay in business) nine different regulating authorities had to sign off, including organic certification, transportation, the state Environment Department, weights and measures licensing, the Livestock Board, the USDA and even Homeland Security.

To top it off, Pati and Terrie had to be creative in a hurry. On the cut-and-wrap front, for example, they went to the largest refrigeration company in the nation, Polar King, and asked them to custom-build an 800-square-foot, self-contained fiberglass facility for cutting, hanging and wrapping, to be housed at TCEDC. "They were great to work with," Pati said, "and we were able to install it very quickly." On the other hand, finding the right combination of staff, two in the mobile unit and two in the cut-and-wrap, proved to be a longer-lasting challenge, though they are very pleased with the staff in place now.

In addition to being mobile, the matanza is highly humane, as I witnessed during my visit. A USDA inspector is on site to ensure that animals are healthy, well treated and feel as little pain as possible when they are killed. The whole process is held to the highest standards, the inspector told me, including organic certification.

Here are other pertinent details about the matanza:

- It operates only within a 100-mile radius of Taos (with a few exceptions).
- It can process hogs, cattle, bison, sheep, goats, captive elk and yak.
- It can average 4 to 10 animals a day, depending on size.
- Its regular customers include tribes, local ranchers and restaurants.
- TCEDC charges a fee for the slaughter and for the cut-and-wrap.
- The start-up cost of the project is under $500,000, $100,000 each for the slaughter lab, the semi-truck and the cut-and-wrap facility, plus labor and overhead.

That's *only* $500,000, by the way—not much money for all the benefits of local slaughter.

For example, Terrie said the matanza processes about 100,000 pounds of meat each year, meat that is produced by the community and stays in the community, as does the money it generates. This includes the added value it brings to the ranchers via sales at farmer's markets and at grassfed premium prices, which in turn has a positive impact on maintaining the land-based traditions and culture of the area. The Food Center at TCEDC assists ranchers with labeling and marketing too, if they want it.

By bringing the slaughterhouse to the producer, fuel and transportation costs are saved, feedlots are bypassed, economic values can be added on, food stays in the community in which is was raised and cultural traditions are reinforced.

Mobile Matanza and operator Gilbert Suazo, Jr. © Courtney White.

However, Pati cautions, "Never do this as a stand-alone enterprise. It must be part of a community food system. That way it is part of a larger effort to help people."

- **For more on TCEDC see:** *http://www.tcedc.org*
- **For more on Mobile Slaughter Units see:** *http://www.mobileslaughter.com/ and http://smallfarms.wsu.edu/animals/processing.html*

An Agrivoltaic System

What is the best way to utilize sunlight—to grow food or to produce fuel?

For millennia, the answer was easy: we used solar energy to grow plants that we could eat. Then in the 1970s the answer became more complicated as fields of photovoltaic panels (PVPs) began popping up around the planet, sometimes on former farmland. This was part of a new push for renewable energy sources, and as the technology has improved in recent years, so has the scale of solar power projects on land that could otherwise produce food.

In the 1990s, the food vs. fuel debate took a controversial turn when farmers began growing food crops for fuels such as corn-based ethanol, with encouragement in the form of government subsidies. Today the production of biofuels, including massive palm oil plantations, has become big business, often at the expense of hungry people. As a result, the land requirement of the biofuels industry, not to mention its deleterious impact on ecosystems and biodiversity, has become huge—and it keeps growing.

Making the situation even more complicated and controversial is a simple fact: according to scientists, the amount of land needed to replace fossil fuels with biofuels exceeds all the farmland available on the planet. In other words, increased competition between food and fuel for agriculturally productive land means that the stage is set for food shortages and rising conflict as the projected human population on Earth swells to nine billion by 2050.

Solar panels above a farm field in France.
Photo courtesy of Christian Dupraz.

These developments led French agricultural scientist Dr. Christian Dupraz to ponder a question: could food and fuel production be successfully combined on one plot of land? For example, *why not build solar panels above a farm field so that electricity and food can be produced simultaneously?* In addition to resolving the conflict between land uses, solar panels would provide an additional source of income to farmers, while at the same time sheltering crops from the rising temperatures and destructive hail and rain storms associated with climate change.

Why not, indeed—except that no one had implemented such an idea and researched its possible benefits and limitations! So Dr. Dupraz and his colleagues at INRA, France's agricultural research institution, decided to try it themselves.

"As we need both fuels and food," he wrote in a scientific paper, "any optimization of land use should consider the two types of products simultaneously."

In the same paper he also coined a new word to describe this system, *agrivoltaic*.

In 2010, Dupraz and his colleagues built the first ever agrivoltaic farm, near Montpellier, France, to test their hypothesis. In a 2,000-square-meter test field they planted crops in four adjacent plots—two in full sun (as controls), one under a standard-density array of PVPs (as if the solar panels had been mounted on the ground) and one under a half-density array of PVPs. The panels were constructed at a height of four meters (13 feet) to allow workers and farm machinery access to the crops.

The main issue was the effect of shade created by the PVPs on

plant productivity. The researchers assumed productivity would decline, though there was scant data in the scientific literature to consult. That's why they built two different shade combinations, full vs. half-density, so that they could compare the effects to each other and to the control plots in full sun.

"Basically, solar panels and crops will compete for radiation," Dupraz wrote, "and possibly for other resources such as water, as solar panels may reduce the available water quantity for crops due to increased runoff or shelter effects." By the same token, shade can improve the productivity of crops in a warming world. "Water availability limits many crop productions . . . Shade will reduce transpiration needs and possibly increase water efficiency."

The original agrivoltaic experiment, in Montpellier, France. Photo courtesy of Christian Dupraz.

As the experiment progressed, it became clear that a compromise needed to be struck between maximizing the amount of electricity produced by the solar panels and maintaining the productive capacity of the farm. Here's how Dupraz described it in scientific terms: "The optimum shade level for photosynthetic productivity would be one at which the level of photosynthetic photon flux density is high enough to saturate CO_2 assimilation but low enough to induce shade acclimation and reduce photoinhibition."

It was the Goldilocks Principle at work: too much shade hurt the crops, too little hurt electricity generation. Everything had to be just right. Could this balance be achieved? Variables the researchers identified included:

- The proper angle or tilt of the PVPs
- The proper spacing between solar panels
- Making adjustments for localized conditions (such as latitude)
- Choosing between fixed panels or panels on trackers (cost as a factor)
- The proper height of the PVP array
- Engineering issues involved with the construction of the structure that holds the PVPs in place (must be durable)

At the end of three growing seasons they had their answer: *yes, balance was possible*! But not quite for the reason they expected.

Not surprisingly, the crops under the full-density PVP shading lost nearly 50 percent of their productivity compared to similar crops in the full sun plots. However, the crops under the half-density shading were not only as productive as the control plots; in a few cases they were even more productive!

The reason for this surprising outcome, according to Dr. Helen Marrou, who studied lettuce in the plots, was the compensating ability of plants to adapt to lower light conditions. She reported that lettuce plants adjusted to decreased levels of radiation by 1) an increase in the total plant leaf area and 2) an increase in total leaf area arrangement in order to harvest light more efficiently.

"As a conclusion," Dr. Marrou wrote in a paper, "this study suggests that little adaptation in cropping practices should be required to switch from an open cropping to an agrivoltaic cropping system and attention should be mostly focused on mitigating light reduction and on plant selection."

In other words, it's no longer an either/or situation. Thanks to the work of Dr. Dupraz and his colleagues, we know that agrivoltaic systems can combine food production with energy production on one parcel of land, while at the same time increasing the resilience of agriculture to climate change.

Music to Goldilock's ears—and to ours!

- **For more information see:** "Combining solar photovoltaic panels and food crops for optimising land use: towards new agrivoltaic schemes" by C. Dupraz et al. in *Renewable Energy* 36 (2011) 2725-2732.

Leave It to Beavers

Of all the good things beavers do, the least appreciated may be their role as wetland carbon engineers.

Thanks to a high density of plant matter and a low rate of decomposition, wetlands are the world's best ecosystems for capturing and storing the carbon from CO_2. Their destruction, on the other hand, releases lots of CO_2 into the atmosphere as their soils dry out and oxidize. Moreover, at least one-third of the world's wetlands are composed of peat, a type of soil created by dead or dying plants that are permanently water-bound. Peatlands, which include bogs and fens, contain 30 percent of global terrestrial carbon but cover only three percent of the earth's land surface (eight percent in the U.S.)—which is a lot of carbon bang for the buck.

Alas, of the approximately 200 million acres of wetlands that existed in the U.S. during the 1600s, more than half has been destroyed, mostly by draining and conversion to farming or commercial and residential development. Although the rate of destruction has slowed considerably in recent years, thanks to our understanding of the critical role wetlands play in ecosystem health, roughly 60,000 acres are still lost every year.

Which is where our friend the beaver comes in.

Beaver dams create wetlands by trapping sediment and slowing down water (one hydrologist calls beaver dams "speed bumps" in a creek). By one estimate, as much as one meter of sediment per year is caught behind beaver dams, and some sites can be occupied as long as fifty years. Many dams are large as well, often stretching 1,500 feet. In 2010, researchers in northern Alberta, Canada discovered the world's biggest beaver dam, which at nearly 2,800 feet is twice the length of Hoover Dam!

Beaver, *Castor canadensis.* © Shutterstock.com

Biologists have long considered beaver to be a keystone species, estimating that 85 percent of all wildlife in the American West at some point in their lives rely on the ponds and riparian habitat that beavers create. For example, beaver ponds are important nurseries for fish, including many rare and endangered species. And it's not just wildlife that benefit from our industrious friends. According to the EPA, beaver ponds allow wetland microorganisms to detoxify pesticides and other pollutants, producing cleaner drinking water for people and reducing the cost of treatments downstream.

Conversely, when beavers are killed or trapped for removal and their dams fall apart, a cascading series of unhappy changes occur, including decreased riparian stability, lowered water tables, higher and more frequent flooding, reduced wetland acreage, degraded habitat for wildlife, diminished water quality and less resilience to the effects of drought—not to mention all the carbon that is released back into the atmosphere.

And we've trapped a lot of beavers over the years.

Before the arrival of Europeans, it's estimated that 100 to 400 million beavers existed in North America, or roughly 10 to 50 beavers per mile of stream. Today, only 6 to12 million beavers remain in their original habitat, which once extended from the Arctic to northern Mexico. Researchers directly link the removal of so many beavers to the widespread degradation of watersheds that we see today, which is why many consider the beaver's near annihilation to be this nation's greatest environmental disaster. Fortunately, it's a mistake that we can correct and we are beginning to do so.

The beaver is the largest rodent in North America. It weighs 40 to 50 pounds and

has a scaly, paddle-shaped tail and four buck teeth, two on top, two on bottom. These incisors never stop growing, which means that beavers need to keep them filed down by gnawing on trees and other woody objects. Beavers have webbed feet, dexterous hands and transparent lids that cover their eyes when they swim. They also have a slick coat of fur and guard hair that enables them to live in a wide variety of ecosystems, a characteristic that unfortunately made for high-quality hats as well.

Beavers' tree-cutting, dam-building ways haven't endeared them to landowners, however, especially ones who fail to see the ecological benefits of their busy work. Fortunately, this "varmint" attitude among rural residents has been changing in recent years, as landowners begin to understand that beaver dams keep water on their land longer. In a drought, this extra water is much appreciated!

Which brings up another reason to put these wetland carbon engineers back to work: *adaptation*.

In an era of climate change, which includes greater variability in weather extremes, beavers and their dams increase the land's ecological resilience to unanticipated changes. Here's a list of resilient attributes, borrowed from the *Seventh-Generation Institute*, a nonprofit that works to restore beavers to their rightful role. A beaver dam:

- Slows snowmelt runoff, which extends summertime stream flows and restores perennial flows to some streams.
- Slows flood events, which could otherwise incise stream channels.
- Contributes to the establishment of deep rooted sedges, rushes and native hydric grasses, which buffer banks against erosion during high flows and provide shade to creeks and streams, reducing water temperature.
- Elevates the water table, which can sub-irrigate nearby land (including farmland).
- Increases the amount of open canopy in forested areas.
- Creates conditions favorable to wildlife that depend upon ponds, pond edges, dead trees or other habitats in streams not modified by beaver.
- Increases the mass of insects emerging from the water surface.
- Creates favorable conditions for the growth of bank-stabilizing trees and shrubs, including willow and alder.
- Greatly increases the amount of organic carbon, nitrogen and other nutrients in the stream channel.
- Ameliorates stream acidity.
- Increases the ecosystem's resistance to perturbation.

Beaver dam. © Shutterstock.com

In a world awash with high-tech ideas for solving our food, energy and climate challenges, we sometimes forget that nature has the best solutions—merely field tested for millennia! Our friend the beaver is a case in point. Toss in the job of carbon sequestration and the picture gets even better.

To top it off—beavers do their carbon engineering for free!

As we enter a period of longer droughts, bigger floods and rising demands for increased water quality and quantity, competition among water users will only increase. Here's one simple answer: get beavers back to work.

- **For more info see:** "Beaver as a Climate Change Adaptation Tool: Concepts and Priority Sites in New Mexico" at *www.seventh-generation.org/Publications.html*

The MoGro

What's a MoGro? It's an oasis in the middle of a food desert. At least that's what I thought when I saw the mobile grocery store parked on the plaza at Santo Domingo Pueblo, north of Albuquerque. Pueblo residents probably felt that way, as well, when the store made its first visit in the spring of 2011.

Physically, the mobile grocery, MoGro for short, is a large, custom-built semitruck that expands in the middle when parked. Inside is a full-service, mini-grocery store, including a refrigerated section for vegetables and frozen food. Flour, rice, milk, pasta, olives, meat, cheese, salad, canned goods—it's all there.

With a catch.

All of the food is either organic, grassfed, local, lean or low-sugar (or a combination thereof), which means it's healthy. There's nary a can of soda pop, box of donuts or bag of greasy potato chips in the whole place, and intentionally so. The food is affordable, too, which is another reason why the MoGro feels like an oasis. It's also popular, as I witnessed. It visits Santo Domingo twice a week, attracting 70 to 80 customers per day. And much of what they purchase is fresh produce.

Philosophically, the MoGro is a way to eradicate the persistent health problems that plague Native American communities by providing nutrition-rich, affordable food on a regular schedule and conveniently located. It's the brainchild of Rick and Beth Schnieders in collaboration with Johns Hopkins University's Center for American Indian Health, based in Albuquerque; La Montanita Food Cooperative; and Santo Domingo Pueblo. Their collective vision is to eliminate so-called food deserts by bringing healthy, affordable and sustainable food to the people who need it most. Food deserts are created when a full-service grocery store is located far enough away from a community that residents are encouraged to choose the easier—and cheaper—alternatives for meals: fast food and gas station convenience stores.

The result of food deserts is a well-documented epidemic of obesity, diabetes, high blood pressure and heart disease. Native Americans have a 35 percent obesity rate, one of the highest in the nation. Moreover, their reliance on processed foods can be traced back more than a century to the time when the federal government, as part of its "acculturation" program, encouraged Native families to adopt a diet of lard, sugar and white flour, food that didn't sync with native health needs at all.

The idea for the MoGro took root ten years ago on the Navajo Reservation when the Schnieders, who have been long-time supporters of the Center for American Indian Health, visited a grocery store in Chinlee, Arizona. They were appalled by the food choices they saw. "They were all bad," said Beth. "There were no veggies in the entire store, for example." Meanwhile, the center received reports from its project workers that Navajo mothers were grinding up candy bars to feed their infants.

This gave Rick Schnieders a middle-of-the-night idea: a beer truck. Not stocked with beer, of course, but with food. At the time Rick was CEO of Sysco, the largest food service corporation in the nation. As a 27-year Sysco employee, he knew a thing or two about food and food delivery. He also served on the Board of Share Our Strength, an industry-supported nonprofit devoted to ending childhood hunger, which connected him with the Center for American Indian Health. Through this contact he learned that what native peoples needed more than access to better information and education was access to healthy food itself.

Enter the beer truck idea, now rechristened as the MoGro.

The Schnieders and the center decided to approach Santo Domingo Pueblo to see if tribal residents might be interested in their idea. Out of 500 households surveyed, 300 responded and 98 percent said they would be receptive to a mobile grocery. This kicked off a two-year dialogue and planning process.

"They knew they had a problem," Rick said. "One leader told us they were already building a dialysis facility for diabetes patients in the pueblo. They were definitely interested in alternatives."

In the meantime, the Schnieders had to answer a question: what exactly was a mobile grocery store? When they looked around for examples, they found none. The closest prototypes were an unrefrigerated mobile store in Oakland, California (since closed) and the U.S. military's mobile commissary for troops, which featured many non-food items. Even an inquiry to the Rand Corporation produced a dead end. Apparently no one had ever tried this idea before.

Their learning curve, in other words, was steep.

Working with Santo Domingo Pueblo and La Montanita Co-op, the Schnieders came up with an inventory of healthy, non-processed food that met the needs of tribal members. Next, they custom-designed a semitruck, hired staff locally and began twice-a-week runs to the pueblo. Most of the groceries were set up and sold outside the truck, which turned out to be a mistake. Sun, rain, wind and dust were hard on both the food and the shoppers. The answer was MoGro 2.0, an air-conditioned truck where customers shop inside.

Another challenge has been a pleasant one—the popularity of the MoGro. Not long after deliveries began at Santo Domingo, the Pueblo of Cochiti contacted the Schnieders and asked to sign up. Others followed. Today, the MoGro makes regular visits to San Felipe, Jemez and Laguna Pueblos as well. Additionally, it stops for a half-day at the non-native community of Cochiti Lake, the result of many residents stopping by the truck to shop!

For all its pioneering fits-and-starts, the MoGro appears to be a success. Not only is it in demand—the Schnieders have fielded inquiries from all over the world—it has had a tangible, positive impact on the communities it serves. These include 1) providing affordable access to healthy foods, 2) saving customers up to $100 per week with its "MoGro Bucks" discount program, 3) reducing carbon footprints by something like 10,000 car miles per week and 4) strengthening local food traditions.

So, is a MoGro replicable in other food deserts, including urban ones? Absolutely, say the Schnieders.

The key to making the model work is:

- Community support (local hires, native language speakers)
- Regularly scheduled hours
- Low prices
- A warehouse

The challenges include:

- Steep start up costs (but not as steep as building a grocery store!)
- Patience (the MoGro is only now breaking even financially)
- Perennial fundraising (the MoGro is run as a nonprofit)
- Meeting demand
- Resisting pressure to include soda, candy, donuts etc.

A satisfied customer! Photo courtesy of Rick and Beth Schnieders.

It's not easy creating an oasis in a food desert. There's still a learning curve, the Schnieders say, but they feel the MoGro has turned a corner thanks to their staff, their partners and the support the project has received.

Fortunately, the MoGro is no mirage!

The MoGro on location. Photo courtesy of Rick and Beth Schnieders.

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