Quivira Coalition

Resilience

A Voice of the New Agrarianism

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A Carbon Ranch

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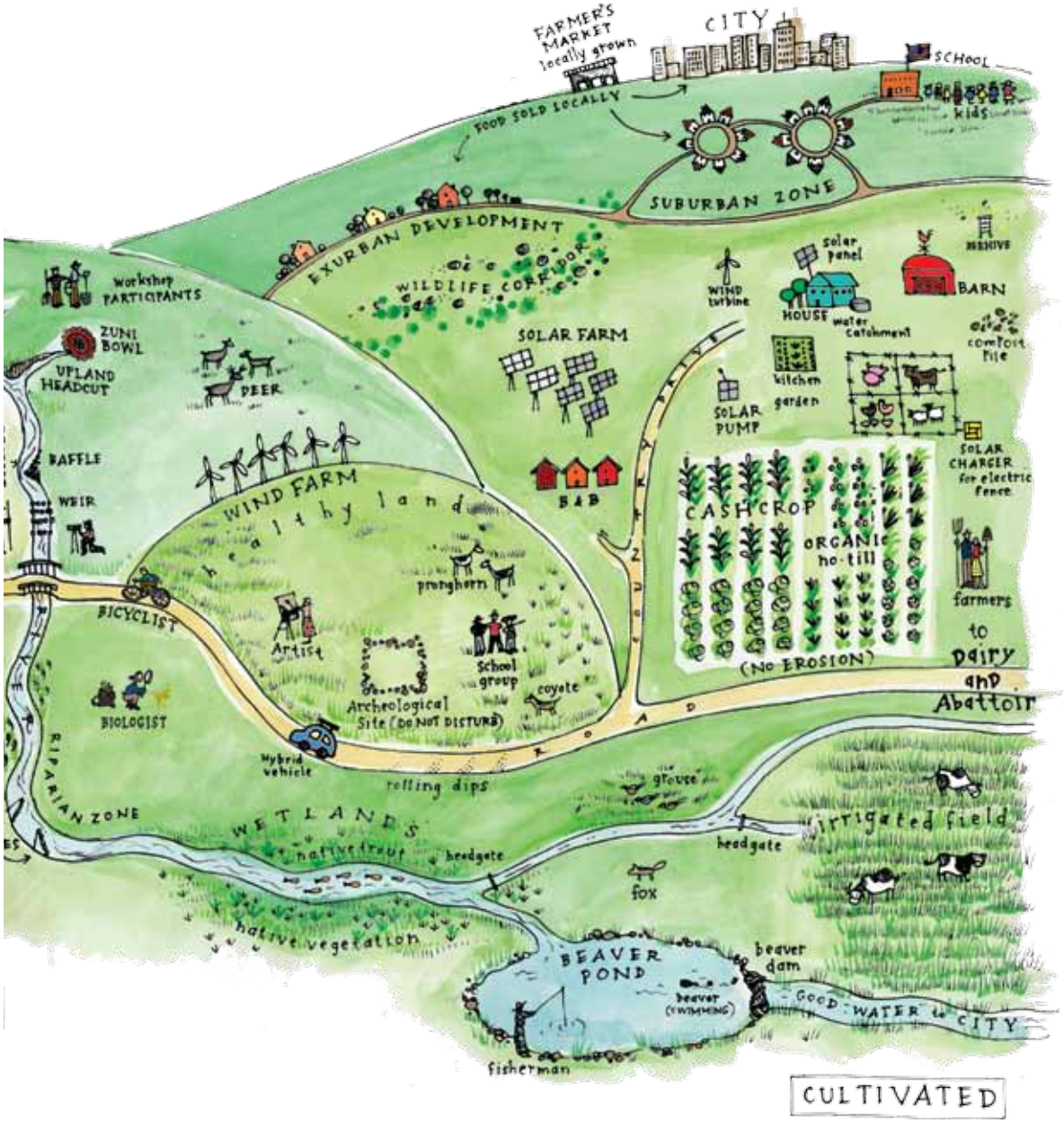

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From the Editor's Desk

In this issue of our journal, we introduce a new title, a new purpose, and a new idea.

The title is ***Resilience*** which reflects the ongoing mission of the Quivira Coalition to build ecological and economic resilience on western working landscapes.

Accomplishing this mission, however, requires a new agrarianism, which Wendell Berry describes as "a philosophy, a practice, an attitude, a loyalty and a passion – all based in close connection with the land. It results in a sound local economy in which producers and consumers are neighbors and in which nature herself becomes the standard for work and production."

We see our journal as a way to give voice to this critical new movement. For this inaugural issue of Resilience, we are also introducing a new idea: The Carbon Ranch. Its purpose is to mitigate climate change by sequestering additional carbon dioxide in plants and soils, reducing greenhouse gas emissions and producing co-benefits through good land stewardship.

It's not an academic issue. The recent decision by the U.S. Senate to postpone climate legislation and the failure of last year's Copenhagen summit to produce tangible progress means Business-as-Usual still rules. Meanwhile, the carbon dioxide (CO_2) content of the atmosphere has risen to 390 parts per million, significantly above what many scientists consider the level necessary to keep the climate stable for human life.

What to do? Many of us are turning to the only real possibility of large-scale removal of greenhouse gases from the atmosphere: plant photosynthesis and related land-based carbon storage activities.

It's all about building resilience. It's also about a land ethic – which is why we decided to include three essays here that were delivered at our Annual Conference in 2009, which celebrated Aldo Leopold. It's all part of the new agrarianism — the why and the how. Let us know what you think.

Thanks for being part of the Quivira Coalition Community.

Quivira Coalition Board Members*

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Feature

The Carbon Ranch: Fighting Climate Change... One Acre at a Time

by Courtney White

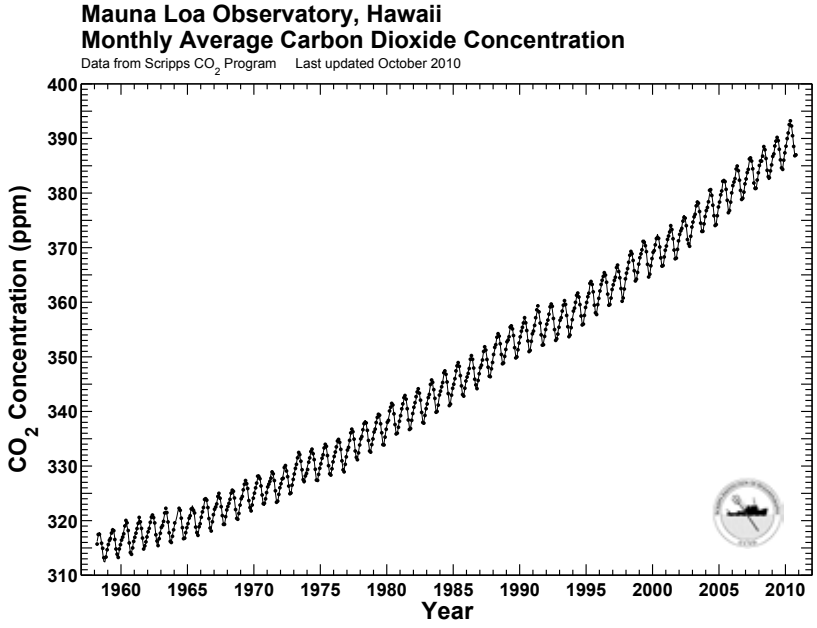
Right now, the only possibility of large-scale removal of greenhouse gases from the atmosphere is through plant photosynthesis and related land-based carbon sequestration activities. Strategies include: enriching soil carbon, no-till farming with perennials, employing climate-friendly livestock practices, conserving natural habitat, restoring degraded watersheds and rangelands, increasing biodiversity, lowering agricultural emissions, and producing local food. Over the past decade, these strategies have been demonstrated individually to be both practical and profitable. A carbon ranch bundles them into an economic and ecological whole with the aim of reducing the atmospheric content of CO_2 while producing substantial co-benefits for all living things.

The Anguished Question

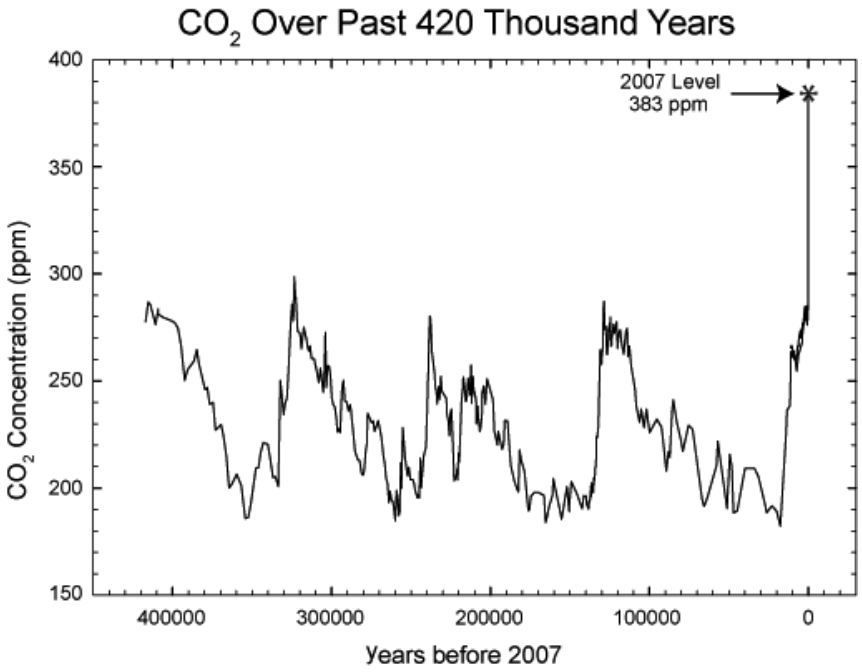
"***What we do in the next two to three years will determine our future. This is the defining momen***t."
– Dr. Rajendra Pachauri, head of the UN's Intergovernmental Panel on Climate Change, in 2007

The climate challenge now confronting all societies on the planet is as daunting as it is straightforward: under a Business-As-Usual scenario, the rising content of heat-trapping trace gases in the atmosphere – principally carbon dioxide, methane and nitrous oxide – pose a dramatic and potentially catastrophic threat to life on Earth.

The science of climate change and its correlation with industrial activity seems clear. The challenge—and the opportunity—we face can be summarized in three pertinent graphs from the Scripps Institute at UC San Diego (http://scrippsCO2.ucsd.edu/program_history) which chart the rise of the atmospheric content of carbon dioxide, a heat-trapping gas that has significantly contributed to a rise of 0.8 Celsius in the Earth's temperature since 1750. [1]



The first graph (above) shows the famous Keeling Curve. This graph represents concentrations of atmospheric CO_2 in parts-per-million (ppm) as measured by the Scripps Institute's observatory on Mauna Loa, Hawaii, under the direction of Dr. Charles Keeling. The annual highs and lows reflect the amount of CO_2 'breathed in' by the planet's vegetation in the spring and 'exhaled' in the fall. In 1780, the amount of CO_2 in the atmosphere was approximately 280 ppm.



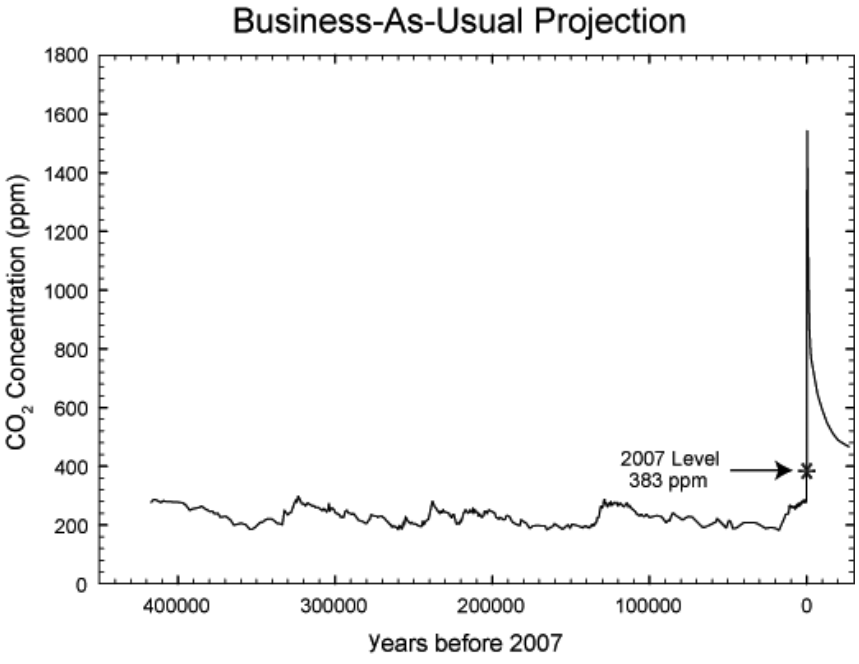
The second graph (above) compares the current level of CO_2 ppm to the historical record. The dips correspond with planetary cooling periods ("ice ages") and the subsequent rises correlate with warming trends. Note that past CO_2 maximums barely exceeded 300 ppm. Today, it is 390 ppm – the highest level in at least 2.1 million years. [2]

The third graph (right) is a scientific projection of CO_2 under current emission trends. Under a Business-as-Usual model, CO_2 will rise to 1500 ppm, or thereabouts, and not return to pre-industrial levels even tens of thousands of years into the future.

What does this mean? A comparable rise in CO_2 took place during the Permian period, culminating 251 million years ago in the "Great Dying" when 90% of all species on the planet went extinct. The difference is that during the Permian period, it took millions of years to reach 1500 ppm, whereas it might take us only a few centuries. Furthermore, human civilization is coterminous with the current Holocene period whose remarkably stable climate over the past 10,000 years gave rise to the agricultural revolution, among many other developments. However, a rising level of CO_2 in the atmosphere jeopardizes this stability, perhaps permanently (on human time-scales), even without reaching Permian-like CO_2 maximums.

Dr. James Hansen, the Director of NASA's Goddard Institute for Space Studies and the nation's top climate scientist, states it this way: "Business-as-usual greenhouse gas emissions, without any doubt, will commit the planet to global warming of a magnitude that will lead eventually to an ice-free planet." [3]

Clearly, action is required, but a critical question needs to be addressed first: What "safe" level of CO_2 ppm should we aim for? (Note I am focusing on CO_2 for two reasons: 1) It is the most prevalent and long-lasting greenhouse gas in the atmosphere. 2) The warming effect of the other trace gases is being offset currently by the cooling effect of atmospheric aerosols such as soot and other forms of pollution that reflect solar radiation back into space.)



As recently as five years ago, calls to limit atmospheric CO_2 focused on staying below the doubled pre-industrial level of 280 ppm. For example, in a 2004 paper published in ***Science,*** two Princeton University scientists argued for the stabilization of CO_2 at 500 ppm, which required that greenhouse gas emissions be held near the (then) present level of seven billion tons of carbon per year (GtC/year) for the next fifty years. [4]

By 2007, in response to new research, the United Nations Intergovernmental Panel on Climate Change (IPCC) lowered the CO_2 target to 450 ppm while also calling for a substantially speeded up timeline for emissions reduction. This new target became widely accepted among many non-scientists, who saw it as a politically "realistic" goal that also kept overall global warming within acceptable levels of concern. [5]

Then, in the fall of 2008, Dr. Hansen co-authored a paper that set a new CO_2 target: 350 ppm. The reason for the lower target was twofold: (1) Hansen et al argued that slow planetary feedback processes, such as polar ice sheet disintegration and methane gas releases, were not included in previous models of global warming and may come into play much faster than anyone anticipated. This means first, that more warming is already in the "pipeline" than previously calculated, and second, their analysis of the paleoclimate record indicates that a CO_2 amount on the order of 450 ppm, if maintained, would push Earth toward an ice-free state – a critical tipping point that must be avoided.

In summary, they wrote: "***Paleoclimate evidence and ongoing global changes imply that today's CO_2 is already too high to maintain the climate to which humanity, wildlife, and the rest of the biosphere are adapted***." (emphasis added) [6]

Since 2008, many climate activists, researchers and policymakers around the world have embraced the 350 ppm target. For example, journalist Bill McKibben, who raised the first popular alarm about global warming back in 1989 with his book ***The End of Nature***, has founded ***350.org***, a nonprofit whose mission is to reduce atmospheric CO_2 by inspiring "the world to rise to the challenge of the climate crisis [and] create a new sense of urgency and of possibility for our planet." [7]

If we accept the arguments that Hansen, McKibben and many others make for an atmospheric CO_2 target of 350 ppm—and I do—then how do we get there?

Historian and novelist Wallace Stegner once said that all books should try to answer an "anguished question." [8] The same is true for ideas, movements and emergency efforts. In the case of climate change, the anguished question is this: **What can we do right now to help reduce atmospheric CO_2 from its current level of 390 ppm back to 350 ppm**?

In an editorial published in July 2009, Dr. Hansen proposed an answer: "Cut off the largest source of these emissions – coal – and allow CO_2 to drop back down to 350 ppm through agricultural and forestry practices that increase carbon storage in trees and soil." [9] In their 2008 paper, Hansen et al specifically say that a 50 ppm drawdown via forestry and agricultural practices is quite plausible.

These words should be considered "Operating Instructions" for the 21st century. Personally, I'm not sure what to do about the coal side of his equation, which requires governmental action, but I have an idea about how to increase carbon storage in soils.

I call it A Carbon Ranch.

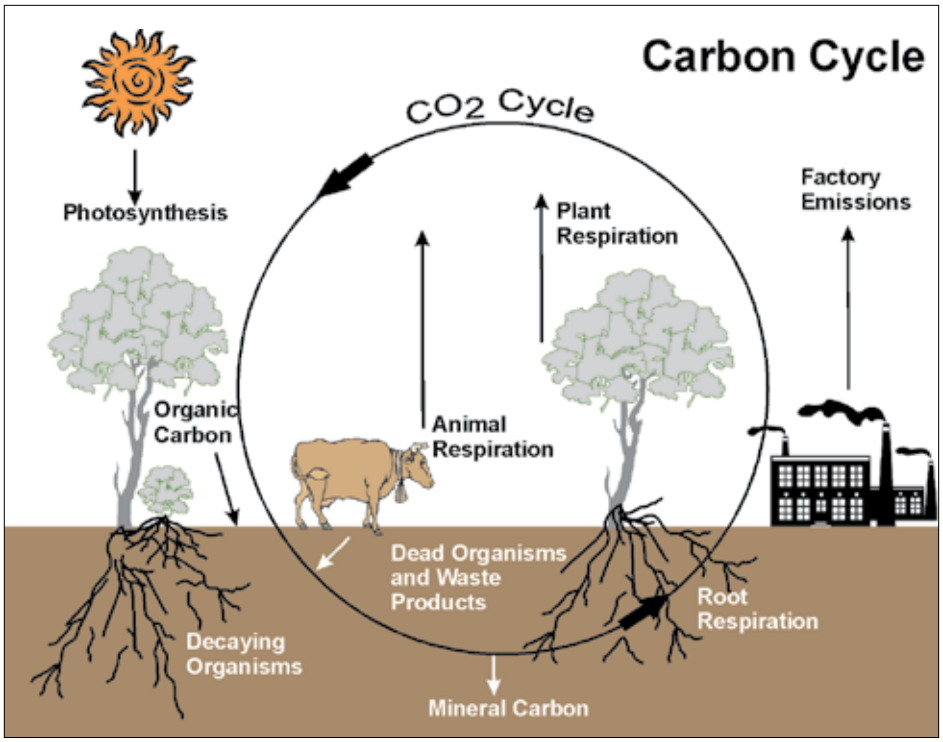
What Goes Up Must Come Down

"***Carbon is the basic building block for life. It is only a pollutant when in excess in the atmosphere or dissolved in water. Over millennia a highly effective carbon cycle has evolved to capture, store, transfer, release and recapture biochemical energy in the form of carbon compounds. The health of the soil —and therefore the vitality of plants, animals and people depends on the effective functioning of this cycl***e." – Dr. Christine Jones, soil scientist

The purpose of A Carbon Ranch is to mitigate climate change by sequestering additional CO_2 in plants and soils, reducing greenhouse gas emissions and producing co-benefits that build ecologi-

cal and economic resilience in local landscapes.

According to the dictionary, "sequester" means: to withdraw for safekeeping, to place in seclusion, to place into custody, or to hold in solution – all of which are good definitions for the process of sequestering CO_2 in plants and soils via photosynthesis and sound stewardship.



To understand how A Carbon Ranch works, we have to start with the fundamentals. The process by which atmospheric CO_2 is converted into soil carbon is neither new nor mysterious. It has been going on for tens of millions of years and all it requires is sunlight, green plants, water, nutrients and soil microbes (For more details see Dr. Christine Jones' work, available on her website www.amazingcarbon.com)

There are four basic steps to the CO_2/ oil carbon process:

- Photosynthesis
- Resynthesis
- Exudation
- Humification

Photosynthesis: This is the process by which energy in sunlight is transformed into biochemical energy in the form of a simple sugar called glucose, via green plants, which use CO_2 from the air, water and soil and release oxygen as a by-product.

Resynthesis: Through a complex sequence of chemical reactions, glucose is resynthesized into a wide variety of carbon compounds, including carbohydrates (such as cellulose and starch), proteins, organic acids, waxes and oils (including hydrocarbons) – all of which serve as "fuel" for life on Earth.

Exudation: Around 30-40% of the carbon created by photosynthesis can be exuded directly into soil to nurture the microbes that grow plants and build healthy soil. This process is essential to the creation of topsoil from the lifeless mineral soil produced by the weathering of rocks over time. The amount of increase in organic carbon is governed by the volume of plant roots per unit of soil and their rate of growth. More active green leaves mean more roots, which mean more carbon exuded.

Humification: This is the process of creating a chemically stable type of organic matter composed of large, complex molecules made up of carbon, nitrogen, minerals, and soil particles. Visually, humus is the dark, rich layer of topsoil that people generally associate with stable wetlands, healthy rangelands and productive farmland. Land management practices that promote the high ecological integrity of the soil are key to the creation and maintenance of humus. Once carbon is sequestered as humus it has a high resistance to decomposition, and therefore can remain intact and stable for hundreds or thousands of years. A lack of humus can mean that the carbon exuded from plant roots simply oxidizes and recycles back to the atmosphere as CO_2.

Additionally, high humus content in soil improves water infiltration and storage, because of its sponge-like quality and high water-retaining capacity. Recent research demonstrates that one part

of humus 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.

In sum, the natural process of converting sunlight into humus is an organic way to pull CO_2 out of the atmosphere and sequester it in soil for long periods of time. If the land is bare, degraded or unstable due to erosion, and if it can be restored to a healthy condition with properly functioning carbon, water, mineral and nutrient cycles; and if it is covered with green plants with deep roots, then the quantity of CO_2 that can be sequestered is potentially high. Conversely, when healthy, stable land becomes degraded or loses green plants, the carbon cycle can become disrupted and will release stored CO_2 back into the atmosphere.

In other words, healthy soil = healthy carbon cycle = storage of atmospheric CO_2. Any land management activity that encourages this equation, especially if it results in the additional storage of CO_2, can help fight climate change.

Or as Dr. Christine Jones states: "***Any…practice that improves soil structure is building soil carbon***." [10]

What would those practices be?

In the arid rangelands of the Southwestern United States, there are six strategies to increase or maintain soil health and thus the carbon content of grass or shrub-dominated ecosystems. Sequestration strategies include: 1) planned grazing systems, especially on degraded soils; 2) active restoration of riparian, riverine and wetland zones; and 3) removal of woody vegetation, where appropriate, so that grass may grow in its stead. Maintenance strategies include: 4) the conservation of open space so there is no further loss of carbon-storing soils; 5) the implementation of no-till farming practices; and 6) management of land for long-term resilience, i.e., increasing the capacity of land and people to adjust to perturbation and changing climatic conditions.

Fortunately, a great deal of the land management "toolbox" required to implement these strategies has been tried and tested by practitioners, landowners, agencies and researchers. Some of it remains controversial in certain quarters despite its demonstrated on-the-ground success, and much of it is currently blocked by economic, bureaucratic and paradigmatic obstacles.

Sequestration strategies and their role in the holistic vision called "A Carbon Ranch" include the following:

1) **Planned grazing systems**. The carbon content of soil can be increased by three principal methods:

- the establishment of green plants on previously bare ground;
- deepening the roots of existing healthy plants; and
- the general improvement of nutrient, mineral, and water cycles in a given area.

Planned grazing is key to all three. By controlling the timing, intensity and frequency of animal impact on the land, the "carbon rancher" can improve plant density, diversity and vigor. Specific actions include:

- the soil cap-breaking action of herbivore hooves, which promotes seed-to-soil contact and water infiltration;
- the 'herd' effect of concentrated animals, which can provide a positive form of perturbation to a landscape by turning plant litter back into the soil (An intensive version of this effect is sometimes called a "poop-and-stomp.");
- the stimulative effect of grazing on plants, followed by a long interval of rest (often a year), which causes roots to expand while removing old, oxidized forage; targeted grazing of noxious or invasive plants which promotes native species diversity and vigor; and
- the targeted application of animal waste, which provides important nutrients to plants and soil microbes.

Additionally, planned grazing systems – including management-intensive, time-controlled, short-duration, and mob-grazing systems – have the advantage of focusing the practitioner's attention on the day-to-day and week-to-week condition of the land. This enables the manager to achieve specific ecological goals effectively, such as the goal of increased quantity, density and vigor of green plants (and thus increased carbon storage).

Cattle waiting to move onto fresh pasture - mob-grazing. (Photo by Tamara Gadzia)

Creating a new floodplain on the Dry Cimarron River. (Photo by Tamara Gadzia)

2) **Active restoration of riparian, riverine, and wetland areas**. Many arroyos, creeks, rivers, and wetlands in the Southwest exist in a degraded condition, the result of historical overuse by humans, livestock and industry. The consequence has been widespread soil erosion, loss of riparian vegetation, the disruption of hydrological cycles, the decline of water storage capacity in stream banks, the loss of wetlands, and many other examples of land "sickness." The restoration of these areas to health, especially efforts that contribute to soil retention and formation, such as the reestablishment of humus-rich wetlands, will result in additional storage of atmospheric CO_2 in soils. The toolbox for the restoration of these areas is now well-developed, practical and potentially capable of being implemented at scale if desired. There are many co-benefits of restoring riparian areas and wetlands to health as well, including improved habitat for wildlife, increased forage for herbivores, improved water quality and quantity for downstream users, and a reduction in erosion and sediment transport.

3) **Removal of woody vegetation**. Many meadows, valleys, and rangelands have witnessed a dramatic invasion of woody species such as piñon and juniper trees over the past century, mostly as a consequence of the suppression of natural fire and overgrazing by livestock (which removes the grass needed to carry a fire). The elimination of over-abundant trees by agencies and landowners via prescribed fire or other means has been the focus of much restoration activity in the Southwest recently. The general goal of this work is to encourage grass species to grow in place of trees, thus improving the carbon-storing capacity of the soil. Not only can soils store more CO_2 than trees, they also have the advantage of relative permanence. Trees can burn up, be cut down, or die of disease or old age, all of which can ultimately release stored CO_2 back into the atmosphere. Additionally, the removal of trees has an important co-benefit: they are a potential source of local biomass energy production, which can help reduce a ranch's carbon footprint.

Maintenance strategies that help keep stored CO_2 in soils, so they won't be lost back into the atmosphere, include the following:

4) **The conservation of open space**. The loss of forest, range or agricultural land to subdivision or other types of development can dramatically reduce or eliminate the land's ability to pull CO_2 out of the atmosphere via green plants. Fortunately, there are multiple strategies that conserve open space today, including public parks, private purchase, conservation easements, tax incentives, zoning and economic diversification that helps to keep a farm or ranch in operation. Perhaps most importantly, the protection of the planet's forests and peatlands from destruction is crucial to an overall climate change mitigation effort. Not only are forests and peatlands important sinks for CO_2 , their destruction releases large amounts of stored carbon back into the atmosphere.

Removing invasive juniper on to restore native grasslands. (Photo by Kirk Gadzia)

Moving the herd through an open landscape. (Photo by Avery C. Anderson)

Note that "protection" may still result in the loss of stored carbon if the land stewardship practices don't maintain or improve the health of plants and soil. A farm or ranch, for instance, may be protected from development by a conservation easement but its poor ecological condition (or its poor management) may cause CO_2 to leak back into the atmosphere. This is one reason why those farms and ranches that have already improved the health of their land, and thus improved the carbon storage capacity of their soils, need to be supported economically, socially and politically so that they benefit from their good work and continue to practice good stewardship.

5) **The implementation of no-till farming practices**. Plowing exposes stored soil carbon to the elements, including the erosive power of wind and rain, which can quickly cause it dissipate back into the atmosphere as CO_2 . No-till farming practices, especially organic ones (no pesticides or herbicides),not only protect soil carbon and reduce erosion, they often improve soil structure by promoting the creation of humus. Additionally, farming practices that leave plants in the ground year-round both protect stored soil carbon and promote increased storage via photosynthesis. An important co-benefit of organic, no-till practices is the production of healthy food.

6) **Building long-term resilience**. Nature, like society, doesn't stand still for long. Things change constantly, sometimes slowly, sometimes in a rush. Some changes are significant, such as a major forest fire or a prolonged drought, and can result in ecological threshold-crossing events, often with deleterious consequences. "Resilience" refers to the capacity of land, or people, to "bend" with these changes without "breaking." Managing a forest through thinning and prescribed fire so that it can avoid a destructive, catastrophic fire is an example of building resilience into a system.

Managing land for long-term carbon sequestration in vegetation and soils requires building resilience as well, including the economic resilience of the landowners, managers and community members. For example, cooperation among disparate individuals or groups such as biologists, conservationists, ranchers and policymakers —with the goal of improving land health can help to build ecological and economic resilience within a watershed. This can have two important effects: direct storage of CO_2 in the soil, as humus is created, and the strengthening of relationships required for the maintenance of healthy soil over time.

All of these strategies have been demonstrated to be effective in a wide variety of landscapes. The difficult job now is how to integrate them into a "climate-friendly" landscape that sequesters increasing amounts of CO_2 each year, and does so economically.

But all of this raises an important question: Is CO_2 sequestration in soils actually worth pursuing? In other words, can the potential amount of CO_2 stored as soil carbon make a difference in the Big Picture? The quick answer is yes.

A report published in 2007 by the Congressional Budget Office said that about half of total annual CO_2 emissions planet-wide are currently being absorbed by the world's oceans, soils and vegetation, which, together with the atmosphere, form the planet's only natural carbon sinks. The other half of those emissions remain in the atmosphere. The United States produces about six billion metric tons of CO_2 per year (6GtC), which is one-quarter of the global total, while its current land-use and forestry practices have the net effect of removing the equivalent of about 0.8 billion metric tons of CO_2 from the atmosphere annually.

Restored grasslands on the JX Ranch, south of Tucumcari, New Mexico. (Photo by Courtney White)

According to the report, "Studies estimate that biological sequestration has the technological potential to sequester about 40 billion to 60 billion metric tons of CO_2 in the United States over the course of 50 years and another few tens of billions of tons over the following half-century." [11] That's approximately 1GtC per year, or one-sixth of what the U.S. produces annually. A billion metric tons of CO_2 = 1 gigaton (GtC) and 1ppm of CO_2 = 2.12 GtC. Therefore, sequestering 1 GtC per year in the United States would reduce 0.5 ppm of CO_2 per year. Since the atmospheric content of CO_2 is rising at a rate of 2 ppm annually, soils could potentially have a significant effect on climate change.

According to Dr. Hansen, while fossil fuels are adding 8.5 GtC per year into the atmosphere, the atmospheric increase of CO_2 is only 4.5 GtC per year – which means 4 GtC is going into carbon sinks. He estimates that 3 GtC are being absorbed by the oceans. This means 1 GtC is being absorbed by everything else. He sees this as good news.

"The fact that Earth's land masses continue to produce a net sink of carbon dioxide provides a glimmer of hope for the task of stabilizing climate," he writes. "This carbon sink occurs despite large-scale deforestation in many parts of the world, as well as agricultural practices that tend to release soil carbon to the atmosphere. Improved agricultural and forestry practices could significantly increase the uptake of carbon dioxide." [12]

How is this possible?

There is a simple answer: Two-thirds of the Earth's land mass is grassland – and home to two billion people who depend on livestock at least partially for their livelihood. This means that managing the land for CO_2 sequestration, even on a small scale, could have a big impact on people and the planet. Livestock are key both economically and ecologically. Important as a source of food and wealth (also culture) to much of the Earth's human population, livestock could be mobilized for carbon action.

"Healthy grasslands, livestock and associated livelihoods constitute a win-win option for addressing climate change in fragile, dryland areas where pastoralism remains the most rational strategy for the wellbeing of communities," write the authors of a United Nations' Food and Agriculture Report. "***It is a win-win scenario for sequestering carbon, reversing environmental degradation and improving the health, well-being and long term sustainability of livestock based livelihoods***." (emphasis added) [13]

Critics who view livestock grazing as a negative environmental stressor and argue for its complete

cessation might be surprised to learn that early research, according to Dr. Peter Smith (professor of Soils and Global Change at the University of Aberdeen, Scotland), indicates that "carbon accrual on optimally grazed lands is often greater than on ungrazed or overgrazed land." [14]

Taken together, sequestering CO_2 in the soil has the potential to significantly mitigate the climate crisis. However, A Carbon Ranch must do more than just photosynthesize energy.

The Sins of Emission

"***Let's be clear…We will still have to radically reduce carbon emissions, and do so quickly. We will still have to eliminate the use of fossil fuels and adopt substantially more sustainable agricultural methods. We will still have to deal with the effects of ecosystems damaged by carbon overload***." – editors of *The Wall Street Journal*

Here is the reality check. The increased sequestration of CO_2 in soils won't solve climate change. It won't even be close if the emissions of greenhouse gases are not dramatically reduced at the same time. According to experts, this reduction must be on the order of 50-80% of current emissions levels within 50 years in order to avoid surpassing the 450 ppm threshold that many consider an upper limit for a viable planet. Accomplishing this goal will require a massive rearrangement of our energy sector toward fossil fuel-free technologies as well as big changes in the everyday lives of Americans. That's a Tall Order, of course, but if we are serious about slowing or reversing the accumulation of CO_2 in the atmosphere, then it should be clear that Business-As-Usual can't continue much longer.

A Carbon Ranch can help in three ways: (1) by measuring and then reducing the amount of greenhouse gas emissions it contributes to the atmosphere; (2) by producing renewable energy "on-ranch" which it can use itself and/or sell to a local or regional power grid; and (3) by participating in local food, recreation and restoration activities that lower our economy's dependence on fossil fuels.

It is important to note that the current CO_2 crisis did not develop after post-World War II, but began with the invention of agriculture 10,000 years ago. Plowing, clearing, burning, desiccation, erosion and the draining of wetlands all contributed to an important loss of stored soil carbon back into the atmosphere as CO_2. In fact, some scientists calculate that fossil fuel burning surpassed agriculture and deforestation as the primary source of CO_2 only in the 1970s. Today, more than four times as much global warming comes from fossil fuels than from land use activities. Also, much of the CO_2 released historically by agriculture has fallen back to earth.

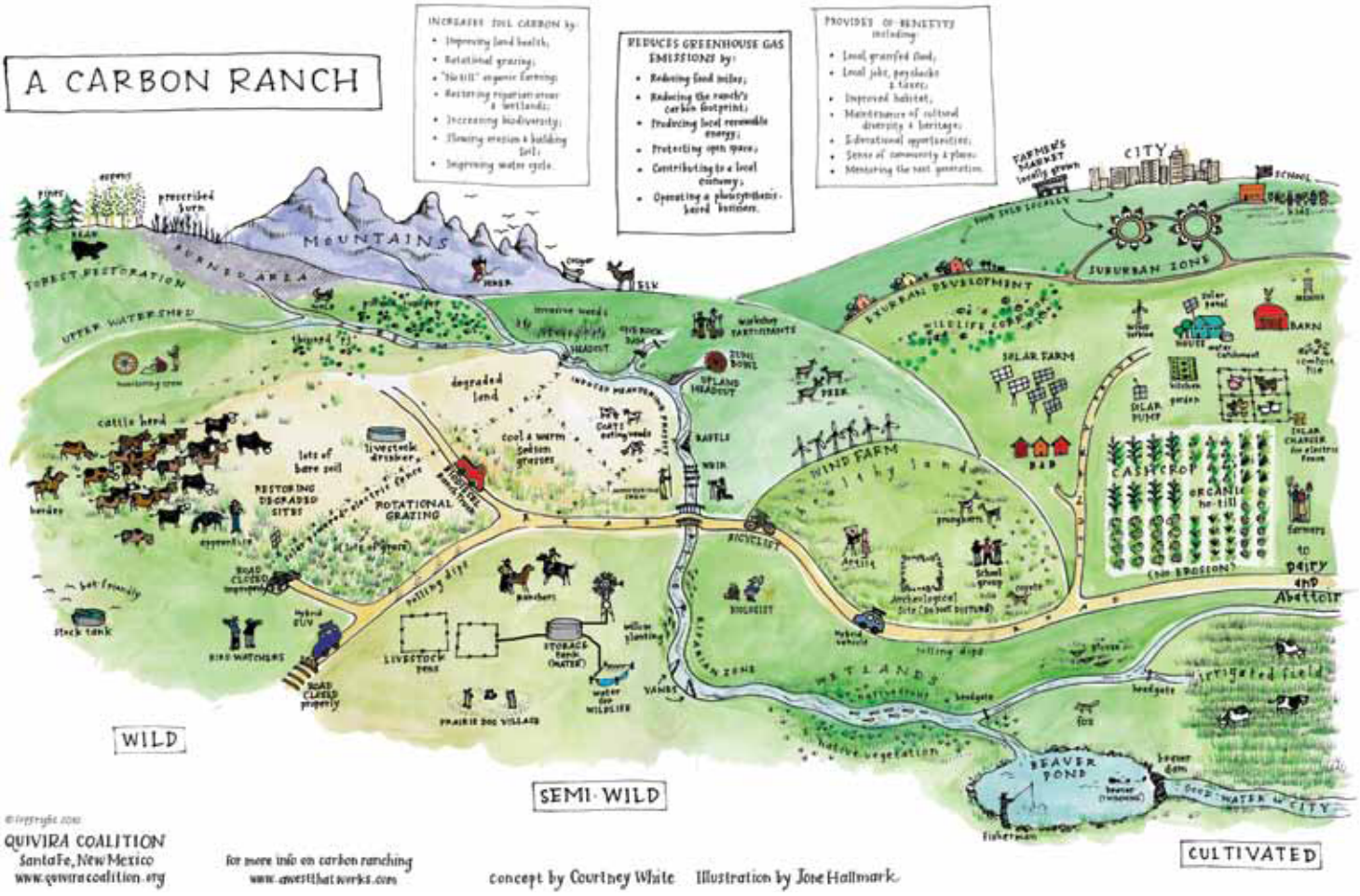
Lastly, A Carbon Ranch can help by confronting the controversy over offsets and carbon credits which are the two strategies most frequently touted by governments, businesses, agencies and others for encouraging the creation of a so-called "carbon marketplace." In this marketplace, "credits" created by the sequestration of CO_2 in one place can be 'sold' or traded to 'offset' a CO_2 polluting entity, such as a coal plant or airline company, someplace else—supposedly to the benefit of all. In reality, these schemes appear to mostly offset our guilty feelings rather than actually affect climate change.

Here's how A Carbon Ranch can help reduce CO_2 emissions:

1) **Reducing the "footprint" of A Carbon Ranch**. This is a two-step process. The first step is to assess the amount of greenhouse gas emissions that are rising from a particular landscape or operation. The second is to follow this assessment with a concerted effort to reduce these emissions. One way to measure this carbon footprint is to conduct a Life-Cycle Assessment (LCA) of an enterprise—an inventory of the material and energy inputs and outputs characteristic of each stage of a product's life cycle. This is a recognized procedure for tracking the ecological impacts of a television set or a refrigerator, for example; different types of LCAs exist for different types of products. [15]

For A Carbon Ranch, there are four important measures of its LCA:

- Cumulative energy use
- Ecological footprint
- Greenhouse gas emissions
- Eutrophying emissions



The first three measurements are relatively straightforward and many credible methodologies exist to calculate energy use, ecological footprints and emissions, though most are designed for urban contexts or industrial agriculture.

However, the fourth measurement, eutrophying emissions, has been the source of considerable controversy in recent years. It refers to the amount of methane produced by the digestive system of livestock and released by belching during its time on the ranch, farm or feedlot – a process that has a negative connotation in the public's mind. Because, in fact, research indicates that the amount of methane produced by ruminants can be considerable. For example, a United Nations report released in 2006 titled "Livestock's Long Shadow" determined "that livestock are responsible for 18 percent of greenhouse gas emissions, a bigger share than that of transport." [16]

This amount, however, is due to chemical fertilizer production, deforestation for pasture, cultivation of feed crops (corn), feed transport, animal production (fermentation and methane and nitrous oxide emissions) and the transportation of animal products. In other words, the report rolled together a natural biological process – eutrophying emissions – with fossil fuel-intensive industrial livestock production activities, especially those employed in feedlots, and branded the entire system with a negative stigma. As a result, the report created an impression among the public at large and promoted vigorously by some advocacy organizations— that the answer to the climate crisis is to eat less red meat.

Instead, one answer is to eat more meat – from A Carbon Ranch.

When considering the methane question in regard to climate change, there are a number of important points to keep in mind:

- As already noted, the warming effects of methane and nitrous oxide are currently being offset by heat-reflecting aerosols in the atmosphere.
- The largest single source of methane worldwide is wetlands (22%), followed by coal, oil and natural gas (19%), livestock (16%) and rice

cultivation (12%), with burning, landfill, sewage, manure, termites and release from the ocean making up the remaining 31%.

- Methane is also produced by rainforests, whales, termites, bison, reindeer, camels, giraffes, and many other animals, and has been rising into the atmosphere for millions of years.
- The methane we should really be worried about is the type found in frozen beds of methane hydrates located below permafrost layers and shallow seabeds which, when melted, will release very significant amounts of the potent greenhouse gas into the atmosphere.
- According to the Soil Association of the United Kingdom: "Grassland left ungrazed on fields unsuitable for ploughing emits as much methane when it decays over-winter as if consumed by ruminants…" [17]
- The vast majority of methane produced by the agricultural sector comes from a system drenched in fossil fuels.

Author Michael Pollan put the last point this way: "We transformed a system that in 1940 produced 2.3 calories of food energy for every calorie of fossil-fuel energy it used into one that now takes 10 calories of fossil-fuel energy to produce a single calorie of modern supermarket food. Put another way, when we eat from the industrial food system, we are eating oil and spewing greenhouse gases." [18]

The answer, Pollan says, is to "resolarize" the American economy – which means weaning Americans off their heavy 20th-century diet of fossil fuel and put them back on a diet of contemporary sunshine. "If any part of the modern economy can be freed from its dependence on oil and successfully resolarized," Pollan writes, "surely it is food."

For the purposes of A Carbon Ranch, the methane emission issue is just one part of the overall 'footprint' assessment. The goal of a Life-Cycle Analysis is to measure an operation's energy use and emissions so that it can reduce both over time. Ultimately, the goal is to become carbon-neutral or, ideally, carbon-negative – meaning, the amount of CO_2 sequestered is greater than the ranch's carbon footprint.

2) **Producing renewable energy**. Anything that A Carbon Ranch can do to produce energy on-site will help balance its energy footprint and could reduce the economy's overall dependence on fossil fuels. This includes wind and solar farms, the production of biodiesel from certain on-site crops for use in ranch vehicles; biomass for cogeneration projects (This is especially attractive if it uses the woody debris being removed from the ranch anyway.), micro-hydro, micro-wind and solar for domestic use; and perhaps other as yet unrealized renewable energy alternatives.

3) **Participating in a local economy**. A Carbon Ranch should carefully consider its role in the 'footprint' of the greater economy. Are its products traveling long distances or otherwise burning large amounts of fossil fuels? Ditto for visitors, ranch owners and employees. Does participating in a local economy – food, recreation, and energy – increase or decrease the overall footprint of the ranch? How else can it reduce greenhouse gas emissions locally or regionally? For example, it is generally accepted that involvement in a local food market, where the distances between producer and eater are short, shrinks the fossil footprint of a ranch considerably. There is some contradictory research on this point, however. In my opinion, the technical issues of local vs. global food systems in terms of food miles traveled is largely neutralized by the wide variety of co-benefits that local food brings economically and ecologically. This will be discussed in the next section.

4) **The trouble with offsets**. In the past few years, efforts to monetize or incentivize carbon sequestration have focused on creating a carbon marketplace complete with so-called carbon credits that can be bought or traded to offset the carbon emissions of a polluting entity. This marketplace generally requires a "cap" on total carbon emissions, whether regionally or nationally, so that a "value" or price can be placed on the credits themselves. In other words, if a polluter exceeds its cap by a certain percentage, then it can buy or trade for an offset that brings it back into compliance. This cap-and-trade idea was the heart of the Waxman-Markey bill passed by the

"...the trouble with offsets highlights an important challenge for carbon ranching: profitability...how can a landowner who desires to mitigate climate change earn a paycheck, without which there will no carbon ranching?"

U.S. House of Representatives in 2009, a bill which sought to confront climate change by stimulating private markets.

However, many observers – myself included – have become increasingly skeptical of the offset concept at regional or national scales. Objections to offsets include:

- We need actual net reductions of atmospheric CO_2 not just the neutralizing offset of a polluter by a sequesterer.
- There are moral and ethical implications to letting polluters redeem themselves with offsets, the way medieval nobles bought indulgences from the Church for their sins (for a powerful parody of this situation see www.cheatneutral.com, where philandering adults can buy offsets from monogamous couples so they can keep on cheating).
- It is unrealistic to expect the same system that created the climate problem in the first place – i.e., our current economy and specifically its financial sector – to solve this problem and to do so with the same tools. Furthermore, it is not OK for Wall Street to profit from a problem it helped to create.
- At best, offsets may be illusory; at worst they're fraudulent – thus imperiling the whole purpose of the idea. This concern is captured in an investigative report by the ***Christian Science Monitor*** published on April 20, 2010, titled "Buying carbon offsets may ease eco-guilt but not global warming." [19] The investigation found that people buying offsets are getting "vague promises instead of the reductions in greenhouse gases they expect." They are buying into projects that are never completed, or are paying for ones that would have been done anyway. Mostly they feed shady middlemen and promoters seeking profits from green schemes, said the report's authors. "Carbon offsets are the environmental equivalent of financial derivatives: complex, unregulated, unchecked and – in many cases – not worth the price," they write. In a spectacular example, the Vatican was swindled. In 2007, Cardinal Paul Poupard accepted a gold-framed certificate from a company promising to help it become the "first carbon-neutral sovereign state" on the planet. The promised forest in Hungary was never planted. A papal spokesman told the *Monitor* that "the case is being studied to take legal action in order to defend the Vatican's reputation."
- The monitoring required to quantitatively verify actual and additional (meaning a net increase) CO_2 sequestration in the soil in order to satisfy the marketplace is too complicated, cumbersome, expensive and intrusive for many landowners. Out West, this is an especially sensitive topic, as many ranchers already feel like there are too many people with clipboards walking across their land. If protocols are not considered comprehensible and user friendly by landowners, then skepticism will remain high in a community that already has doubts about climate change generally.

For these reasons and more, offsets and carbon credits may not be the economic engine of the future that so many proponents tout it to be. Nevertheless, the trouble with offsets highlights an important challenge for carbon ranching: profitability. If not offsets, then how can a landowner who desires to mitigate climate change earn a paycheck, without which there will no carbon ranching?

One idea: a more appropriate marketplace might be at the local level. A county government, for example, could help to create a local carbon market to help offset its judicial buildings or schools or prisons. It could possibly do so through its ability to tax, zone and otherwise regulate at the county level. It would still have to deal with some of the other challenges confronting offsets, but at least it would keep the marketplace local.

Another idea: reward landowners financially for meeting sequestration and emissions goals. The

federal government routinely subsidizes rural economic development enterprises that the private marketplace won't touch, such as the current effort to bring high-speed broadband Internet to rural communities. Additionally, the government often provides incentives to businesses for market-based approaches, including corn-based ethanol production, solar power development, and wind technology (and don't forget the federal government's catalyzing role in the birth of the Internet). It would be perfectly logical, therefore, to reward early adopters of carbon ranching with a direct financial payment as a means to wake up traditional markets.

In sum, although the main purpose of A Carbon Ranch is to sequester additional CO_2 in plants and soils, it must take every step possible to reduce the amount of greenhouse gas emissions it contributes to the atmosphere – with the ultimate goal of becoming a carbon-neutral or even carbon-negative operation.

The Joy of Co-Benefits

"***Carbon ranching has no downside***." – John Wick, rancher and director of the Marin Carbon Project

In its effort to sequester carbon in soil and reduce emissions, A Carbon Ranch also produces a list of co-benefits that make the whole enterprise even more vital. They include:

- **Local grassfed and organic food**. By managing land for a healthy grass cover, A Carbon Ranch is the natural setting for raising grass-fed livestock, whose environmental and human-health benefits are well-documented. Additionally, the market for organic, grassfed meat is growing steadily, which means this could be a way to monetize climate-friendly beef as an economic strategy.
- **Improved ecosystem services**. In 2005, the United Nations published its Millennium Ecosystem Assessment, a global evaluation of ecosystem services on which human well-being and environmental health depend. These services include the provision of food, fresh water, wood, fiber, fuel, and biodiversity; flood, pest and disease regulation; nutrient cycling, soil stability, biotic integrity, watershed function and photosynthesis; and spiritual, educational, recreational, and aesthetic experiences. According to the assessment, nearly all of these services are in gradual or steep decline. By improving soil structure and grass cover via grazing management, riparian and wetland restoration, tree thinning, open space protection, and no-till farming practices, A Carbon Ranch can contribute substantially to reversing the decline in these essential services.
- **Habitat protection**. In addition to the protection of the open space necessary for wildlife, A Carbon Ranch promotes the coexistence of domestic and wild animal populations. That's because it operates on the principle that the natural processes that sustain wildlife habitat, biological diversity and functioning watersheds are the same processes that make land productive for livestock. Healthy land, in other words, is the basis for healthy relationships between all living things.
- **Rural economic development**. Producing local food, restoring creeks and rangelands, marketing climate-friendly enterprises, and developing local energy will require a great deal of work, and therefore could potentially create a many jobs for rural residents. For example, the number of eroded creeks and wetlands in the Southwest that could be restored, is substantial, which means the potential for employing people in restoration jobs is equally substantial.
- **Maintenance of culture and diversity**. Since A Carbon Ranch involves livestock, horses, roping, branding, as well as farming, irrigating, timber harvesting, wildlife viewing and many other traditional activities, it can strengthen and support local and regional land-based

Grassfed cattle. (Photo by Tamara Gadzia)

cultures. It will require a mixing of innovation with tradition, but this can be a healthy way of rejuvenating a sense of community and cultural continuity.

- **Educational opportunities**. A carbon ranch requires a careful blending of ecology, economics, stewardship, restoration activities, monitoring, collaboration, and innovation, which means it has the potential to become a dynamic site for a wide variety of educational opportunities, including tours, workshops, field trips, Outdoor Classrooms, clinics, and training programs.
- **Bridging the Urban-Rural Divide**. Many people concerned about climate change live in cities or other urban arrangements while most carbon sequestration work will take place in the countryside, which means A Carbon Ranch has a huge potential to bridge the long-standing and expanding gulf that separates urban and rural residents today. In other words, urban can support rural economically, politically and socially, while rural can deliver the climate change mitigation that we all need so urgently.
- **Participation in a local economy**. Much has been written in recent years about the value of local economies. A carbon ranch can help by its emphasis on local food production, energy development and localized restoration activities.
- **Opportunities for the next generation**. If A Carbon Ranch could become a profitable enterprise, then it would undoubtedly become attractive to young people who want to get into (or back to) farming and ranching, restoration or other efforts to fight climate change. Additionally, older farmers and ranchers could be enlisted to mentor the next generation of land managers, especially if they have expertise in one or more of the necessary skills to run A Carbon Ranch.

There are other important co-benefits that carbon ranching can provide, including reconnecting urban residents with a source of their food, softening the effects of drought on landowners, and assisting with the terribly important challenge of feeding a global population that is expected to reach nine billion people by mid-century.

On the first point, not only is human well-being wrapped up with how food is produced— including the issue of carbon footprints and efforts to protect and restore carbon sinks— food is something everyone understands. That means it can play a key educational role in fighting climate change.

"By focusing on food systems, climate action will become more real to people," write Sara Scherr and Sajal Sthapit in a 2009 report for the WorldWatch Institute. "The status of farmers and land managers will be enhanced as their responsibility as stewards for a stable climate is recognized and rewarded. And society will reconnect in a new way with its ancient roots in the cultivation of land for food." [20]

On the second point, strategies that combat drought, especially in the arid parts of the developing world, will become critical as the desertifying effects of climate change become more apparent. For many around the globe, this issue will be a matter of life and death.

"Livestock are an irreplaceable source of livelihoods for the poor," write the authors of the 2010 FAO report cited earlier. "Livestock is the fastest growing sector, and in some countries accounts for 80% of the GDP, in particular in drylands. Seventy percent of the 880 million rural poor people living on less than $1 per day are at least partially dependent on livestock for their livelihoods and subsequent food security." [21]

Progressive grassland management, they argue, can increase productivity and food security, provide development opportunities in resource-poor drylands, and reduce impacts of drought and climate change.

On the third point, the issue is simple and profound: How can we feed nine billion people sustainably? In the past, the answer was to bring more and more land into production, especially marginal land (steep, dry or heavily forested). This is less and less an option today for a wide variety of reasons, including urbanization, conservation concerns and erosion. Meanwhile, according to a recent study, the world will require 70-100% more food by 2050 than we produce currently. [22]

One answer, according to this study, is to produce more food with the same amount of land (or less), which they call sustainable intensification and which involves increasing agricultural yields. Too often this becomes an argument for increased genetic engineering of crops or the development of new types of pesticides. But it could also describe the rise in stocking rate of cattle on a ranch that practices herding or another type of intensive management. In any case, it won't be easy, as the authors of the report note. "Any optimism must be tempered by the enormous challenges of making food production sustainable while controlling greenhouse gas emission and conserving dwindling water supplies, as well as meeting…the goal of ending hunger."

Fall branding crew on San Juan Ranch. (Photo by Avery C. Anderson)

That sounds like a job for A Carbon Ranch.

None of this will be easy. In fact, the obstacles standing in the way of implementing A Carbon Ranch and sharing its many co-benefits are large, diverse, and discouraging. But is it worth trying anyway? Absolutely. If A Carbon Ranch could it make a difference in the fight against climate change – which I consider the overarching crisis of the 21st century – then I think it must try. The alternative – not trying – means we consign our future to politics, technology and wishful thinking, none of which have made a difference so far.

Remember the old joke about how to eat an elephant? One bite at a time. It is the same with carbon ranching: The only way we can succeed is one acre at a time. Will it be fast enough? Will it make a difference? Will it work? I don't know – no one does. That's because we face an unprecedented future. We live on a planet that has not seen CO_2 levels this high for two million years – almost as long as there have been humans. We face a collective challenge that is literally unimaginable, though with each passing day scientists clear a little bit more of our future's fog, revealing a worrisome picture.

Some see salvation in high technology, including the capture of CO_2 at its source, to be stored underground, or the scrubbing of greenhouse gases from the atmosphere by hundred of thousands of boxcar-sized filtering machines. Unfortunately, these technologies, even if practical, are years away from deployment. And the climate crisis, as evidenced by recent headlines, is happening now.

This leads to a question: What about low technology?

Carbon ranching doesn't need to be invented. It already exists. We know how to grow grass using animals. We've learned how to fix creeks and heal wetlands. We're getting good at producing local grassfed food. We'll figure out how to reduce our carbon footprint, and develop local renewable energy sources profitably. We don't need high technology— we have the miracle of photosynthesis already. What we lack is the will to try something old. Low technology won't save the planet by itself, of course, but it is essential to the quality of life on Earth no matter how much CO_2 exists in the atmosphere. Too often, however, our eyes seem fixed on the stars and our minds dazzled by distant horizons, blinding us to possibilities closer to home. Perhaps we should be looking down, not up.

At the grass and the roots.

[Citations on next page.]

Courtney White, Executive Director of the Quivira Coalition.

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Kneeling in Mud:
the conundrums of a tree hugging, cattle ranching human

by Julie Sullivan

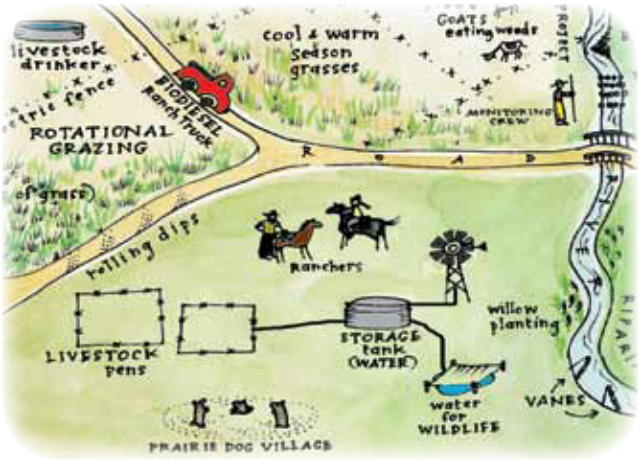
I'm kneeling in mud and manure, my hands through the metal bars of the crowding tub, propping up the bum front leg of this day-old calf who is trying to nurse his mamma. It just started to rain. Everyone else is in the house.

Every life is precious.

It's April. On our ranch, in the San Luis Valley of Colorado, this means we are calving. Nighttime lows drop to single digit temperatures and daytime highs may reach 50 degrees Fahrenheit. Temperature swings and the shrieking endless wind are hard on calves and humans alike. 14,000 foot peaks to the east are covered in snow.

I grew up in a small city, loving animals, the ocean and the empty field up the street that housed scraggly Italian pine trees, iceplant and a city water reservoir. I became an actor, a teacher, a vegetarian, a Cattle-Free-In-'93 environmentalist sure my convictions were based in the truth. In graduate school, I slept on the ground every night for two years, studying the planet by living directly with it. For a decade I taught for the same school, exploring environmental issues by meeting the people who live the problems and strive for solutions. Then I met a rancher named George with a deep land ethic and a great border collie, and fell in love. Now I'm a cattle-ranching-Deep-Ecologist tree-hugger kneeling in the muck trying to save a calf.

During a radio interview last year, I was asked if it's possible to be a rancher and an environmentalist. Possible: not easy. Small decisions become huge when beliefs and needs compete: the belief that nature is sacred and has intrinsic value versus the need to make a living from a particular piece of land. Like all creatures, we use the planet in order to live and thrive, but we also have to play nice with others—



find a way to make a living that doesn't mangle every other life form.

Every life is precious.

Aldo Leopold said "the sure conclusion is that the biota as a whole is useful." [1] Right now George sure doesn't think this calf is useful. No rancher would. But I do. And I'm a rancher now.

When George and I met, ***A Sand County Almanac*** by Aldo Leopold was one of three books we both had read. Sportsman and wolf advocate, farmer and forester, academician, naturalist and public lands administrator, Leopold navigated the conflict between conservation and utilitarianism by holding to the belief that "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise." [2] Navigating my own set of internal and external contradictions, Leopold's words and life provide good counsel.

I realize that Leopold wasn't referring to an individual member of a species when he said that all biota are useful. He spoke as witness to the profligate destruction of any plant or animal deemed

useless by humans. Examining the world and probing beyond convenient labels of useless and useful, Leopold saw the foundational undergarments that support life on this planet. All those "useless" entities actively support the "useful" ones—wheat doesn't grow without soil microbes. We Need The Useless. Even this calf.

Our categories are too limiting, I like wearing a pair of shoes two sizes too tight, we hobble around pinched and irritable, unable to commit to something new until the old wears out. The categories "useful" and "useless" are worn out. Life is full of equivocation; even molecules can't decide if they are mass or motion. Nothing is purely one thing or another. Not me, not you, not this calf.

If Leopold were around now, he just might subscribe to the first principle of Deep Ecology: "The well-being and flourishing of human and non-human life on Earth have intrinsic value. These values are independent of the usefulness of the nonhuman world for human purposes." [3]

Every life is precious, even the useless.

People tell us not to let sentiment and subjectivity influence our interactions with nature. Don't anthropomorphize! But this advice runs counter to the gut experience we have as children: we feel the affinity that exists between us and other life forms until someone teaches it out of us. Biophilia, a love of life and living systems, may have been essential to the development of the very brain most folks believe makes us so different from other animals. [4] In other words, connecting with the rest of life may be what made us human. Connecting to a particular life, like this calf, makes us humane.

Facts alone don't inspire us to change; we change when our mind and our heart are touched by the particular sorrows and joys of another life. Land stewardship, animal husbandry and what we buy at the grocery store are all matters of what Leopold calls the "ecological conscience," which is "an affair of the mind as well as the heart. It implies a capacity to study and learn, as well as to emote." [1]

Our bodies use the planet in order to survive, and our minds rationalize this use in 10,000 ways. But our hearts know that the entities living on this planet with us are not here solely for our use. Land, animals, soil fungi and rocks are not resources. They are "the community to which we belong." [2]

A Proper or Suitable Place

As a child I wanted to find that world where animals and trees spoke to me and I understood. I wanted to fit snugly against the rest of life, my odd angles and bumps a sure fit in the larger jigsaw-puzzle.

Some lives follow a straight line, and some resemble a mosaic: a seemingly random assortment of tiny bits of glass or paper. The mosaic artist holds an organizing image in mind as she works, an image the viewer can't discern until the piece is complete. My life is like this. It's hard to see the theme until you step back. Then the design becomes clear. The motivation behind each of my choices, and which leads me to this moment in the mud are the questions. How do I belong? How do humans belong?

Being a word person, I looked it up in *Webster's New World Dictionary, Second College Edition*:

"Belong" means:

1) to have a proper or suitable place
2) to be part of; be related or connected to
3) to be a member of (with, to)
4) to be owned

It seems the trick to belonging is to know where we are and who is here with us.

Once upon a time, we humans were intimate with our "proper and suitable place" in the world. Logging families knew their woods like they knew their family members; farmers tasted and smelled their soils. Today, most children can identify 1,000 corporate logos but don't know more than a dozen species that live in their yard. [5] Most adults are no better.

My ability to identify my proper and suitable place is determined by what I know, and what I think is important. I know I need George's approval and love and the support of my family, close friends, and people I respect. Chico and Zeke, the border collies — their opinion matters to me. Less obvious is the fact that I need buy-in from soil fungi, bees, and rainstorms. I don't even know the identity of everything whose good will matters to me.

Leopold offers counsel for rediscovering how to find our proper and suitable place. "Disregarding all those species too small or too obscure to be visible to the layman, there are still perhaps 500 whose lives we might know but don't." [1] Think of it: 500 sources of information and insight. In reality, there are far more than 500; biologists' current estimate is that more than 10 million species inhabit the planet, and most are still unknown. "A handful of soil and litter is home for hundreds of insects, nematodes, worms and other larger creatures, about a million fungi, and ten billion bacteria…. [this] lump of earth contains information that would just fill all fifteen editions of the Encyclopaedia Britannica." [4] If I want to learn anything about these 500 or 10 million other lives, direct experience is my best bet; there is no substitute for touching a sea slug or being stalked by an alligator (having experienced both, I know I'll never forget either). Direct, visceral experience gives us immediate information. But experience alone won't necessarily lead to wisdom or a change in behavior unless it also compels us to ask, "Given what I've learned, how will I now live differently?"

For the better part of a decade, I taught graduate and undergraduate students for the Audubon Expedition Institute at Lesley University (AEI). Students and faculty lived together, outside, for the entire semester studying ecology, ecosystems, cultural diversity and progressive education methodologies. Without a specific place to call home and far from anyone who knew me well, I couldn't rely on familiar friends or places for solace or help. If I needed support, I had to look to whatever was around me, and I found that the non-human world was always present, always offering its inspiration, ideas and companionship—as well as its dangers. My circle of concern grew beyond well-known people and places. What I considered my community expanded to include dirt, water and canyon wrens.

I took this seriously. At AEI, students and faculty sit together at least once a day to make decisions by consensus. Consensus can be laborious and tedious; it is also the most inclusive and generative of decision-making processes. Everyone affected by a decision is "brought to the table,"and given a voice in the decision. Collectively, we would arrive at a decision that, more than likely, none of us individually could have discovered. A decision almost always involved compromise on everyone's part, yet it also included everyone 's input so usually we were all willing to live with the outcome.


Julie Sullivan and George Whitten. (Photo by Amber Reed)

Those 500 or 10 million other species on the planet rightfully belong at the table when we make decisions that affect their lives. Our proper or suitable place depends on their good will, which we encourage when we let their stories "build receptivity into the still unlovely human mind." [2] We have to enter the other's life in the way a child gives himself over to storytime, or a traveler arrives in a foreign country — humble and receptive.

Blind

George likes to say that city people, when they come to the ranch, don't know how to see. They don't see the difference between this black cow and this other black cow, or between that patch of grass and this one over here. On the other hand, George goes to the city and doesn't know how to tell a "safe" crazy street person from a dangerous one. George and I have different receptors because we grew up in different places with different requirements for survival.

There's an oft-told story of Cortez's arrival in Mexico that may be fiction but, like any fable, presents a useful allegory. It is said that the Aztec didn't

George and Julie's cattle grazing on the Baca Wildlife Refuge, 2010. (Photo by Amber Reed)

"see" Cortez's ships because they had no concept of a large boat that could sail across the open sea. The allegory: It is possible to be blind to something readily apparent just because it is new to you.

I'm always surprised by how blind I can be to things that are outside my experience. What's worse, I seldom realize when my perception is limited in this way. Lopsided and incomplete knowledge gives birth to lopsided decisions and actions. Self-righteousness settles in when I confine my experiences, friendships and reading material to those that reaffirm what I already believe to be true and avoid the people and experiences that might shake me from my certainty.

Living in the wild for years and now living on the ranch stretches my sensory and intellectual capacity and shakes my certainty daily. I'm building new receptors all the time. Odd and unexpected teachers arrive to help.

Take grass, for example. I never really looked at grass, even though I grew up in a city rich with irrigated parks and had studied and lived in western grasslands for a decade. I met George when my students and I visited his ranch as part of our semester studying the Rocky Mountain region. We had seen desperate places overgrazed into dust and were suspicious of Holistic Management®, assuming it to be a nothing but a rationale that let ranchers continue to overgraze.

In November, when we arrived at George's ranch, the meadows were a bleached gold stubble. Not pretty in the conventional sense, they looked pretty darn dead, dotted with frozen cow pies. George got on his knees, held the dried frothy seed heads and crisp blades and talked about grass being our mother, the sun being the source of all wealth on Earth, and his work as a grass farmer who uses cattle to harvest this miracle of photosynthesis. In our five days at the ranch the students and I worked with George and slowly trained our eyes to see the meadows as George did: a mosaic of microhabitats pulsing with biodiversity, dotted with spots of bare ground. The short stubble left by a cow isn't necessarily the sign of an unhealthy landscape regardless of my aesthetic

response to a grazed pasture. It's the ratio of bare ground to healthy grass plants that indicates the vigor of a grassland. Bare ground is like a hardened opinion, no chance of a seed establishing itself when the surface is hardpan and unable to absorb moisture.

My years with the Audubon Expedition Institute brought me into communities radically different from my liberal, artistic, Southern California family. The curriculum required that I learn directly not only from nature but also from people. In the Pacific Northwest, we met with loggers, Earth First! activists chaining themselves to trees and with the Washington State school commissioners whose budgets were dependent on dollars earned from logging state-owned, old-growth forests. I studied the issues and stood in clear cuts. I was sure I knew what was right and true.

It was easy to vilify loggers until I spent weeks in Forks, Washington and realized that some of these loggers loved the woods, and loved the skill they had when it came to cutting trees with the least amount of damage to the rest of the forest. They took pride in doing a job well, and I was culpable in whatever impact their work had on the forests I loved. I used paper and wood.

Our receptivity to the stories of others helps us step back from our own experience so these other lives can shake up our preconceptions and opinions. We won't find our proper and suitable place in the territory occupied by only one viewpoint or species. We've all seen the failure of lopsided, one-size-fits-all approaches to land management, public schools and marriage. Solutions created from only one point of view can't help but fail to meet the legitimate needs of all the grass plants, children or people involved. Knowledge fosters insight and eradicates fear and as Leopold told us, conservation is best when it is not born of fear. "Conservation is a positive exercise of skill and insight, not merely a negative exercise of abstinence or caution." [1] Substitute the word "life" for "conservation" and you have an ethic to live by.

A Positive Exercise

It's not clear that splinting this calf's leg is a positive exercise of either skill or insight. It could be futile. Last year two calves had this same problem. George was convinced there was nothing to be done and I followed his lead. Our apprentices couldn't bear the idea that otherwise perfect calves were to be shot. They insisted we consult a vet, who said we might splint their legs. One calf we splinted four days after he was born. He improved through the summer but later his foot folded under again. The other calf we splinted at birth. Now you can't pick him out in the field of yearlings.

None of us intentionally does the wrong thing when it comes to animals, the land and our proper place in nature. We use the skills and experience we have and do our best. But there is always more to learn. In my years of teaching it was always the student who frustrated me the most who also taught me the most. Every semester brought a student I couldn't reach, someone for whom my insight and teaching skill didn't click. While I could have blamed the student, I was the teacher and it was my job to figure out what this student needed. I had to learn something new in order to serve this student.

Most of the time, the answer to a problem is to learn something new. For all of George's skill, insight and years of experience, he was flummoxed last summer by the bum legs on those two calves. We needed a little humility and a kick in the pants from our apprentices who weren't hemmed in by habit when it comes to ranching and animal care. We found a "positive exercise" that not only saved a calf last year, but may well save the calf I currently have in my arms.

When it comes to the planet, it isn't up to us to decide who belongs and who doesn't. Every being—every rock, ant, louse—is a member. This calf—the one in the corral with me right now is part of the "enlarged boundaries" Leopold spoke of when he said that the land ethic "enlarges the boundaries of the community to include soils, plants, and animals, or collectively: the land. [2]

The first rule of tinkering is that you save all the sprockets and springs until you are absolutely certain that you don't need them. Slash-and-burn logging destroyed yew trees, considered trash trees by the logging industry. Taxol, one of the best cancer

CARLY Apprentice Sam Ryerson with Julie and George. (Photo by Elaine Patarini)

fighting drugs comes from yew trees. Dams and overfishing led to a decline in the number of salmon running upstream to spawn, die and decompose; the result is a loss of soil fertility in the forests of the Pacific Northwest. Our tinkering might be inevitable, but we still need all the parts.

Who I include as a member of my community says a lot about who I am and what I value. I wouldn't necessarily choose biting red ants as members of my club, but here they are. There are people with whom I disagree, but that doesn't mean I get to ignore them.

George asked me once if I felt I'd had to renounce part of who I am and what I believe in order to be a rancher. No, I haven't. I try to blend my past and present selves, to make them talk to one another and learn from one another rather than dismiss one another. Sometimes I find symmetry in the relationship between them, sometimes I thrash around in the contradiction created by the two: Every life is precious; we can't save them all.

My favorite metaphor for describing my unwieldy identity is to compare it to a prolapsed uterus. I've seen this twice in 10 years of ranching. A potentially fatal condition, a prolapsed uterus looks like a creature from another galaxy with odd, mushroom-shaped pulpy blobs all over it. It flops and slithers away from you as you try to tilt it back into the cow. Sort of like trying to shove a jellyfish into a pop bottle.

Pieces of my identity slop over the edges of any membership category. Sometimes it feels like being a Deep Ecologist cattle rancher may be too swollen an oxymoron to ever fit neatly into any one life. The simple fact of my being a rancher makes me suspect to environmentalists. My commitment to the Wilderness Act, endangered species and forgettable creatures like soil microbes makes me suspect to ranchers.

The paradox inherent in my personality isn't exclusive to me. Life is full of paradox. Most of us aren't comfortable with paradox and try to resolve it, discounting one aspect and aligning with the other. We discount one another in the process, creating a monoculture in our minds and lives, rather than wrestling with a diversity of opinions and experiences. But if all the biota are useful, and if a cranky student is a teacher in disguise, then perhaps the best way to navigate our relationship with others, human and other-than-human, is to widen our figurative arms as far as they can reach and include it all.

George and I are clear on at least one thing: "The cows are in charge of us." Our days are shaped by the needs of the cattle, and, no matter what we plan, they have the last word. We live by serving them. And in the end they serve us, restoring the land's fertility and feeding people.

Each of us is owned by the things that command our attention, be it an idea, a principle or a specific being. Our time and money pour into that which is served. We tend to be a consuming, materialistic society focused on the human-made trappings of suc-

Embracing it all. (Photo by Avery C. Anderson)

cess and privilege. People work long hours, take few vacations, and, even then, are tied to their jobs by communication devices which they feel compelled to answer, no matter where they are and what is happening. They may not call it being owned, but that's what it looks like to me.

I'd rather be owned by the cows.

Crouching in the rain and muck this evening, propping up this calf, a line from Shakespeare runs through my mind:

The quality of mercy is not strain'd.
It droppeth as the gentle rain from heaven
Upon the place beneath. It is twice blest:
It blesseth him that gives and him that takes
(***The Merchant of Venice***, Act 4, scene 1)

This calf's value isn't monetary: he is a teacher, offering lessons both simple and transcendent. Simple lessons: Some hopeless situations have straightforward solutions and a little extra effort can heal a hurt. Transcendent lessons: No matter how long we've lived and learned we are never a finished product. We are at our best when we are humble, curious, and generous with our mercy.

We may think in the abstract but we must care for the specific: it is the only way we actually make a difference. This calf. This moment in time. This choice.

Consider this—
that in the course of justice none of us
Should see salvation; we do pray for mercy,
And that same prayer doth teach us all to render
The deeds of mercy.
(***The Merchant of Venice, Act 4, scene 1***)

Just because something is hard doesn't mean it's wrong. I choose to sit here with this calf because I believe it is the right thing to do. I choose to embrace the paradox of being a rancher and a Deep Ecologist, belonging to both the human and the rest of the world. The larger our circle of concern, the more inclusive our community, the more we are "twice blest." I strive to belong and hope for mercy. Life is precious.

Julie and her husband, George Whitten, run a grassfed cow/calf-to-finished steer operation, with the long-term goals of re-localizing food systems while increasing the ecological health of all the land with which they work. They shared in the 2006 Clarence Burch Award. In 2003, Julie created an intern program on the ranch, and, in 2008, in conjunction with the Quivira Coalition, created the CARLY ranching apprenticeship program. The first CARLY apprentice arrived at the ranch in April 2009.

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Navigating Beauty and Utility:
an Apprentice's Journey

by Amber Reed

Recently, I heard an interviewer ask a rancher if they thought that there was a future in ranching and farming. I thought "Well, plastic sure is tasty, what kind of a question is that?!" So here is my answer to that interviewer: "Yes, there is a future in agriculture but it takes practice, humor, creativity, stamina and serious guts." I'm still working on all that; in the meantime, here is my story.

I decided to apply for the Quivira Coalition's CARLY (Conservation and Ranching Leadership and Youth) Ranch Manager Apprenticeship at the San Juan Ranch while I was teaching elementary reading in Leadville, Colorado. I had spent the last three years teaching everything from second grade to Sophomore Biology. My voyage through public schools started with Teach For America in inner city Atlanta, Georgia, and Charlotte, North Carolina, before landing me in the mountain community of Leadville.

Even though I loved my students, in my spare time, devoured magazines about cows and dreamed about "the farm." I almost made the jump after high school when I deferred from college and spent six months working on farms in France and Italy. When I returned though, I went to Bowdoin College, and it wasn't until five years later that I finally decided it was time.

Very few of my friends over the years have taken steps toward agriculture. Often there is no way to break in without a family place, and these days most people won't take the leap without the promise of decent wages and benefits. CARLY is trying to fill that gap. By setting up yearlong apprenticeships that benefit both the apprentice and the mentors, CARLY is like the rebel Future Ranchers of America.

What Quivira is doing with CARLY is both old-fashioned and revolutionary.

Wilderness Home

I was born in West Virginia to a family of Italian immigrant coal miners to whom cooking and gardening were a sort of religion, and to a family of clannishly self-employed tradesmen and bicyclists who, on a given day, might have a fistfight over tomatoes or metal alloys.

As a kid, I moved to Maine because of a tree. Birch trees actually. My stepdad is a birch bark canoe builder. So rural Maine it was. My mom planted herself some garlic to make herself feel at home. We used to hike to Higgins Brook for a bath. It was only a mile away. We hauled all of our water from a nearby spring, and we used moss in the outhouse since toilet paper was some sort of European invention. Personally, I thought it was a pretty good one; besides, didn't rigatoni and meatballs come from Europe?

Growing up in the backwoods of Maine, we were always walking the line between wilderness and agriculture. Leopold writes: "The true problem of agriculture, and all other land-use, is to achieve both utility and beauty, and thus permanence." I think that we balanced and even integrated utility and beauty in our everyday lives. Leopold describes watching the woodcocks' mating dance and how so many agriculturalists might "live on the land, but not by the land…" I think this disconnect is caused by being too busy to stop and enjoy our surroundings. Or, it's just simply habit.

In the spring when I was a kid, we used to walk out to Ray Gill's field and lie in the grass at dusk. The woodcocks, just like in Sand County, would do their wildly swirling mating dance against the clear sky. One night, we were lying so quietly that a doe almost stepped on us before she bounded away. The deer: beauty and utility.

A few years ago, while visiting home in Maine, the end of hunting season was drawing close and my stepdad hadn't shot his deer yet, even though one had been nibbling out of the garden and under the apple tree for some weeks. He decided that he was going to trade his gun this year for one of his older methods of hunting. So he boiled up his snares and gloves and set up a snare in the woods by the garden. He then tied a piece of string to the snare and strung it all the way back to the house where he tied a small bell to its end just inside his bedroom window. Mom said that he laid in bed at night waiting for that bell to ring. Every time the wind rang the bell, he would leap from the bed. Finally, one night the bell rang for real. She said that he tore out the house in his underwear and speared the deer in his snare. Then he came back inside to get us, and we all went out to feel deer that was still warm and give our thanks. After that he ate deer for three meals a day, until his gave himself TMJ (serious jaw pain). The doctor had to tell him to lay off the deer meat until his jaw healed. The deer: utility and beauty.

Sometimes it's hard to love something and eat it, too. Maybe that's why people disconnect themselves from their land and animals. The resulting ease leaves people able to mistreat something without the connection. Ranchers and farmers must balance this perfect contradiction every day. For others, this presents a dilemma when they don't have the chance to live close to the land. I love cows. I love to watch them drinking water or investigating some new human idea of management. I love to listen to them eat. And I love to eat them, too. I'm willing to live with that contradiction. The cow, you know who she is: the gorgeous and delicious builder and leveler of life.

This balance of use and beauty was much harder for me to understand or articulate when I was younger. Leopold talks about how utilitarianism has regimented us as easily as any queen in England did. Perhaps this need to make every acre or every animal productive has caused the real disconnect between us and land. I have to admit that, for a time, I wanted to keep every acre of forest untouched. I was a canoe trip leader for many summers in Maine,

Amber Reed, San Juan Ranch CARLY apprentice, feeding a new calf. (Photo by Aimee Danch)

Taking the mother herd up Tracy Canyon, Colorado. (Photo by George Whitten)

Minnesota, and Southern Canada (mostly Quebec and Labrador). We took trips in wood canvas canoes; everything was minimal, old fashioned. We used to say that we were low tech and hard core.

At 19, I led my first six-week trip. It was through the rapids, muskeg and black spruce forests of the Mistassini River in Quebec. We didn't see a single person outside of our group until Day 30. The first thing I saw was a dozer clearing brush for pulp harvesting. I cried. Three years later, I led a trip on the same river. We saw our first person on Day 7. On Day 10, we hit a blackened forest. There had been a lightning strike and thousands of acres had burned. There were skidders harvesting the dead trees. The kids on the trip were furious, mad about the destruction of their forest. I understood. But I explained that all the paper that we used came from somewhere and better from an already burned forest. When confronted with the real deal, it's a struggle between use and abuse, and preservation.

Leopold understood this potential compromise between agriculture and wilderness. I think this is the split Quivira is trying to bridge.

Responsibility

A card came in the mail the other day from my mom, and I realized how many pictures my family takes of food. My dad sent me pictures of buckwheat pancakes that he had grilled on his "beach." His beach is actually a terraced garden perched on a hillside overlooking the Ohio River. He poured sand on each level, and he sits up there smoking a pipe under his mimosa tree and rebuilding motors. My grandmother has also sent me many pictures of pasta tossed with garden vegetables, and she joked about my grandfather's mushroom projects stinking up her basement.

It struck me how much love and energy we all put into food. How we spend hours at the table, hours in the garden, hours in the woods, and now hours in the pastures with the cows.

Leopold wrote about how farmers are responsible for keeping their land healthy and for feeding the people who depend on them. "A farmer has the same obligation to help, within reason, to preserve the biotic integrity of his community as he has, within reason, to preserve the culture which rests on it. As a member of the community, he is the ultimate beneficiary of both." I agree with Leopold, but times have changed too. Society and the government encourage farmers to exploit their land and grow unhealthy food. I think we should take Leopold's idea of responsibility and flip it back on society. Society is also responsible for supporting the farmer.

We can all attest to the crazy, busy lives that ranchers and farmers lead. I can't imagine that sustainable agriculture will survive without an effort to,

as Leopold put it, "[get] a life, as well as a livelihood, from our acres…" A friend of mine who recently attended a dinner lecture for the Colorado OB/GYN Society heard an interesting theory on the future of resident training. Dr. William Droegemuller (OB/GYN North Caroline) spoke about how the millennium generation (that's me and anyone born between the late 70s and mid-90s)…values lifestyle over income and won't sacrifice happiness as much as previous generations wood. He also said that millenniums are good at collective bargaining and will probably have the power to change some unreasonable norms like 90-hour workweeks.

This Dr. D was obviously referring to a job from which you can actually go home from even if it's only for a few hours. Now, my generation doesn't have any illusions about forcing a 40-hour workweek on farmers. Yet, my generation is definitely suited to agriculture if they value lifestyle over income. I think we are also in a good position to help change the paradigm of agricultural partnerships.

Some of the old paradigms work and some don't. Many of us who are going into agriculture don't have a family ranch or farm to take over or even a husband or wife who wants to milk cows or make pasture plans with us (I can't see why not). So we have to find another way to make it work.

The partnerships I have in mind are with restaurants, schools and other farms with a business cohort; and with apprentice programs. These types of partnerships might give agriculture the boost it needs to stay afloat in a time when the number of ranchers and farmers in America doesn't even equal 2 percent of the population and their average age in 2007 was 57.

There was a great example of business partnerships in a recent New York Times article, "*In Portland's (Maine) Restaurants, a Down East Banquet*." It basically said that Portland is a great place to open and run a restaurant. AND it's not just because the rent is cheaper than in New York. In Portland there are "vigorous farm-to-table networks" that include shares in CSAs, visiting the farmers' markets or having partners who owned and ran farms. It means that menus have to change according to season.

Got milk? Late Spring steer at San Juan Ranch, Colorado. (Photo by Amber Reed)

Several chefs said that it keeps them experimenting. Recently, these chefs threw an event called "Deathmatch," which was "an 18-course fantasia of a last meal."

This is what my generation of farmers and ranchers need to do. We need to encourage events like Deathmatch and try to grow food that restaurants want to work with. We need to form CSAs with other farmers, so we can provide what the other one doesn't. There are a lot of farmers out there trying to grow/make everything in a comprehensive CSA instead of doing a few things well and cooperating with others.

Quite a few private schools and colleges are starting to either run their own farms or partner with local farmers to provide their food. Students are a great source of free labor and farming is a very practical education for them in return. Some public schools are starting to follow suit with small experimental gardens and the occasional farm visit or tour of a farmer's market or country fair. Programs like 4-H could develop a holistic branch that received funding from organizations that already support sustainable agriculture. Kids love animals and plants and need more of that contact in the modern world, just as agriculture needs them to be deeply interested.

Despite the scarcity of actual farmers and ranchers today, there are a lot of people interested in going into agriculture, although I'm betting, they might not have a life partner who wants to be splat-

tered with manure on a regular basis. This is a good opportunity to find that business cohort and go in on land, animals, equipment, leases, etc. I just met a woman the other day who is also serious about dairy and holistic land management, so you never know whith whom you might go into business.

As for apprenticeships, CARLY numbers in the handful of real apprenticeships that exist today. Many of the opportunities out there are just a source of free labor without a real educational component. Apprenticeships are being redefined now as many young people graduate from college in a bad economic time with very few practical skills. CARLY is really trying to fill that gap. My apprenticeship at San Juan Ranch was a watershed experience. That experience started a cascade of ideas, events and knowledge, which have, and will continue to, focus on a real purpose: to prepare me for life as a serious agrarian with resilience, scope, and ingenuity.

My intention is to own and operate a small dairy and creamery and to help other people find practical management solutions to restoring their land and their connection to it. I'm still a CARLY Apprentice these days, but this time I'm working on the James Ranch in Durango, Colorado. Instead of herding cows on the range this summer, you'll find me milking cows in the open-air milking parlor and flipping cheeses in the aging room. One of the reasons I am excited to work for Dan and Becca James is because they have changed so many of theusual dairy paradigms. The cows graze green grass (no grain ever), get milked only during the growing season and only once a day, keep their heifer calves until they are weaned onto grass, and produce lovely golden cheese (with some help from Dan and Becca). Each of these decisions results in a million consequences that improve the overall farmer's happiness and flexibility, animal health and longevity, as well as makes for a stout business.

I am a CARLY Apprentice, not to remake myself in the shape of a conventional rancher or farmer, but to develop "terroir," as Paul Kindstedt (Author of *American Farmstead Cheese*) put it - "the notion that place, shapes the quality and character of a cheese." Hopefully, my own "terrior" won't develop along the lines of a Limburger.

As an ode to farmers and ranchers everywhere, here is some poo for thought (for those who know me best and my favorite subject)… I went to close up the chickens the other night and the door had fallen shut (because of the wind), so they roosted under the chicken tractor. At the time the field was being irrigated, so I crawled underneath the coop and pulled the chickens out one at a time and put them inside the door of the coop. (When the sun goes down, so does their brain; even with an open door, they won't "un-roost" from an unsafe location). Their flapping wings sprayed my face with water and dislodged poop balanced on the chicken wire floor above me. I crawled around in the dark for a while carrying squawking chickens above the muddy water. Just as I was about to carry out the last one, I backed into the edge of the coop and a rain of chicken poop went down my pants!

So, that is my answer to the interviewer's question: "Do ranchers and farmers have a future?" Last week, in reply to my chicken adventure email, Aimee (the first yearlong apprentice at San Juan Ranch) wrote, "Ah, the moments that make it all worthwhile…" She is so right. Leopold would agree too as he followed the meandering tracks of a skunk during the January thaw in Sand County.

Amber Reed was the first CARLY Apprentice at San Juan Ranch in Saguache, Colorado. She is currently a CARLY Apprentice with James Ranch Artisan Cheese, Durango, Colorado. Contact Amber at amberfreed@gmail.com

Amber milking the girls at the James Ranch, Colorado. (Photo by Dan James)

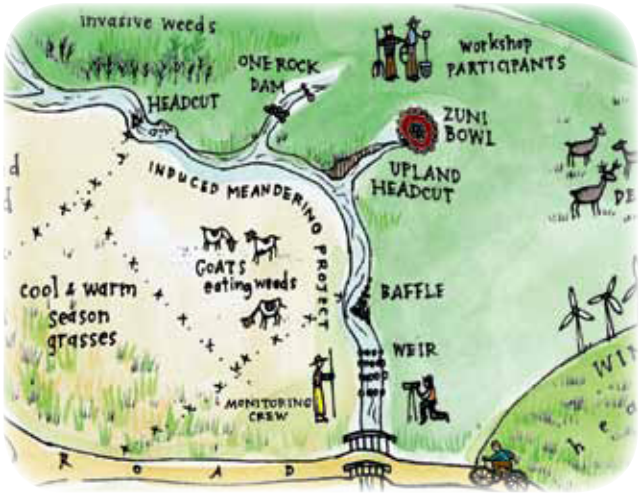
Alone in a World of Beautiful Wounds

by Craig Sponholtz

Ever since I was very young, I have been enthralled by the immensity of western landscapes. I imagined that the classic idea of landscape beauty is experienced by people who live in and visit the mountains, plains and deserts of the West. This is the kind of beauty that can even be absorbed at a glance while travelling at high speeds down expansive highways. It is immediate, accessible and requires no commitment. I have spent most of my life living and working all over the West and have come to realize that this snapshot of beauty is not what I experience. Postcard horizons have always captivated my imagination, but mostly because I wonder what is in that canyon or in those mountains at the edge of the sky so far away. I have always been most interested in the intimate folds and nooks that are hidden away in all of this vastness.

Eventually, a good bit of luck and a well-spent student loan allowed me the opportunity to secure my own fold in the vastness. I bought twenty five acres of brush, trees, box canyon and arroyo tucked away on the edge of a truly immense horizon. This was my first chance to set my own roots into the land on my own terms, and the experience has been absolutely profound in my life. For the first time, I had the chance to get to know a place in intimate detail. I came to know all of the individual players that shaped the landscape. I came to know the trees, the wildlife, the weather and the shadows. I came to know many small and beautiful things. I realized that this kind of knowing is slow, deliberate and requires a long-term commitment.

I have since spent nearly fifteen years on this piece of land, with my hands in the dirt, moving rocks, planting trees, cutting brush and attempting to reshape my corner of the world into a form of my liking. It has mostly been a solitary task and a humbling endeavor, to say the least. Like so many others, I set out on this path with all the best intentions, loads of youthful energy and just enough information to be dangerous; and I was. I struggled alone through eight years of pure trial and error erosion control in an attempt to solve a problem that didn't really exist. From all those years of experience, I can now say that if you try hard enough to solve a nonexistent problem you can certainly go a long way toward creating one; and I did.



Fortunately for my learning curve, and, arguably, my land, I decided to leave and seek out a formal education in my new found passion: watershed restoration. I moved about seven hours away to pursue a master's degree, with the hope of discovering whatever it was that trial and error could not teach me. It turned out that this distance I created between my land and myself was an essential part of the learning I needed. During those years of infrequent visits, my understanding of the system I had been dealing with made great leaps forward. I always came back to my land with a slightly different perspective based on newly earned knowledge. I

A "mega" Zuni bowl built by Craig Sponholtz to heal a headcut on Windmill Draw, Red Canyon Reserve, May 2010.
(Photo by Avery C. Anderson)

learned that the arroyo I was working on was not really an arroyo at all—it was an alluvial fan. I learned why my every attempt to stop the perceived erosion only created more. You can't treat an alluvial fan like an arroyo and expect it to remain stable. Trial and error had not revealed this fundamental truth.

During my studies I was fortunate enough to come across the stream restoration work of Bill Zeedyk, and I was even more fortunate to have the opportunity to learn from him by helping out on several Quivira Coalition volunteer projects. I learned that, with keen observation and patience, one could actually help nature do its own healing. I embraced this philosophy immediately. "Letting nature do the work" just sounded right and, instinctively, I knew it was so. I also learned that in order to work with—rather than against—nature, it was necessary to understand the many complex, overlapping processes and variables that shape ecosystems through time. I returned to my land and applied these new insights. I observed more, did less, did it better and began to produce visible results. I began to see the beauty in what I was doing. I started to understand how this small fold in the vastness was connected to every other fold and to the vastness itself. I began to perceive the underlying processes that weave the fabric of this landscape together. My concept of a whole landscape began to take form.

Form and Function

Traditional design theory emphasizes two aspects of an object: form and function. "Form" is defined as the shape and structure of something and "function" is defined as the action for which a thing exists. While these two aspects of an object are necessarily intertwined, this definition implies that the relationship of form and function is a static condition. Nothing is static in nature. When we look at a vast horizon we see landforms that are the result of millennial geologic and weathering processes, and while we may not be able to see it, these landforms continue to change grain by grain in every moment. Nature does not simply create forms for a static singular function. Natural forms are created by the ceaseless unfolding of complex processes. A "process" is a phenomenon marked by gradual changes through a series of states. A process is anything but static; it has no beginning and no end, just changes.

Process is the best way to describe how runoff flowing in an arroyo gradually changes its form at the apex of an alluvial fan and becomes dispersed sheet flow. This was a process I needed to understand on my own land. Process also describes how an eroded gully heals itself by continually eroding its banks, or how a wetland builds itself by growing plants that capture soil that grows more plants.

I believe that Bill Zeedyk's greatest insight is that we, as restorationists, must become partners with natural healing processes and that the art is to know which part of the process we must become. At times we can act as catalysts, jumpstarting the establishment of plants that will provide stability. Other times, it is only necessary to gently steer a process, as in favoring the natural erosion of one bank to build floodplain on another. Perhaps most importantly, we must know when it is necessary to just get out of the way and let a natural process unfold. In this case we can still serve a valuable function as eager students of nature and willing receptacles of its wisdom.

I have a background in sculpture and ceramic art, and I have always been interested in the creation of beautiful forms through complicated processes.

Aesthetics continue to play a key role in all of the work I do because that is how I relate to the environments in which I work. As a professional restorationist, I do a great deal of rock work in streams and wetlands and I find that what started as a desire to create beautiful structures now serves the function of connecting me to the intimate details and subtleties of a restoration site. This not only improves the overall aesthetics of my work, but also plays an important part of seamlessly blending my work into the natural system. Aldo Leopold captured the essence of this idea when he said, "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise." I have learned that a thing that blends seamlessly into its environment is beautiful and tends to serve nature's function.

"The Frog Spa," Rock Lined Plunge Pool, Cañon Bonito Ranch, New Mexico, 2009. (Photo by Craig Sponholtz)

The form of any stream restoration structure is dictated first by the intended process it will drive; then by the characteristics of the project site, the availability of materials and the type of tools available to do the work. There is one more crucial element that dictates the form of a structure: opportunity. Careful observation and a clear understanding of regenerative processes will reveal a multitude of site specific opportunities. Recognizing these opportunities is truly an art. Opportunities can take the form of a boulder or bedrock outcropping, a clump of sturdy vegetation, a low bank or almost any other feature that can be used to advantageously create a unique solution. Utilizing every available opportunity creates strength by integrating structures into the skeleton of the land. An opportunistic approach creates seamlessness and finds agreement with long-term natural processes. My goal is to recognize the small opportunities that make a big difference and to act on them. This is why watershed restoration is endlessly creative and endlessly rewarding.

A Learning Process

I see myself as a creator of forms and a facilitator of processes. As I've said, processes don't begin or end; they just change. Most often the change I seek is from a degradation process to a healing process, and my job is to determine what forms best facilitate that desired change. This brings up an interesting question: How does form drive process? To begin with, the form should not remain static. Consider how a One Rock Dam stops erosion by driving the processes of moisture infiltration, plant recruitment and soil building.

These processes are initiated by the single layer of rocks that comprise a One Rock Dam. This layer of rock acts as a mulch. Rock mulch alone will slow runoff, increase soil moisture, protect seedlings and retain soil particles. When placed in the context of an eroded gully, the rock mulch must be positioned properly and have dimensions that relate to the form of the channel. The form of the One Rock Dam and the way it interacts with the form of the eroded gully creates the additional benefit of channel stabilization, thus leading to increased plant cover and the collection of sediment that eventually fills the bed of the channel. Ultimately the form drives the

healing process. With time, the specific form of the One Rock dam becomes less and less important as natural regenerative processes take over. The One Rock Dam ultimately disappears as the channel continues to stabilize, aggrade and heal.

When I reflect on the path that I have traveled, I can see how my own learning process was formed by the challenge of wanting more from our desiccated landscape. My imagined ideal of nature was just as vast as the one I observed around me, but maybe a bit greener and perhaps a little shadier. I now realize that I am not unique in my desire to live in a better version of this place. I think many of us look at the gullies and arroyos of this land and sense what was lost with all of that eroded soil. Aldo Leopold was sadly aware of this. He said, "One of the penalties of an ecological education is that one lives alone in a world of wounds." I started down my own path with that in mind and observed so many wounds, some superficial and some apparently fatal. I had no idea of what to fix, but felt compelled to fix it anyway. I started to do the work of healing without knowing the cause of the malady. I only knew enough to recognize the wounds. My unquenchable desire to do better by the land eventually taught me that all those wounds are opportunities yet to be realized. They are opportunities to connect with the land, with complicated processes, with natural beauty and ultimately with each other.

My desire to be part of the solution has connected me with many others who are driven by the same need. I have had the privilege of meeting some of my best friends over headcuts. I have formed lifelong bonds while contemplating bank erosion. It turns out that I was never really alone. I was just caught up in my own little fold in the vastness. When I took the time to look around I found out that there were all kinds of people who, just like me, actually volunteered to do this stuff in their free time and even thought it was fun. The group energy was infectious. With all those hands we could move mountains of rock in a day, and by the end of a weekend workshop we had healed many wounds.

I now have the opportunity to teach watershed restoration all over the Southwest. I get to work with young folks, old folks and everyone in between. I work with groups of all types, all with a desire to be part of the healing process, regardless of their specific interests. I get motivated by how excited people are to learn that they really can do something to help, and I am constantly energized by the ecstatic feeling they get when they create something beautiful. I try hard to catapult my students past some of my own pitfalls so that their learning is swifter and a little less arduous. When I teach, my goals are very simple. First, I stress the importance of recognizing degradation and identifying its causes. Secondly, I emphasize that there is always something that can be done and we all need to be empowered to do it. Finally, I encourage the sense of artistic fulfillment we get when we create something beautiful and seamless that is sure to work. I see this as my responsibility because I don't want to live alone in a world of wounds. I want to inhabit a beautiful world of opportunities for healing the land, and to empower others to do the same.

Craig Sponholtz.
(Photo by Avery C. Anderson)

Craig Sponholtz is founder and president of Dryland Solutions Inc., in Santa Fe, New Mexico. He works throughout the Southwest with private landowners, nonprofits, tribes and government agencies. He leads workshops in erosion control and passive waterharvesting techniques that seek to give students the skills and encouragement needed to go out and make a difference in their home watersheds.

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Coda

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The Carbon Ranch: Using Food and Stewardship to Build Soil and Fight Climate Change.
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