The Quivira Coalition

Journal

A Voice of the New Agrarianism

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The Back Forty

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The Quivira Coalition
1413 Second St., #1
Santa Fe, NM 87505
Phone: 505-820-2544
Fax: 505-955-8922

Courtney White
Executive Director
505-820-2544 Ext. 1#
executive@quiviracoalition.org

Catherine Baca
Education and Outreach
Program Director
505-820-2544 Ext. 2#
cbaca@quiviracoalition.org

Tamara E. Gadzia
Publications Director
505-820-2544 Ext. 3#
tegadzia@quiviracoalition.org

Michael Bain
Land & Water Program Director
505-820-2544 Ext. 6#
mbain@quiviracoalition.org

Avery C. Anderson
Capacity Building and Mentorship
Program Director
505-820-2544 Ext. 5#
avery@quiviracoalition.org

Deanna Einspahr
Business Manager
505-820-2544 Ext. 4#
deanna@quiviracoalition.org

Ellen Herr
Office and Membership
Coordinator
505-820-2544 Ext. 0#
admin@quiviracoalition.org

www.quiviracoalition.org

Cover photo of Centennial Valley, Montana, by Courtney White.

From the Editor's Desk

"The only progress that matters is on the actual landscape of the back forty." – Aldo Leopold

For some time now, I've worried about the growing disconnect between the Front Forty and the Back Forty in America. Increasingly, the news from the Front Forty – Washington, D.C., Wall Street, state capitols, mainstream news outlets – has become both discouraging and unreal. That's because so little actual progress is being made anywhere on critical matters and because current events seem so utterly disconnected from how the world actually works – disconnected from the land, for instance.

In contrast, the news from the Back Forty is very encouraging. In many places that I have visited, people are solving on-the-ground problems with innovative ideas, cooperative efforts, and abundant enthusiasm. For example, during a recent tour of a farm in Texas, I was astonished to learn that the farmer had built a working hydrogen fuel cell battery in his barn from off-the-shelf parts. He looked like someone from a Norman Rockwell painting, proudly showing off his invention – a green energy gizmo!

It confirmed my feeling that American ingenuity and can-do spirit is alive and well – on the Back Forty. You just never hear about it in the Front Forty press.

In this issue of our Journal, we try to correct this imbalance a little bit by offering stories of actual progress from the Back Forty. I hope you will find them as encouraging and hopeful as we have.

Happy Reading! Courtney

P.S. In order to make room for other authors, I'll be writing less frequently for our Journal. For more of my writing visit: www.awestthatworks.com

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Feature

The Back Forty and the Big Picture

by Grady Grissom

"Pay the mortgage" is the fundamental challenge of ranching. This essay is the story of my response to that challenge. The story begins with my childhood in Colorado where I spent considerable time on my grandparents' ranches. The land, the animals, and the work ethic took me by storm and by the sixth grade I knew I would be a rancher. Summers from junior high through college were spent on ranches and I worked full time for several years after college in eastern Colorado.

Grady Grissom 'neighboring'. (Photo by Courtney White)

The eastern Colorado culture imprinted me with a utilitarian view of grasslands. Grasslands were meant to produce beef and pay the mortgage. I did not perceive grasslands as wild, natural places to be conserved. People who worried about prairie dogs and predators needed to mind their own business.

My teenage years also included a love of mountain climbing and rock climbing. Along with my brother I roamed the Rockies from Colorado to Canada on climbing trips. Climbing experiences and the culture as an undergraduate at Princeton University imprinted me with an ecological view of the mountains. I engaged the environmentalist perspective that wild places must be protected and segregated from humans.

I held these conflicting views of grassland and mountain environments through my years as a graduate student in geology. Even when I became a partner and manager at Rancho Largo Cattle Company in southeast Colorado in 1995, I still had not recognized that my views of grassland and mountain systems were incompatible. These views were the result of two distinct cultural influences, not a rational perspective on ecosystem value and function. Fifteen years at Rancho Largo have begun to provide that rational perspective. In the process of paying the mortgage I developed views on what a healthy ecosystem is and how natural systems relate to human communities.

My journey convinced me that grasslands are wild natural places that humans can manage toward desired outcomes. These experiences on the Back Forty are an analogy for the Big Picture conflicts between "environmentalism" and "conservation," between industrial society and ecology. My story illustrates that ultimately human economies must be part of the solution, not the problem.

Early Years (1995 – 1999)

My arrival at Rancho Largo in 1995 was the culmination of a dream. The career path through graduate school was always aimed at ranching. My wife and I pulled up our family from a stable position in California to pursue my dream in ranching. The ranch was 14,000 acres of mixed short-grass prairie and pinon-juniper/canyon habitat. The ground was in acceptable ecological condition. A long history of leasing and summer grazing

had created a gramma grass dominated system, with cool season grasses, forbs, and shrubs in low abundance. I was incapable of recognizing the ecological condition at the outset. Ranch work had taught me to handle day-to-day problems and jobs but I had very little knowledge of big-picture management. Critical concerns like stocking rate, ecological health, and the mix of cattle enterprises were not yet in my sphere of knowledge.

My initial management approach was characterized by high expectations and planning. On paper it looked simple; maximize stocking rate to spread fixed costs (overhead) over more cattle. In other words, we'll push the suggested stocking rates but we'll do all the 'right things' – such as top genetics, tight calving seasons, selective breeding driven by detailed animal records, detailed financial records, pasture rotations, etc.

Intuitively, I understood that stocking rate was the most important decision a manager makes. However, I did not understand that there is no leeway to push the envelope. All the newest breeds, feeds and technologies can't overcome too many cattle – the inverse relationship between stocking rate and animal performance is a strict limit. Poor animal performance swamps any financial benefits from extra cattle. In the cow-calf business this economic message is sent by low conception rates, and for yearlings the message is low gains per day. Unfortunately, I couldn't hear what the land and cattle were telling me. I clung to the efficient stocking rate paradigm and tried all the right 'fixes' as the financial losses mounted.

Eventually, in the late 1990's the cultural knowledge of my neighbors broke through. They never told me what to do; ranchers are scared to death of telling someone how to run their business. Instead, I gained their knowledge through the community tradition of 'neighboring' which is shared labor in the spring at branding and in the fall at shipping and preg-checking. Neighboring is all at once recreation, social interaction, and a business transaction. For me it was a valuable education. I finally began to notice that the 'successful' ranchers had two things in common: fat cattle and lots of residual grass. Spring, fall, drought, or blizzard – the ranches that persisted for generations had more grass and fatter cattle than anyone else.

Lloyd Hall. (Photo by Grady Grissom)

This was especially true of two old timers in their eighties, Lloyd Hall and Julias Roberts. These men started a long time ago with a mortgage; today I suspect they own a ranch and their cattle outright. Neither managed by textbooks and trade magazines, their land and cattle had taught them what worked. I began to ask about stocking rates but the answers were never direct. "It depends," they replied. I wanted concrete quantitative advice. Finally, Lloyd told me, "Look at your cows, they'll tell you when you're overstocked before your country will. If you learn to listen to your cows you'll always have grass." Lloyd changed my paradigm. My cattle taught me to decrease stocking rates, I addressed overhead costs directly, and within a year the ranch started on a trend toward profit.

The message of the Early Years from a ranching perspective was simple: cultural knowledge about stocking rates passed through generations of successful family ranches is a key to economic survival. I have been told repeatedly that ranchers who manage 'the way Dad did' are headed for failure. I found the exact opposite to be true. The cumulative experience on the interaction of cattle, land, and money held by native ranchers is invaluable.

There is also a valuable ecological message from the Early Years. Ranching on native grasslands is inherently sustainable. The immediate economic message from poor cattle performance forces ranchers to destock before overgrazing damages ecology. The level of animal performance required by the cattle markets

forces a stocking rate that is ecologically low. Ranchers who persist in overstocking will not survive economically. This ecological protection holds as long as the land and cattle are owned by the same entity.

In recent years ranchers and conservationists have found common ground at the radical center. However, their motivations are fundamentally different. Conservationists place inherent value on ecology. For instance, Aldo Leopold's 'land ethic' infers a value judgment. Leopold's land ethic is a set of values by which humans can live compatibly with the land. The conservation community exists outside of the ecosystem with the motivation to make the system healthy. In contrast, ranchers exist inside the ecosystem with the motivation to survive economically – to pay the mortgage. They don't consciously act within a land ethic. Instead, their complete dependence on ecosystem function and limits set by the sustainable carrying capacity of the ecosystem, make them and their cattle literally members of the ecosystem in a biological sense.

These contrasting motivations toward the common goal of ecosystem health created the historical tension between ranchers and ecologists. They also created my conflicting paradigms for grasslands and mountains. Ranchers like Lloyd and Julias have unconsciously managed toward ecosystem health by keeping an economical stocking rate. A conscious realization that maximum ecosystem health equals maximum profits could change their perspective on some management issues. For instance, prairie dogs limit ecosystem production from a given area of land. Thus rancher profits are reduced in the short term. However, these species increase diversity and thus resiliency of the ecosystem. There is an argument that over long time periods and large land areas this diversity, resiliency, and general ecosystem health will increase production and profit. The equation of ecosystem health with maximum profit began to resolve my conflict and is the heart of the radical center for ranchers and ecologists.

The conservation community can also benefit by understanding that ranchers function inside the ecosystem. The economic limit that animal performance sets on stocking rate protects the ecosystem from human ambition. Human ambition is a given that will not change. Hence, the stocking rate limitation is critical to conservation and ecosystem balance. For instance, a bad scenario ecologically is when land ownership diverges from cattle ownership. In this case the economic message from poor animal performance goes to the cattle owner and not the land owner. The cattle owner does not return the following year but someone else does. The land becomes a revolving door of cattle ownership and overstocking becomes chronic. Unwise subsidies to ranchers can create the same scenario. The rancher's economic dependence on the land forces them into sustainable stocking rates. Subsidies can hide this economic check and make overstocking chronic. Better to let natural selection eliminate the ranchers that overstock and remove them from the gene-pool.

Middle Years (2000 – 2003)

The conscious rationalization that ecosystem health equals maximum profit became the central theme of my management in the Middle Years. Before, I rotated pastures but the motivation was an immediate increase of carrying capacity. I was not managing toward a goal or desired ecological outcome. What is maximum ecosystem health? How could pasture rotations move toward ecosystem health? I had no concrete answers to these questions. Rotations were a 'black box' or recipe that I followed. I didn't understand how to 'read' the land, and my stocking rate was swamping any potential improvements derived from rotations.

Prairie dog. (Photo by Tamara Gadzia)

Introduction to Tim Stephens (NRCS) and Kirk Gadzia fundamentally changed my outlook. I began to appreciate the interaction of ruminants and grasslands. I came to understand that grazing can decrease the diversity of species on grasslands – ample evidence of which I saw at Rancho Largo. Cools season grasses were sparse as were many desirable warm season species such as Blue Stem, Side Oats Gramma, and Green Needle Grass. Forbs and shrubs were also missing or very limited.

Since diversity of species is a critical component of ecosystem health, I decided on an ecological goal of increasing cool season grasses, mostly Western Wheat. With Tim and Kirk's help, I learned to assess the critical processes on my land: the water cycle, the mineral/nutrient cycle, and the plant reproduction cycles. I started to watch what my cattle ate, and when, and I researched the reproductive cycles of common plants on my land. All these actions, along with accidents and guesses, told me that I needed longer deferral periods to increase my cool season grasses. The mathematics of pasture numbers dictate longer deferrals with more pastures (all else equal), so I cross-fenced from 9 to 36 pastures and managed them for minimum 100 day deferrals between grazing periods. Today deferral periods average 180 days.

Management toward a desired outcome greatly changed the ecology at Rancho Largo. Cool season grasses (Western Wheat, Needle and Thread) have roughly doubled in abundance. Big Blue Stem, Side Oats Gramma, Vine Mesquite, and Green Needle Grass now occur in almost every draw, whereas nine years ago I could have taken you directly to the few localized occurrences of these species. Four Wing Salt bush and a variety of forbs are increasing everywhere and winterfat has increased to a point that it's economically significant. Beetles, crickets, ant piles, rodents, bird species, antelope, and deer have also visually increased.

Why did long deferrals increase plant diversity? In two words the answer is 'seed bank.' All the plant species I increased were in low abundance and high demand, seasonally if not year round. They reproduce by seed. Even at low stocking rates these low-abundance, high-demand plants cannot go to maturity and produce seed without planned deferral (note that 100 days defers a plant for the better part of a growing season – cool season or warm season plants – and 180 days ensures full-season deferral). Long deferrals allowed increased plant reproduction but they also addressed the other basic ecological processes. Long deferrals and appropriate stocking left additional old rank grass as residual after a graze. This high residual improved the capture and storage of precipitation (water cycle) by an order of magnitude. Residual grass in contact with the ground surface is converted to fertilizer by the soil food chain (mineral cycle).

There is a strong temporal correlation between Return on Investment (ROI) and management toward a desired outcome with cross fences that allowed long deferral periods. *Figure 1* shows that ROI was negative in the early years and inflected upward in 1998 - 1999 when stocking rates were reduced. This curve is ROI on cattle only, not real estate. Hence, the upward inflection indicates improved cattle performance when stocking rates were dropped. The real estate ROI curve (not shown) would have decreased as stocking rate decreased. The interesting point is that in the late years (after 2003) stocking rates were increased to levels that exceeded those in the early years (red bars labeled Average Stocking Rate). Despite the high stocking rates in late years cattle performance remained high as shown by the ROI cattle (maroon) curve. The green bars show that the late years were not high rainfall years. Hence, high animal performance at high stocking rates in the late years can be attributed to ecosystem health and diversity not unusual rainfall. The trend toward ecosystem health started in 2000 when cross fencing allowed longer deferrals between graze periods (the aqua curve, Average Length of Deferral). The aqua curve spiked in 2002 – 2003 because cattle were removed from the ranch due to drought.

My monitoring program is driven by decision-making rather than statistical significance. Hence, the scientific community has limited interest in my data and my story. Dr. Fred Provenza recently paraphrased a physicist with the line: "One doesn't understand complex natural systems, one interacts with them." This concept is exactly appropriate to my story. I laid the story out as a linear sequence of thoughts, actions, and

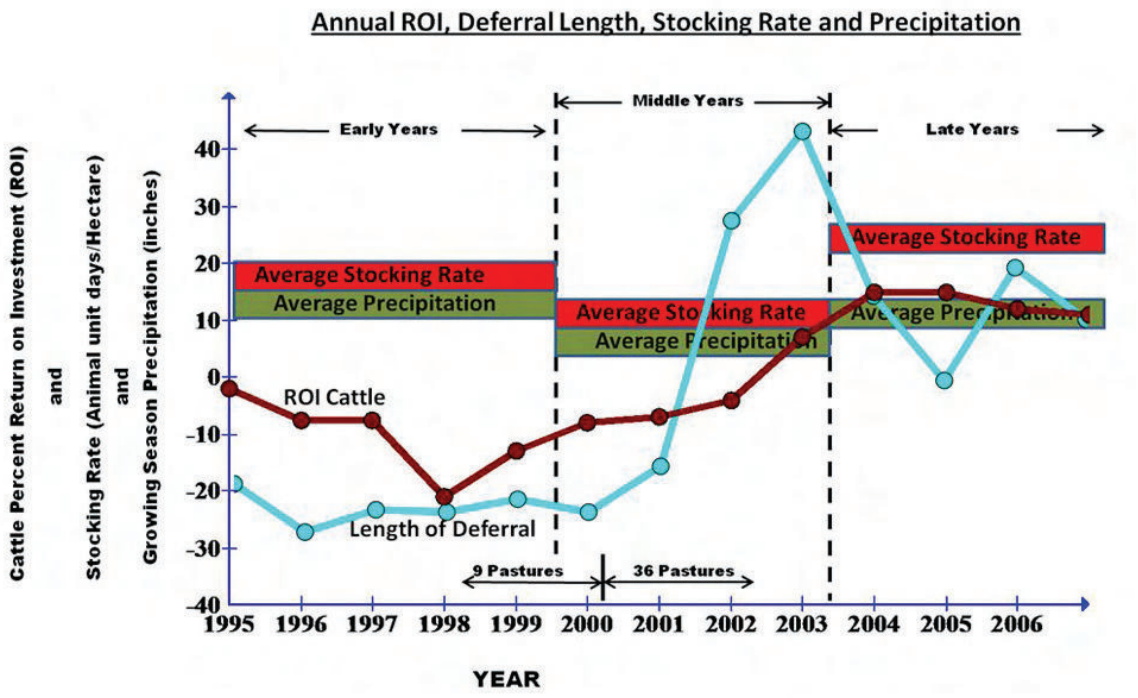


Figure 1: Return on investment for the Cattle Enterprise (ROI Cattle (%), maroon curve) versus year.

results. In fact, the process was a complex web of interactions between land, cattle, money, and management. An initial decision to cross-fence for longer deferrals exploded into a myriad of personal, ecological, economical, and management changes. Fragments of that web were linear cause-effect relationships but these cannot be separated from the whole.

Planned recovery grazing is a powerful tool to transform ranchers into ecosystem managers. For myself and many others, this transition began with concentrating animals in time and space and responding to results. Results will be positive and negative; what matters is the response. The process is analogous to a life-long beer drinker trying whiskey. The effects of concentrated animals are magnified and immediate. If one concentrates animals without a desired ecological outcome he will likely end up stumbling around the parking lot drunk. Alternatively, if one responds to positive and negative results with a goal in mind a transition occurs. One comes to appreciate and often becomes infatuated with the ecosystem they depend on. Ranchers manage their animals for economic survival; ecosystem managers manage their land for a desired ecological outcome and maximize their economic returns. The difference between the two is a Leopoldian land ethic.

The Late Years (2004…)

One day in late 2006, I returned from chores to a phone message that said "You are on the Army's map." This message referred to the proposed expansion of the United States Army's Pinon Canyon Maneuver Site – a 245,000 acre site was created to train Ft. Carson soldiers in the 1980s in the largest condemnation action in U.S. history. In late 2005, a map leaked from Ft. Carson showing a five million acre expansion of the current Pinon Canyon Site. In late 2006, the Army officially designated 412,000 acres as the first acquisition. My phone message from a friend informed me that we were part of the 412,000 acres.

My initial reaction was fear and sickness. Having heard about the condemnations in the 1980s, I knew that families were escorted off their land – their lifeblood – by armed federal marshals. The fear still remains today, but a renewed appreciation and gratitude for my lifestyle has replaced the sickness. The

threat reminded me that I had a unique relationship with this particular piece of land.

Many who saw the condemnation process in the 1980s warned that it could not be stopped. However, as a community and as individuals we knew that we would not forgive ourselves if we didn't fight for our land. Opposition to expansion was diverse and unanimous.

Some had the foresight to understand that biological and historical documentation of private lands in southeast Colorado would be valuable in the fight. Efforts toward a biological study began in 2006 when $250,000 was raised, primarily from Colorado Lottery funds. In some ways it was easier to raise the money than to gain access for biologists to private ranch lands. Fear of the Endangered Species Act and mistrust of the environmental community created significant barriers to land access. In the end the overwhelming threat of expansion drove people to the radical center. A unique contract that protected property owners was negotiated with the Colorado Natural Heritage Program at Colorado State University. Access to private land was obtained throughout most of a million acre study area.

At the outset biologists warned that the ranchers might not like their results. They were simply objective observers of the natural system. The biologic study team was pleasantly surprised in their first field season as they documented an incredible diversity of rare plants, animals, and insects. A preliminary report from the ongoing study said "this area has a high landscape integrity and very high conservation value – a testament to the quality of management by the landowners in this area." Ranay Rondeau, Director of the Colorado Natural Heritage Program submitted a quote: "It is the best kept secret in Colorado that the biggest wilderness area we have is in private hands." The scientists attributed the biological diversity and overall land health to a unique combination of Pinon-Juniper canyon lands intermixed with short-grass prairie and effective stewardship by land owners.

This biological study, perhaps the largest ever performed on private lands, supports my contention that ranching is inherently sustainable ecologically. Keep in mind this was not a study of selected ranches that manage for biological diversity. This was a study across the entire spectrum of ranch management, from traditional cow men like Lloyd and Julias to ecosystem managers and all combinations in between. The one common thread through most of the million acre study area is small to moderate sized family ranches with the cattle owned by the land owner.

The Pinon Canyon Expansion Opposition Coalition also raised funds for a historical and archeological study in the same million acre area. The National Trust for Historic Preservation supported this study and in June of 2007 placed this region on the National List of Most Endangered Historic Sites. Securing access to private lands for the historical study was less contentious but the results were similar. The historians and archeologists from Colorado Preservation Incorporated were astounded at the historical resources. The scientists documented pre-historic rock art, cliff dwellings, and religious sites in addition to a rich legacy of historic Native American sites. The Santa Fe Trail cuts through the area along with numerous stage routes and abundant homestead sites and historic ranch buildings.

"It is the best kept secret in Colorado that the biggest wilderness area we have is in private hands."— Ranay Rondeau, Director of the Colorado Natural Heritage Program

The focus of the historical study is that these resources are not fenced off or removed from their cultural source. Instead the historical sites are "in the context of the evolving land based culture where they originated." For instance, historical ranch buildings and homesteads are commonly renovated and put to practical use in today's ranch culture. This intimately woven combination of natural resources, people, history, and culture is termed a 'cultural landscape' by historians and archeologists. The cultural landscape concept emphasizes that humans are in integral component of 'natural' landscapes.

The combination of biological and historical studies on a million acres of private lands is unprecedented. This work documents an on-going cultural landscape. The data illustrate a compatible symbiotic relationship between human economies and an ecosystem on a landscape scale over a long period of time. In the time period documented human economies evolved from hunter/gatherer/farmer prehistoric cultures, to nomadic hunters, to pioneer farmer/ranchers to modern ranchers.

The lesson from the Late Years is the power of community. The threat from the Army moved five million acres of ranchland, farms, rural communities, and towns to the radical center. Differences were set aside to respond to a common threat. People realized that what matters in an agricultural based economy is resources; land, water, and people. A 'community ethic' was formed that placed value on these resources. The placement of value on land, water, and people is the heart of Aldo Leopold's land ethic. A 'community ethic' is simply Leopold's land ethic multiplied by the power of a community. The power of an entire community at the radical center is profound. The struggle to stop expansion is far from over, but thus far several of the poorest counties in Colorado have fought the US Army and the wealthiest, most powerful counties in Colorado to a stand-still.

Conclusion

The common thread throughout this story is the interaction of people and land. In 1995, I intended to apply my agenda to a piece of land. My first lesson was to be humbled by the land. My economic model would live within the bounds of the ecology. This lesson is very simple in writing but in real world practice it is very difficult to learn and accept.

Accepting the land's limitations is at the heart of Leopold's thought and it is the essence of Courtney White's "Age of Consequences" (see www.chronicleofconsequences.com). My experience of learning to live within the land's limits on the Back Forty is a direct analogy for the "Age of Consequences." Humans have tried to force an economic model on a global ecosystem. At some point that model will fail and we will be forced to respond.

The recognition that human survival and prosperity is limited by the earth's natural systems is not new. The interesting question is: How will humans respond to the earth's limitations? In the early 20th century Teddy Roosevelt and Aldo Leopold responded with the 'conservation movement,' which focused on the sustainable use of resources and kept humans in the equation. The 'environmental movement' replaced Conservation in the 1960s and began to separate human and natural systems. This separation of humans and nature is fundamental to environmental thought, just as the Cartesian separation of mind and body was fundamental to western philosophy. Humans, human economies, and human activities are assumed to be outside of nature and detrimental to nature. Hence, the environmental paradigm on how to face the "Age of Consequences" is driven by limiting human economies and activities for the sake of nature. Environmentalism is fundamentally opposed to human self interest.

My story from the Back Forty argues otherwise. Ranchers are 'in' nature. Their dependence on their land is complete and their land depends on them. Simply by surviving economically they are responding to the Age of Consequences. They love their land but their decisions are not driven by a moral code that separates them from the land and requires sacrifice. The data from the biological study of southeastern Colorado shows that traditional private lands ranchers maintained a healthy ecosystem on a landscape scale. My experience at Rancho Largo was an example of 'New Ranchers' learning to enhance diversity and profits with grazing strategies. In both cases ranchers are land-dependent and their motivations are selfish.

Courtney White argued in the previous Quivira Coalition Journal that environmentalism is a failed movement. I submit that the separation of humans from nature is the root cause of that failure. The combined biologic and historic studies in southeast Colorado portray thousands of years of history where humans are symbiotic to nature in a cultural landscape. The studies do not portray prehistoric humans or Native Americans as passive within the ecosystem. There is mounting archeological, paleontological, geological, historical, and biological data supporting the principal

that pre-historic and historic native cultures actively managed land to their benefit. Dan Dagget's book *Gardeners of Eden* summarizes these studies and provides case histories of modern humans that play a symbiotic role in shaping ecosystems. The corollary to this principle is that the removal of humans from natural systems is illogical, unfounded, and unwise.

The fundamental problem with the human / nature dichotomy is that it ignores Machiavelli. Environmentalism asks humans to sacrifice for nature's sake. My story portrays humans acting in their own self interest within natural and economic systems. Nature is ultimately about survival and reproduction. Selfish motives of organisms create a vast web of interactions. Human economies are no different. Economic systems that work are based on individuals and entities pursuing self interests.

rado illustrates the power of a Community Ethic. Individuals went to the radical center and combined their own self interests to create a community self interest. They realized individually and collectively the importance of community assets; land, water, and people. They found an identity and rediscovered the intricate network of economic dependencies between rural ranch communities, small town farm communities and small cities. They began to realize that the resiliency of the community depended on land health and the diversity of these local economic interactions.

Could these things have happened without the threat of Pinon Canyon Expansion? Probably not in the same way. But the Quivira Coalition has moved masses to the radical center and founded a Community Ethic in parts of New Mexico. Environmentalism is dying while land ethics and a new agrarianism are

"The death of environmentalism and the human/nature dichotomy is a critical first step toward responding to the Age of Consequences. Embracing a land ethic is the second step. I believe the third step will be turning a land ethic into a Community Ethic."

What about the industrial revolution and human economies that seem incompatible with nature? The Age of Consequences brings the large scale human dependence on nature to the forefront. Just as I struggled to accept those limitations on a small piece of land, humans are struggling through the acceptance process. We are beginning to realize that conservation is about human preservation, not natural preservation. The earth will be fine with or without us. The earth went lifeless for a billion years, evolved life and has seen multiple mass extinctions. On a geologic time scale nature will take care of itself. Leopold's Land Ethic, Wendell Berry's Agrarianism and the Conservation Movement are about human survival and quality of life.

The death of environmentalism and the human/ nature dichotomy is a critical first step toward responding to the Age of Consequences. Embracing a Land Ethic is the second step. I believe the third step will be turning a land ethic into a Community Ethic. The story of Pinon Canyon Expansion in Southeast Colo-

growing in the Back Forty all over the country. Emphasizing the economic links across the "Urban – Rural Divide" can build Community Ethics. The Age of Consequences and human self interest will ultimately drive a transition to sustainable economies. The question is: will the resilience of the earth system keep it in a regime that will support humans through the transition?

Grady Grissom received a BA in Geology from Princeton University in 1984. Subsequently he worked on ranches in eastern Colorado until 1987 when he returned to graduate school. He finished a PhD at Stanford University in 1991. From 1992 to 1995 Grady worked as a farrier in the Bay Area. In 1995 Grady returned to Colorado to serve as a partner/manager of Rancho Largo Cattle Co. east of Walsenburg, Colorado. Contact Grady at grissomgrady@gmail.com.

Colloquium

The Back Forty Down Under:
Adapting Farming to Climate Variability

by Christine Jones, Ph.D.

The financial viability of the agricultural sector, as well as the health and social wellbeing of individuals, families and businesses in both rural and urban communities, are inexorably linked to the functioning of the land.

There is widespread agreement that the health of vegetation, soils and waterways in many parts of the Australian landscape have become seriously impaired, resulting in reduced resilience in the face of increasingly challenging climate variability.

Agriculture is the sector most strongly impacted by these changes. It is also the sector with the greatest potential for fundamental redesign. The Australian nation has the opportunity to be a world leader in the implementation of innovative technologies centred on adaptation to our variable climate.

In addition to enabling the farming community to more effectively deal with warmer, drier conditions, the restoration of landscape function will result in the active drawdown of excess CO_2 from the atmosphere via stable biosequestration in soils.

Fundamental redesign of food, fuel and fertiliser production is vital to the survival and profitability of the Australian agricultural sector. We cannot afford to continue with business as usual.

While climate cannot be altered, the resilience of the agricultural sector can be markedly improved by changes to land management regimes. The most meaningful indicator for the health of the land, and the long-term wealth of a nation, is whether soil is being formed or lost. If soil is being lost, so too is the economic and ecological foundation on which production and conservation are based.

Completing the Carbon Cycle

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

Holistically grazed land (left) compared to set-stocked neighbor's paddock (right), southern Victoria, Australia, April 2009. There has been no fertilizer used on the holistically grazed property for nine years. (Photo by Patrick Francis)

people, depends of the effective functioning of this cycle.

All major greenhouse gases, including carbon dioxide, are cyclical. The issue is that too much CO_2 is being emitted to the atmosphere and insufficient amounts are being sequestered. A 'carbon pollution reduction' agenda might therefore include:

(1) 'completing the carbon cycle' through active biosequestration of emitted CO_2 into soils, the planet's largest carbon sink, with a capacity five times greater than that of vegetation; and

(2) developing regional biofuel and biofertiliser capacity, reducing dependence on fossil fuels in the agricultural sector.

Emissions trading, while useful to focus public and corporate attention on the need to reduce carbon pollution, cannot of itself have significant impact on global concentrations of atmospheric CO_2. It could however, be beneficial, if the funds raised were used to restore balance to the climate by supporting natural carbon, nitrogen and water cycles, via the restoration of perennial groundcover and soil microbial activity. Economic development is only sustainable if it strengthens, rather than depletes, natural resources.

Recent research has confirmed that the capacity of the ocean to act as a carbon sink has markedly declined, with the top 100 metres of water being close to CO_2 saturation. This finding highlights the urgent need for 'active drawdown' of excess CO_2 already in the atmosphere, as well as reducing further emissions.

The well grassed area on the left has good infiltration compared to the overgrazed area on the right, which has lost soil carbon and soil water-holding capacity. Rainfall that cannot infiltrate simply sits on top of the ground and evaporates. (Photo by Patrick Francis)

The dark coloured carbon sequestered around the roots of perennial grasses is readily observed in light coloured soils. (Photo by Christine Jones)

The Soil Carbon Sink

Biosequestration in soil offers a practical and almost immediate solution to legacy load CO_2.

Managing agricultural soils to enhance their capacity to sequester and store large volumes of atmospheric CO_2 in the form of stable humus also has significant implications for soil structure, water-holding capacity and nutrient status. These factors strongly influence resilience, productivity and profitability on-farm, with flow-on benefits for local communities, landscape function, human health and regional and national economies.

Over 95% of terrestrial diversity is in the soil. In order for this life to flourish, the soil ecosystem requires fuel in the form of carbon (from green plants) and 'habitat' in the form of high root biomass. Further, the soil surface requires year-round protection from erosion and temperature extremes (both highs and lows).

Periodically bare soils generally contain only half the organic carbon of similar soils in the same region under perennial cover (for example, see table below). As a result they have poorer structure, lower soil water-holding capacity and reduced nutrient levels.

The data in the below table indicate that a change from annual groundcover (soil bare in summer) to perennial groundcover (healthy living soils all year round), has the potential to increase soil carbon levels by around 1% in low rainfall regions and up to 3% in higher rainfall regions.

An increase of 1% in the level of soil carbon in the 0-30cm soil profile equates to sequestration of 154 tons of CO_2 per hectare (tCO_2/ha) if an average bulk density of 1.4 g/cm3 is assumed, while an increase of 3% in the level of soil carbon equates to sequestration of 462 tCO_2/ha.

Innovative (frontier-type) land management technologies that promote soil building are more productive and less expensive than conventional farming practices that deplete soil carbon.

When biologically friendly fertilisers and continuous sequestration (via perennial cover) are used in place of conventional fossil-fuel based fertilisers in traditional bare fallow systems, the carbon footprint is reversed (that is, more carbon is sequestered than emitted).

Irrespective of whether global temperatures increase, decrease or stay the same, the implementation of a national policy for soil carbon restoration utilising funds derived from the Federal Government's Carbon Pollution Reduction Scheme would build 'real' wealth and ensure security of food and fresh water for the Australian nation.

Farming and Health

The best national health policy is good agricultural policy.

The key purpose of farming is — or should be — to produce nutritious food that benefits the health and well-being of the population. In reality, the farming sector sits at the centre of a complex, capital intensive supply chain focussed largely on production. Decisions are based on the cost of inputs and the anticipated value of outputs. Rarely is the nutritional value of the product considered. The health dimension has tended be viewed as a technical problem that can be fixed by an endless variety of pharmacological magic bullets — accompanied by seemingly limitless unpleasant side effects.

Low, normal and high ranges for average soil organic carbon levels (% by weight) in crop and pasture soils in low rainfall (< 500mm) and high rainfall (> 500mm) regions, Victoria.

	Low rainfall (<500 mm)		High rainfall (> 500 mm)	
	Crop	**Pasture**	**Crop**	**Pasture**
Low	0.9	1.7	1.45	<2.9
Normal	0.9 - 1.4	1.7 - 2.6	1.45 - 2.9	2.9 - 5.8
High	>1.45	>2.6	>2.9	>5.8

Source: Brown , A.J., Fung, K.K.H. and K.I. Peverill (1980). *A manual on the soil testing service provided by the Division of Agricultural Chemistry*. Technical Report Series - Victorian Department of Agriculture, no 34, 16 p.

Interestingly, when people are asked which factors are of greatest importance to them personally, good health nearly always tops the list. Contrary to popular belief, good health is not determined by the quality of our medical system. Rather, it is closely linked to the nutrient content of food - which in turn is linked to the ecological health and organic carbon content of the soil in which food is grown.

Soil health and human health are more deeply connected than many people realise. Food is often viewed in terms of quantity available, hence 'food scarcity' is not seen as an issue in Australia. However, food produced from depleted soils does not contain the essential trace minerals required for the effective functioning of our immune systems.

The nutritional status of soils, plants, animals and people has fallen dramatically in the last 50 years, due to losses in soil carbon, the key driver for soil nutrient cycles. Soil carbon levels in turn are linked to the quality of groundcover.

Routine premature deaths by degenerative conditions such as cardiovascular disease and cancer have become prominent when they were once relatively uncommon. The cancer rate, for example, has increased from approximately 1 in 100, fifty years ago, to almost 1 in 2 today. The effectiveness of the human immune system has been severely compromised by increased exposure to more and more chemicals coupled with insufficient mineral density in food.

This situation can be dramatically improved by the integration of perennial groundcover and biology friendly fertilisers into agricultural production systems, reducing the need for chemical inputs and increasing the nutritive value of the food produced.

Livestock and Methane

Wetlands, rivers, oceans, lakes, plants, decaying vegetation (especially in moist environments such as rainforests) — and a wide variety of creatures great and small — including termites, camels, bison, bison, antelopes, reindeer, caribou and giraffes, have been producing methane for millions of years. A clear distinction needs to be made between natural methane from ruminants and man-made methane from industrial sources. For example, a medium-sized whale produces methane emissions equivalent to 40 cows. There are international policies in place to protect whales and other methane producing wildlife, as well as protecting and enhancing methane-producing ecosystems such as wetlands and rainforests. The natural methane produced in the rumen of pasture fed livestock is not man-made — and is not increasing.

The largest single source of methane worldwide is wetlands (22%), followed by coal, oil and natural gas (19%), enteric fermentation (16%), rice cultivation (12%), with burning, landfill, sewage, manure, termites and release from the ocean making up the remaining 31%.

Global atmospheric levels of methane have remained relatively constant over the last ten years, despite increased ruminant numbers worldwide. This finding raises questions about the relative contribution of ruminant livestock to global methane levels and suggests that other sources and sinks may be playing a more significant role. Methane is broken down in the atmosphere within seven years by the free radical hydroxyl (OH), which is a naturally occurring process. This atmospheric cleanser has been shown to adjust itself up and down periodically and is believed to account for the stability in methane levels in the earth's atmosphere over the last decade – that is, until a sudden increase in 2008.

A global study published in *Geophysical Research Letters* in October 2008 reported that the first increase in methane levels this century had been recorded in the last 12 months. This increase is thought to be due to rapidly accelerating methane hydrate emissions from the Arctic seabed. The findings from the Arctic research cast doubt on the value of attempting to suppress methane production from ruminants.

In Australia, ongoing dry conditions in many regions have resulted in falling stock numbers. Over the last two decades, livestock sources of methane have not increased in this country.

There is therefore no factual basis for selectively targeting ruminants for a 'methane tax' – or worse, interfering with this natural process. Why not a 'carbon pollution tax' on people, cats, dogs, horses, chickens, pigs — and marsupials — for all the CO_2 collectively expired into the atmosphere? Or perhaps a 'water

Vertical stacking. Oats sown into perennial native pasture yield grain plus grazing from the same piece of land. (Photo by Sarah Bruce)

Cropped paddock showing the summer-green perennial pasture beneath a harvested strip of winter oats, sown between alleys of tagasaste. (Photo by Tim Wiley)

vapour tax' on all living creatures? Water vapour is the greenhouse gas that has increased to the greatest extent since the industrial revolution, accounting for 95% (by volume) of increased radiative forcing. Imposing penalties on people and animals for natural processes such as exhaling CO_2 and water vapour makes as much sense as imposing a methane tax on livestock.

In appropriately managed rotationally grazed perennial grasslands and shrublands, green plants and the soil ecosystem 'complete the carbon cycle', ensuring more carbon is sequestered than emitted, easily compensating for the methane produced by livestock. It is interesting therefore, than none of the $26.8 million in Australian taxpayers money recently allocated to methane research included this aspect.

A complete life-cycle analysis would reveal that when the carbon footprint of fuel, fertiliser, herbicides and pesticides are factored in, plus erosion, water-quality decline and the carbon dioxide and nitrous oxide losses from soil, conventionally produced soybeans (or other sources of non-animal protein) would be less environmentally friendly than well-managed livestock grazing. Indeed, the fastest and most economical way to restore soils that have been degraded by annual cropping is through the use of rotationally grazed perennial pastures.

When the ecosystem services of clean air and clean water are taken into consideration, it becomes obvious that perennial groundcover provides benefits for all sectors of society, including urban dwellers. The sooner the completely illogical 'eat vegan' and 'natural methane is a problem' issues are resolved, the better. The evolution of the rumen as an efficient way of digesting plant material evolved around 90 million years ago. It seems extraordinarily inappropriate to interfere with this natural process.

Perennial groundcover, the biomass it produces and the livestock it feeds are all extremely beneficial (if not fundamental) to the planet, provided they are appropriately managed.

Mycorrhizal Fungi

Soil benefits in many ways from the presence of living plants year-round, due to reduced erosion, buffered temperatures, enhanced infiltration and markedly improved habitat for soil biota. Significantly, it is the photosynthetic capacity of living plants (rather than the amount of dead biomass added to soil) that is the main driver for soil carbon accumulation.

Mycorrhizal fungi differ quite significantly from decomposer type microbes in that they acquire their energy in a liquid form, as soluble carbon directly from actively growing plant roots. By this process they are actively drawing down atmospheric carbon and turning it into humus, often quite deep in the soil profile, where it is protected from oxidation.

Where mycorrhizae are functioning efficiently, 40-60% of the carbon fixed in green leaves can be channelled directly into soil as soluble carbon, where it is rapidly polymerised with minerals and nitrogen and converted to stable humic compounds in the soil food-web. The humates formed by soil biota are high molecular weight gel-like substances that hold between four and twenty times their own weight in water. Humic substances significantly improve soil structure, porosity, cation exchange capacity and plant growth.

Mycorrhizal fungi access and transport nutrients such as phosphorus, zinc and nitrogen in exchange for carbon from their living host. Plant growth is usually higher in the presence of mycorrhizal fungi than in their absence. In perennial grasslands, mycorrhizal fungi form extended networks that take several years to develop. They have mechanisms that enable them to survive while host plants are dormant but cannot survive if host plants are completely removed from the ecosystem.

Under appropriately managed perennial groundcover, soil water balance is improved by hydraulic lift and hydraulic redistribution in seasonally dry environments. These processes bring moisture to the root-zone that would not be available to an annual crop or pasture.

Broadacre cropping could benefit enormously from widely spaced rows or clumps of long-lived perennial grasses and fodder shrubs. As yet we do not know the required critical mass to restore soil ecosystem function, but it might only need to be 5-10% perennial cover. The benefit of permanent mycelial networks in terms of aggregate stability, porosity, improved soil water holding capacity, reduced erosivity and enhanced nutrient availability would be immense.

Where soil carbon is mycorrhizal in origin it is stable, which is vitally important in the current debate about soil carbon losses during droughts and fires. The stabilising humification process can also be enhanced via additions of certain humic materials (often included in biology-friendly fertilisers), which have a protective effect on soluble carbon exuded by plant roots.

Conclusion

The number of farmers in Australia has fallen 30 per cent in the last 20 years, with more than 10,000 farming families leaving the agricultural sector in the last five years alone. This decline is ongoing. There is also a reluctance on the part of young people to return to the land, indicative of the poor image and low income-earning potential of current farming practices.

The longer we delay undertaking changes to land management, the more soil (and soil carbon and soil water) will be lost, exposing an increasingly fragile agricultural sector to escalating production risks, rising input costs and vulnerability to climatic extremes.

It's time to move away from depletion-style, high emission, chemically based industrial agriculture and get serious about grass-roots biologically based alternatives.

The future of Australia depends on the future of our soil - and our willingness to look after it.

Dr. Christine Jones is an internationally renowned and highly respected groundcover and soils ecologist. She has a wealth of experience working with innovative landholders to implement regenerative land management techniques that enhance biodiversity, increase biological activity, sequester carbon, activate soil nutrient cycles, restore water balance, improve productivity and create new topsoil. Contact Dr. Jones at christinejones22@aol.com*, and visit her website:* www.amazingcarbon.com*. Dr. Jones will be speaking at The Quivira Coalition's 2010 Annual Conference this November.*

Resilience on the Prairie Edge: the 777 Buffalo Ranch

by Kirk Gadzia

Bison cows and calves moving to fresh pasture on the 777 Buffalo Ranch. (All photos by Kirk Gadzia)

The first time I visited the 777 Buffalo Ranch* south of Rapid City, South Dakota, was in the late 1980s soon after portions of the movie *Dances with Wolves* were filmed there. I remember how exciting it was to see the footage of the stampeding bison herd across the prairie and thinking of the effect of all that animal impact on the landscape.

But the following day, when viewing the real herd, I received a safety lecture on the unpredictable nature of these wild animals and how quickly they could go from grazing peacefully to a full charge. "Be vigilant and aware," were the watchwords.

My next memory was of finding a place in the paddock where some of the bison had broken through a gate. Mimi Hillenbrand, my guide that day, told me she would drive around the back side of the 'escapees' and I was to get out and 'wave a feed sack' to guide them toward the opening and back with the rest of the herd.

Only trouble was there was not a feed sack to be found in the truck, so she handed me her sweatshirt — and it was RED! The joining of the groups went off without a hitch, but visions of bullfighting with the waving red cape still linger.

A red cape is a good metaphor for trying to build resilience in the 21st century. For years bison have been a kind of 'red flag' for ranchers, environmentalists, and public land managers – often a source of conflict between competing visions of the land. Today, however, those battle lines are not so clear cut. That's because our challenge now is to find ways to manage animals, wild or domestic, for ecosystem health and economic sustainability for the long run – resilience, in other words. This is the story of one ranch that is trying to do just that – on the back forty – instead of waving flags.

The 777

In 1972 Ray Hillenbrand and his wife Rita bought the ranch, a prairie property located between the Badlands and the Black Hills of South Dakota. It is also near the historic Buffalo Gap area where huge annual migrations of bison herds once funneled between the prairies and the Black Hills.

* While the name of the ranch is the 777 Buffalo Ranch, the scientifically accurate name of the species to which we refer is *Bison bison*.

Observing a herd of over 1,500 head of these beautiful wild animals running across the ranch is a sight to behold. Sitting on a hillside watching the bison graze while constantly moving with their baby calves, and their distinctive grunting calls is amazing. Even more remarkable is witnessing the bulls interact with the herd during the breeding season. The bellowing of the bulls is reminiscent of the roars of lions on the plains of Africa. Considering that bison were hunted to the brink of extinction in the 1800's, one is reminded of how lucky we are to be able to witness such a spectacle today.

Mimi Hillenbrand, daughter of Ray and Rita, has been involved in the land and bison management as well as marketing aspects of the business from an early age. In 1991 she took her first training in Holistic Management, or HRM as it was known at the time, and has continued her training, and frequently travels to grasslands worldwide in her studies of wildlife and wild places.

Mimi is passionate about these animals and their place on this land. In fact, the health of the land is a driving force for her management objectives and permeates all aspects of the business. During ranch visits we spent as much time identifying plants and observing signs of the health and resilience of the land as we did discussing the bison business. For example, low production grasses are being replaced by deep rooted native species like Green Needlegrass. Native herbs such as Echinacea, prized for its medicinal qualities, also grow in profusion.

Each year Mimi helps create a detailed grazing plan for the bison herd that moves between 25 different pastures during the growing and dormant season. In 1992, in conjunction with planned grazing, ecosystem monitoring transects were established across the ranch and data are collected annually. The data analysis shows a decrease in bare ground and erosion with concurrent increases in species complexity and diversity. The land is improving – becoming more resilient to climate extremes that are "normal" for this landscape where the edge of the prairie meets the black hills.

Raising bison for meat as a business gained significant popularity in the late 1980s. At this time, many new producers entered the business and the price for bison escalated rapidly as new ranches bidded up breeding stock prices to build their herds. By 1998, purchase price for bison reached an all time high that doubled or tripled those of live beef animals.

Unfortunately, the meat marketing segment of the business did not keep pace with the breeding buildup of harvestable bison. This created an oversupply of meat, particularly hamburger and lower end cuts. By 1999, the industry entered a period of rapid price deflation for live animals and meat products.

Mimi Hillenbrand standing in tall prairie grass dominated by Green Needlegrass (*Nassella viridula*) and Sweet Clover (*Melilotus officinalis*).

Flowering Echinacea (*Echinacea purpurea*) in pasture.

Mimi showing map of ranch pastures and holistic grazing plan.

Compounding these difficulties was a period of prolonged drought across much of the nation's bison ranches. The combination of low prices, drought, and the financial hardships they produced, caused many producers to go out of business.

In 2003, Mimi took over ownership and full time management of the 777 Buffalo Ranch. Mimi spent increased amounts of time in the field observing animal behavior and planning, but her most challenging task was to make the business profitable. She began selling more of the marketable animals and aligning forage production to stocking rate. This increased income and began the process of getting the ranch out of debt. She also credits the ranches' progress to her dedicated staff, Dave Schroth who currently manages the day to day ranch operations, and co-worker Moritz Espy.

Keeping the bison as wild as possible is a management goal, but fences make them manageable. In a situation where large scale migration is no longer possible, keeping the animals moving allows time for plant recovery resulting in healthier land. Nowhere is this more evident than at each of the many watering ponds and riparian areas on the ranch. They are healthy and full of cattails, sedges, and other tender water loving plants.

This intense management does require more work on Mimi's and Dave's part, but she feels that the long term health of the ranch land is the real basis of a sustainable bison business. Currently, the ranch grazes about 1,700 head of bison through 25 paddocks over roughly 28,000 acres and markets both meat and live animals.

Buffalo Products

Currently the ranch produces both grass finished and hay/grain finished bison. The hay/grain finishing takes place on the ranch in a roomy corral setting with plenty of water and free choice of both hay and grain. Interestingly, bison will self limit the amount of grain they consume in balance with the high roughage of hay. The ranch also produces and markets a grass finished, direct off the range, product. Customers can choose which product they prefer, making their own decisions about the benefits and flavor of either product.

The largest demand right now in Mimi's customer base is for the hay/grain finished product. Based on customer feedback, this is primarily due to the white fat on the grain finished product versus the slightly yellow fat on the grass finished animals. In an all grass diet, the yellow color of the fat is due to carotene (vitamin A) and after the meat is cooked, is not visible. Nevertheless, some consumers are not accustomed to yellow fat and prefer the white fat meat.

Presently, about 25% of the bison marketed for meat sales are grass finished two year olds. Mimi definitely sees greater awareness of the health benefits and advantages of grass finished meat and is anticipating increased production of this segment of the operation as the market expands. She has teamed up with many local and regional chefs who purchase the bison for their restaurants.

Another aspect of the business Mimi is currently developing is the sale of genetically 'pure' bison to other bison producers and conservation organizations. For many years, bison were crossed with cattle in an effort to produce something called a 'beefalo' or 'cattalo.' Although this cross was never a commercial success, some producers are concerned that any amount of cattle genetics is a negative influence on this basically wild animal. For this 'pure' herd, animals are genetically tested for the presence of any domestic cattle genetics. Those that test positive, no matter how tiny the percentage, do not go into this herd. Although the animals are physically indistinguishable

from the main herd, they are bred only to selected 'pure' bulls and offspring are likewise genetically tested.

In both the cattle industry and a large segment of the bison industry, much emphasis is placed on careful selection of replacement heifers (young females that replace older cows as they are removed from the herd) for desirable traits. The 777 Buffalo Ranch does the opposite; believing they are not able to select replacement animals by visual inspection at a young age, and in fact, that they may ultimately be selecting against the very traits they desired.

An example in the cattle industry is that producers often select the largest heifers from the herd. Over the years this led to larger and larger cow size. These cows may produce large calves, but in most environments, their upkeep and feed intake has proven uneconomical. The 777 Buffalo Ranch does is what is known as a 'gate cut.' For example if 125 young heifers are to be kept for replacements out of 500 heifers available, they simply select the first, second, third, or last 125 of the animals as they go through a gate. Genetic diversity is maintained by purchasing bulls from other producers, but Mimi looks for those who have similar bison production philosophies as the ranch.

Dung beetles burying fresh bison manure.

Clear runoff captured in ephemeral wetland.

Ecosystem Health and Economic Diversity

The health and resilience of the 777 Buffalo Ranch is directly related to the abundance and diversity of its plant and animal species. On the ranch, plant diversity is increasing having many species of native cool and warm season grasses, flowering forbs, shrubs and trees. Deer, elk, antelope, mountain lions, coyotes, bobcats, foxes, badgers, prairie dogs, porcupines, ground squirrels and many other animals share the range with the bison as they have for thousands of years. The ranch is also home to a variety of birds and raptors such as golden and bald eagles, red tail hawks, ferruginous hawks, prairie falcons and many others. Rare grassland birds such as the Baird's sparrow and Long-billed curlew are found in abundance.

Another good measure of the balance now being sustained on the ranch is the increased effectiveness of the water cycle. There are virtually no signs of erosion present, except in the badland areas where soil type prevents plant growth. With nearly all the moisture that falls captured in the soil, the ranch is becoming more resistant to the effects of drought. During the last five years of below average rainfall, the ranch did not have to destock. Fortunately, 2009 was one of the best moisture years in many decades which allowed the ranch to put up all its own hay and also going into winter with stockpiled forage in each paddock.

Hand in hand with increased water cycle effectiveness and increased biological diversity is the health of the mineral cycle. As we guided the herd towards the open gate into the new paddock I asked about the presence of dung beetles. It wasn't long until we found a whole 'herd' of these insects actively working on a fresh dung pat.

The Native American tribes, who first inhabited this region and hunted the bison for many centuries, used every part of the animal. Many of these traditions are carried out still in the craftwork of their descendants. Mimi also owns an outlet store called Prairie Edge which showcases the art and craftwork of these northern plains tribes. It also serves as a market for some of the bison products such as bison robes. The store is located in a beautiful historic building in downtown Rapid City (see: www.prairieedge.com).

Dances with Wolves was not the only movie to be filmed in this beautiful landscape and this is another aspect of the ranch's diversified business segments. In a related effort to make the ranch more economically and ecologically resilient to fuel prices and dependence, Mimi began a program to make biodiesel fuel. The ranch now regularly collects used cooking oil from many of the restaurants in Rapid City and converts it to biodiesel that is used in ranch vehicles and equipment.

Thanks to a diverse income stream, Mimi is as excited about the future of the ranch as she is about its bison herd and other wild inhabitants. The ranch survived the bison business downturn and each year the growth in meat sales and prices continue to move upward. Her focus has also been to provide training opportunities for others, as evidenced by the turnout for the Holistic Management training offered last summer. In essence, the ranch serves as an example of how an operation can explore and answer bigger questions about food, land health, economics, and sustainability in today's tough agricultural world.

Making biodiesel from used cooking oil.

Kirk Gadzia is the founder of Resource Management Services, LLC (RMS), a New Mexico based consulting, training and monitoring organization committed to assisting private and professional resource managers achieve sustainable results. Contact Kirk at kgadzia@msn.com *or visit his website*: www.resourcemanagementservices.com.

Restoring Hózhó:
A View from the Back Forty Thousand

by Tammy Herrera*

"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." -- Aldo Leopold

"Hózhó" is a Navajo word that means "walking in beauty" – or living in a manner that strives to create and maintain balance, harmony, beauty and order. This single word captures the essence of Navajo philosophy: all life is connected to hózhó. The purpose of life is to achieve balance, to nurture harmony in our lives. This concept forms the founding principal for understanding ecological and cultural resilience on Navajo land. Hózhó is similar to, but much richer in meaning than, the term "conservation" as it implies a deep connection between people and land. One cannot be restored without the other.

In essence – hózhó is also Navajo for "land ethic" – a term made famous by Aldo Leopold in his book *A Sand County Almanac* (1949). What made Mr. Leopold different from many other conservationists in his day was his ability to put words into practice. For every conservation challenge - there was an idea, and behind every idea - there was a toolbox of practical methods for implementation. We – the Ojo Encino Chapter of the Navajo Nation – are taking Leopold's words to heart and trying to build our own toolbox by reconnecting our people to the land and redefining what "land ethic" means for us today.

Ojo Encino is located 30 miles due west of Cuba, New Mexico in the heart of Navajo country. Navajo people have been living on this land for centuries, but the community of Ojo Encino was formally established in the early 1970s, and is currently made up of 600+ members. This is where my father was born, and where – after traveling around the west for the early part of my adult life – I have chosen to return, live, work, and raise my family. My work at Ojo Encino

Tammy Herrera shows Ojo students how to bridle a horse at the 4-H Horse School in 2009. (All photos by Avery C. Anderson)

is focused around restoring hózhó. It's about restoring land health. It's about reconnecting people to land. It's about healing wounds on the land. It's about creating new land management systems. It's about feeding our community. It's about maintaining traditions. It's about re-engaging our youth. It's about caring for our elderly. In essence - it's about rediscovering our land ethic, and it requires building local capacity and strategies that make our land based activities economically viable and resilient in the face of climate change. Unfortunately, in recent years hózhó has been hard to find today for a variety of reasons. This is the story of one group – the Ojo Encino Chapter – and their efforts to reinstate hózhó with the help from a few friends.

* *This article is adapted from a talk given by Tammy Herrera at The Quivira Coalition's 8th Annual Conference (2009), and was written with support from Craig Conley and Avery Anderson.*

Challenges

While we have experienced a great deal of success thus far, the challenges facing our community as we work towards hózhó remain daunting. First and foremost, on a daily basis we combat poverty. Our people have known a way of life that is difficult. Many of us live without running water or electricity, and we subsist on commodity food provided by the federal government that is causing obesity, diabetes, and ultimately early and unnecessary death. Healing the social, economic and political issues that plague our community will be a necessary component of restoring hózhó. One of the ways we have taken action on this front is through youth programs (i.e. feral horse youth program and erosion control summer program). Although we have learned to survive, we don't always know how to thrive, to prosper, to keep our lives in balance, to bring hózhó into our daily lives. We have known imbalance for so long, harmony feels unnatural.

The second challenge we face is in getting young people involved, and demonstrating that there is meaningful work to be done in our community. The next generation is our greatest hope for effecting real change in the future, but we often find that the youth with the highest potential leave the Navajo Nation for college or elsewhere as soon as they are able and then they don't return. There are few opportunities for youth to make a good living on the reservation, especially in the rural areas. As a result, many leave or turn to drugs. Advertising, movies, and TV give them a picture of what seems like a better life someplace else. We hope that our programs challenge and inspire these talented young people – ultimately giving them a reason to come home and build a better life here.

The third challenge to our work is the maddening maze of conflicting regulations imposed by the various State, Federal, and Tribal entities that manage our Checkerboard. Overlapping regulations from the Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA) and the Navajo Nation are interwoven with 11 different types of land ownership across the landscape. On top of that – you might encounter 400+ (this is NOT a typo!) signed grazing permittees on a single allotment because, in addition to the current permittees, all of the names of deceased elders since 1930 still appear. This is a nightmare to sort out when you are required to have 50% of the listed permittees sign off on any management decision! With so many different interests, nobody ever seems to be in charge, and try as we might - at times this system is totally defeating. We can be standing in the office of a particular agency with all the signed papers in hand, and be turned away (for the third, fourth, or fifth time…) because of bureaucracy. The agency personnel with whom we work are, on the whole, tremendously knowledgeable and helpful – but their hands are often bound by a system that seems bent on preventing progress. We hope that our continued exploration into this maze yields clarification and simplification of the regulations.

Finally, our fourth challenge is resistance to change. Old habits die hard, especially when the change we seek doesn't always fit in well with the 'more, better, faster' American dream. Hózhó requires that we take our time, find beauty and meaning in what we do, and ultimately create harmony in the world around us. We have worked hard in the last few years to engage community in the process by responding to their needs. We hosted a Native Foods Day and gave away seeds, hoping to promote small-scale local agriculture. We have hosted several grazing management, erosion control, and road restoration workshops hoping disseminate information about land health. And most recently – we hosted our first Ojo Encino Horse Expo where we had expert Navajo horse trainers and veterinarians doing demonstrations for the public. All of these events have been well attended, and this gives us great hope that change will come if we are persistently attentive to our community's needs.

"While we have experienced a great deal of success thus far, the challenges facing our community as we work towards hózhó remain daunting."

Dr. Quintana does a teeth floating demonstration for a crowd at the Ojo Encino Horse Expo, October 2009.

The way it used to be…

While there are many lessons to be learned from our elders, we live in a different world today than the one in which they pioneered. Our ancestors managed huge sheep herds on a landscape that didn't have fences, roads, or BLM regulations. When the resources were depleted, they moved on and allowed the land to recover. When drought presented challenges, they reacted in accordance. Our ancestors were tuned into changes in the land because they depended on the land for their survival. Today we are not free to pack up and move 50 miles north when drought devastates our land. We have to manage within fences, between roads, and in accordance with all of the different land management regimes of the Navajo Checkerboard. In short - we live in a time now where we have to plan instead of react.

Over the past 60 years our people have become almost entirely dependent on the outside world for everything from food, to clothing, fuel, etc… As we have gradually moved away from a lifestyle in which we depended on the land for all of our basic needs, we have shown a significant decrease in our care for that land. We don't need it because we have Wal-Mart. Food for our families comes from grocery stores, and food for our livestock comes from feed stores. There is a total disconnect between the landscape in which we live, and the resources that we utilize. As a result — the land has suffered. The relationship has been broken. There are more people in our community who would be willing to drive an hour to Costco in Albuquerque than there are people who would be willing to use that time to teach their children how to grow food on their own land. But all is not lost! There are elders who still remember the traditional ways of providing for community and caring for our land, and we are hopeful that the hózhó can be mended.

The beginnings in the sagebrush…

Meet the players: The first one is the Rio Puerco Management Committee (RPMC), which was established in 1997 by Congress to help address restoration and management issues in the Rio Puerco Watershed. The second group of players is the Ojo Encino Rancher's Committee (OERC) – established in 2000 with 11 original members for the purpose of providing resources and assistance to those managing native ranch lands. My father was the first president. To date the OERC is the only recognized rancher committee in the Navajo Nation, and its membership has grown to represent 22 ranch units with 40 members. Roughly half of the members are women.

In 2002, Ted Mace and Watson Castillo – two leaders in the Ojo Encino community and prominent member of the OERC - made an ambitious proposal to the RPMC. We asked them to spray herbicide on 10,000 acres of sagebrush on lands within the Ojo Encino Chapter boundary for members of the OERC. We knew this was a big request but we also knew we needed something big to get a serious land management program going in our community. The RPMC was a tough crowd and they had lots of questions. "How will you keep cattle out of the treated areas for the next two years while they are growing grass?" "What is your grazing plan after the 2-year period is over?" Neither Ted nor Watson could answer all of the questions, but they had a firm conviction that this was the right thing to do and we would figure out how to make it work. Amazingly, the proposal was approved. It was a bold gamble, but one that has paid off. This began our journey in restoring health to the land and our community.

The sage treatment was completed on schedule. Then the real work began. The grazing permittees whose land had been treated signed an agreement

to rest the treated lands from grazing to allow vegetation to respond. OERC members also agreed that they would not reintroduce livestock to these areas until they had individual conservation plans in place - a BIG promise, but one that has turned out to be critical to the ultimate success of the effort. We weren't sure what to do next – and then Craig Conley from The Quivira Coalition called to see if we would be interested in having a grazing management workshop at Ojo Encino and his help in developing a single grazing management plan for all of the OERC members. Craig thought at the time that only one plan was needed. We didn't tell him that we were going to need at least 11. He might not have come.

In 2005, The Quivira Coalition had just received a grant from the Public Service Company of New Mexico to provide technical support to individuals who were interested in managing erosion and had some connection to PNM transmission rights of way. Steve Fisher from the BLM saw the opportunity to help the OERC develop grazing plans for the now treated and rested areas. We hired Kirk Gadzia from Resources Management Services, LLC to host a two-day grazing workshop. The event was a big success and a number of 'Plans' were developed. Kirk talked about the causes of overgrazing and the difference between severe grazing and overgrazing. He talked about what happens when a raindrop hits bare ground. All of the workshop attendees acknowledged the land health issues, focusing specifically on grazing management, sources of erosion, and the effect of feral horses on the already degraded landscape. This workshop got people thinking that there might be another way to do things. This was the beginning.

Restoring hózhó

Today, with generous financial support from the Environmental Protection Agency's (EPA) Targeted Watershed Grant program, the Christensen Fund, the Packard Foundation, and the tireless efforts of people like Watson Castillo, the Officers and Members of the OERC, Roger Toledo – Ojo Encino Chapter President, Elizabeth Stoney - Ojo Encino Land Board, Rochelle Vandever – Ojo Encino Youth Crew Leader, Barbara Johnson - Rio Puerco Alliance, Steve Fisher - BLM, Maureen Murphy - NRCS, and Craig Conley, Avery Anderson and Catherine Baca from The Quivira Coalition, we are continuing to systematically chip away at the daunting challenges, and make real change on the ground. Here are several of the programs that are helping us restore our connection to the land:

(1) ***Feral Horse Youth Leadership Program:*** Driving across the Navajo reservation, small groups of feral horses are a frequent sight on the landscape. While romantic at first glance, the darker side of this picture is that these unmanaged herds are overgrazing open range and undermining efforts of native ranchers to restore rangelands to a healthy condition. In many cases, these horses have no training and provide little economic value to Chapter members or their owners. When herd populations grow to unacceptable levels, the BLM and BIA reduce numbers through roundups and auctions. Drought years also take their toll on the horse population through starvation. This scenario is repeated again and again throughout the Southwest. Nobody is happy with this situation but until recently, have not been able to visualize an alternative.

Horses and horsemanship are integral to Navajo tradition and culture. Many Navajo youth and even adults, however, have lost a connection with their heritage of horsemanship and as a result an important aspect of our culture. This pilot program addresses these issues in a positive manner. We expect the transition to a different way of horse herd management to take years.

Ojo Encino students at 4-H Horse School, in June 2009, Albuquerque, NM.

The proposed solution is based on youth education, horse training, and horse population stabilization through the use of fertility control and gelding using traditional methods. Teaching tribal youth about the art and science of horsemanship, horse health management, and grazing management in combination with a horse training program will create a more positive and interactive relationship between horses and people as well as add value to the horses.

(2) *Erosion Control and Summer Youth Employment:* Like the Feral Horse Youth Program, the Erosion Control Program aims to engage the Navajo Youth by providing a summer training program. In the summer of 2009, the crew leaders for the program attended a series of workshops led by restoration specialist, Craig Sponholtz of Dryland Solutions, Inc., and then struck out on their own during the summer – taking responsibility for site selection, design, and construction of erosion control treatments. Over the course of the summer, they built of dozens of structures, and when assessed at the summer's end, Sponholtz commented that "not only was the rock work outstanding, but the treatment designs laid out by the crew demonstrated their real understanding of the way that water and sediment move across the landscape."

This program will continue in 2010, with a new twist; site selection for some of the erosion control projects will be based on the results of an on-going survey of historic agricultural plots in the area. In general, old corn farm fields represent areas that – at one time – had high ecological significance. They were selected as areas for agriculture because they had rich soil and high moisture/nutrient content. More often than not – these old corn farm fields were abandoned when road construction and/or overgrazing changed their hydrology. Though they are now dry, the soil in these plots is generally still rich, and we wager that restoring their water source will make them productive once again. Therefore, we are going to focus our erosion control efforts in the summer of 2010 on healing these once productive pieces of land, with the hope that they can be put into small-scale agricultural production again.

Crew Leader, Rochelle Vandever and Project Coordinator, Watson Castillo, coordinate the Erosion Control Summer Youth Program, July, 2009.

(3) *Road Drainage:* When you think about landscape restoration – roads are rarely the first thing that comes to mind. Good roads, however, are vitally important to a healthy landscape. Not only is a good road safe for travel, but a good road can also act as a tool for water harvesting and distribution. In 2008, The Quivira Coalition hosted their first Roads Workshop at Ojo Encino, led by restoration specialist Steve Carson of Rangeland Hands, Inc. It would be easy to judge the success of that workshop by pointing out specific roads that have been fixed as a result, but perhaps the greatest achievement of that workshop was that Weston Castillo, a resident of Ojo Encino, has now built a business for himself doing road restoration all over New Mexico based on many of the principles he learned during the workshop. In the past two years, with funding from the Targeted Watershed Grant, the drainage of over 30 miles of roads has been fixed or the roads have been closed. Like the Feral Horse and Erosion Control Programs, the Roads Program has helped the Ojo Encino Community to build their own capacity.

(4) *Feral Horse Management:* Although we focus a lot of attention on managing livestock grazing, the real challenge is in managing feral horses on Native lands. We have WAY too many feral horses. In the spring of 2009, we conducted a census of feral horses in the Ojo Encino community (about 55,000 acres). We counted over 700 horses – the number is well over 1000 since many of the mares have since had foals. At that level, horses are eating all the available forage with noth-

ing left for cattle, goats and sheep. In the summer, we became the first Navajo Chapter certified to administer the immunocontraceptive Porcine zona pellucidae (PZP). PZP prevents mares from becoming pregnant for up to 22 months. To date we have immunized over 30 horses and expect to complete over 100 by spring. Our goal is to stabilize the population at around 350 horses. This is a number we believe is sustainable.

Looking Forward

There is much to be optimistic about! Driving into Ojo Encino after the monsoon rains last summer, the hills were full of green grass. At OERC meetings we talk about healthy food, healthy livestock, and healthy land. We complain less and work to solve our own challenges. When people come from the outside and talk about the need for grazing plans, we proudly open our binders, show them our plans and discuss what we are doing to implement them. We have youth who show up in the summer to haul rocks to erosion sites even though they know they aren't on the payroll. Each of these things is beauty. Change comes slowly. It has taken decades to unravel a way of life that persisted on this land for centuries. We are creating a new way of life that combines the old with the new. There is no guide book. Each small step is a major victory and a step closer to what is right, to hózhó, Walking in Beauty.

Aldo Leopold must have been part Navajo because he understood the concept of balance and beauty in nature and how important those concepts were to the health of the land and people. He wasn't afraid of getting his hands dirty, trying new things, and listening to the land. Following Leopold's example, we - the Ojo Encino Chapter of the Navajo Nation - have struck out on a similar journey in land ethic restoration on the back 40,000. Wish us luck!

Feral horses at Ojo Encio that have been brought into the PZP Program.

Tammy Herrera is from the Ojo Encino Chapter of the Navajo Nation. She serves as the project manager for the Ojo Encino Horse Management Program. In this role, Tammy is responsible for overseeing the Horse Reduction Program, the Range Ride Program, the Ojo Encino 4-H Sage Riders Youth Program, the Grazing Management Program, and all of the education/outreach events associated with these programs. In preparing for these roles, Tammy was trained in Holistic Resource Management (by Kirk Gadzia), and she attended a class in Montana on how to properly administer the PZP vaccine (horse birth control). In addition, Tammy serves on the Ojo Encino Rancher's Committee, and is a Project Leader for Hasbidito (a non-profit community organization dedicated to capacity building). Tammy has educated herself on rainwater harvesting, animal composting, and the Mobile Matanza model for small scale meat processing. Utilizing all of these different types of knowledge, Tammy's ultimate goal is to help create a healthy landscape (through proper grazing management) and a healthy community (through the localization of food) in which to raise her family. You can contact Tammy at tammy7herrera@yahoo.com.

Ranching to Produce Tacos Sin Carbon:
The Low Carbon Foodprint of Grass-fed Beef and Sheep Production in the Semi-Arid West

by Gary Nabhan, Ph.D., Duncan Blair, and Dennis Moroney
Tacos Sin Carbon Project of the Flavors Without Borders Foodways Alliance/ Alianza de Sabores Sin Fronteras

Should the issues of fossil fuel use, carbon emissions generated from the food system and their contribution to global warming influence how ranchers manage their operations and how they sell their livestock for beef? Perhaps ranchers who are consistently good land stewards are doing enough already, so that asking them take on the issue of what happens to their livestock once it leaves the ranch may be asking too much. To paraphrase one wise sage, "Ranching can be one of the most elegant, simple means of providing food to the world that exists. The trouble is keeping it simple."

While ranchers in the American West once faced criticism for how they managed public and private rangelands, they are generally getting more praise than ever before for their innovative land stewardship practices. But what has replaced the so-called 'Range Wars' is public anxiety over something else: the effects of 'industrial meat production' on global warming, and the effects of meat consumption on human health. Consumers and environmentalists appear to be preoccupied today with issues such as how far cattle travel to feedlots, and what they eat once they leave the range. That is because much of the generally surmised carbon 'footprint' of meat production and consumption occurs once range-fed cattle depart from the working landscapes of the West. What happens in conventional feedlots, slaughterhouses and frozen storage lockers potentially undoes much of the low-carbon food production that Western ranchers routinely and elegantly do.

Dennis Moroney taking a call. 47 Ranch near Tombstone, Arizona. (Photo by Courtney White)

Livestock's Long Shadow?

If you don't believe these are emerging issues that will haunt us for many years to come, look at the 2006 publication of the United Nations policy briefing on climate change titled *Livestock's Long Shadow* (http://www.fao.org/docrep/010/a0701e/a0701e00.HTM). From our view, this critique of livestock production, like so many others, is so generalized that it fails to distinguish even the most fundamental differences in the strategies which American meat producers employ. It is time that ranchers, as well as the meat consumers who truly care about land stewardship and agricultural sustainability discuss these differences, rather than keeping our heads in the sand and thinking that they will go away.

Innovative ranchers and the consumers who support their efforts are therefore the audiences to which we address this discussion at this critical moment in American food history. While the average rancher

and the average meat consumer do not necessarily have the carbon footprint of meat production on their screen, policy makers do. It would be tragic to see land stewards and food producers caught off guard by the consequences of these policy shifts as they were when NAFTA and out-sourcing policy advocates raised their ugly heads.

Why now? Because anti-grazing environmentalists and some animal welfare proponents have recently been claiming that society as a whole should have one more beef with the Western livestock industry: meat production, they claim, is the major contributor to accelerated climate change. As researchers from the Humane Society and Worldwatch Institute contended in a more recent commentary (Koneswaran and Nierenberg 2008): "The farm animal…is the single largest anthropogenic user of land, contributing to many environmental problems, including global warming and climate change." Unfortunately, they subsume free-ranging livestock foraging on working wild lands under the rubric of "farm animal."

"It is not meat eating [per se] that is responsible for increased greenhouse gasses; it is the corn/soybean/chemical fertilizer/feedlot/transportation system under which industrial animals are raised…The pasture-raised animal eating grass in my field is not producing CO2, [but is] merely recycling it as grazing animals (and human beings) have since they evolved. …" — Eliot Coleman (2009)

There are several problems with this sweeping statement and its categorical indictment of all meat production. For starters, it fails to:

(1) Recognize from the outset that cattle on wild rangelands do not behave like, nor have the ecological impact of, the stereotypic "farm animal," such as the dairy cow or milk goat in a dry lot or irrigated pasture;

(2) Specify which farm animal breed(s) or genetics, under what management conditions, and which meat markets are causing the most problems (or the least);

(3) Recognize that some forms of grass-fed and finished livestock production systems have among the lowest carbon footprints, sustain the highest biodiversity, and maintain the widest range of ecological services of any food production systems on this planet; and

(4) Reward those meat producers who have already made great strides in reducing the 'carbon foodprint' of their livestock operations to mitigate climate change. While many ranchers are now doing the 'right thing,' whether or not society 'rewards' them economically or symbolically, the least we can do is reduce the regulatory burden on them that currently disrupts them from doing what they are good at.

We are not the first to challenge whether meat production inevitably has a high carbon footprint, or argue that our shared goal should be to advance all mixes of grass-fed genetics, perennial pasture management and local markets to mitigate against accelerated global climate change (Coleman 2008; LaSalle 2009; Nieman 2009). As Eliot Coleman (2009) has succinctly put it in his Debunking the Meat/Climate Change Myth:

"It is not meat eating [per se] that is responsible for increased greenhouse gasses; it is the corn/soybean/chemical fertilizer/feedlot/transportation system under which industrial animals are raised…The pasture-raised animal eating grass in my field is not producing CO_2, [but is] merely recycling it as grazing animals (and human beings) have since they evolved. Targeting livestock as a smoke screen in the climate change controversy is a very mistaken path to take since it results in hiding our ability to deal with the real root causes."

While Coleman's salvo has generated dozens of internet commentaries that thanked him for poking holes in the truisms of *Livestock's Long Shadow*, many other observers noted that Coleman offered few facts, numbers or case studies to back up his contention. On the other hand, there are ranchers who do not wish to publicly discuss the relative energy efficiencies or

ecological impacts of grass-fed versus grain-finished feedlot production, out of courtesy to their neighbors and colleagues who may not be making the same strides as they are.

For example, the Farm Bureau is more willing to criticize journalist Michael Pollan for what its members perceive to be an uninformed diatribe against corn-fed finishing in feedlots than to objectively consider whether most of the carbon footprint of livestock production may indeed be in the feedlot rather than out on the range.

Of course, discerning the reasons why the Farm Bureau will not fully discuss the carbon footprint of industrial corn production for feedlot finishing of beef are simple. First, the Farm Bureau politically represents many corn farmers, not just those of us members who raise cattle or sheep on rangelands. Second, most ranchers who are members of the Bureau must currently sell most of their stock to such feedlots, for lack of other alternatives. And yet, to passively accept the current structure of the livestock industry is to fantastically assume that ranchers and consumers should remain minor voices in how our meat is processed, transported and consumed. In fact, it is tantamount to tacitly accepting a certain level of servitude to big feedlot owners and meat packers. To ignore that feedlots and super-sized slaughter houses now control the destiny of the ranching economy more than either government policies, radical environmentalists or consumers would be foolish, for it would be sticking our heads in the sand.

We wish to make one thing explicit: we do not in any way condemn any Western rancher who currently sends his cattle off to a Midwestern feedlot for corn-finishing. However, we are wary of anyone who claims that there is no need to develop alternatives of different scales that give ranchers more economic options than they currently have. If the conventional route of sending most Western cattle off to feedlots is so lucrative and satisfying for the majority of ranchers, then why do the Western ranchers have one of the lowest profit margins (2 to 3 percent most years) of any agricultural business category in America? Why do many ranching families feel they have somehow lost control of their destiny?

In short, it is important that we see how both critics of grazing on public lands and as well as defenders of grain-finishing in feedlots have structured their arguments, and contrast the data associated with grass-fed versus grain-fed, feedlot-finished livestock.

"...we are wary of anyone who claims that there is no need to develop alternatives of different scales that give ranchers more economic options than they currently have. If the conventional route of sending most Western cattle off to feedlots is so lucrative and satisfying for the majority of ranchers, then why do the Western ranchers have one of the lowest profit margins (2 to 3 percent most years) of any agricultural business category in America?"

Carbon Foodprints

The carbon footprint or 'foodprint' of various agricultural systems has been calculated several different ways, and yet, curiously, most critics and defenders of meat production all tend to cite analyses by David Pimental and his colleagues, although they interpret Pimental's data in different ways (Pimental 1997; Pimental and Pimental 2008). Here are some basic patterns derived from Pimental's team at Cornell University:

(1) "Tracking food animal production from the feed trough to the dinner table, [we] found broiler chickens to be the most efficient use of fossil energy, and [feedlot-finished corn-fed] beef, the least. Chicken meat production consumes energy in a 4:1 ratio to protein output; beef cattle production requires an energy input to protein output ratio of 54:1. Lamb meat production is nearly as inefficient at 50:1, according to.... analysis of U.S. Department of Agriculture statistics" (Pimental 1987). However, later analyses found the ra-

tio of fossil fuel calories invested to calories of feedlot beef protein produced to range from 40:1 to 54:1, with the ration for range-fed beef only 20:1 (Pimental and Pimental 2008). In other words, the carbon foodprint for range-fed beef uses 50 to 67% less fossil fuel than the more generalized foodprint dominated by feedlot-raised, corn-fed beef;

(2) "With only grass-fed livestock, individual Americans would still get more than the recommended daily allowance (RDA) of meat and dairy protein," according to Pimentel's (1987) groundbreaking report, *Livestock Production: Energy Inputs and the Environment*. The contention advanced both by some ranchers and many environmentalists is that Americans would have insufficient meat to eat without grain-finishing in feedlots is simply not supported by the data.

To us, it is absolutely absurd to boil this entire debate down to just two possible choices: abstaining from meat consumption or else accepting the necessity and supremacy of grain-finishing in feedlots. As one of us blurted out during our discussions of this debate over the kitchen table, "Does anyone with a functioning brain really believe that the only choices are eating feedlot beef or else becoming a vegetarian?" What if the lands currently devoted to raising annual grains for finishing livestock were to be converted to perennial pastureland (or as Wes Jackson proposes, to perennial grain and legume production)?

Once we accept that typically, grass-fed and grass-finished beef and lamb have carbon foodprints much lower than that of feedlot-finished, corn-fed beef, we must still concede that even this comparison ignores the diversity and complexity of these issues. To begin with, there are many kinds of grass-fed and grass-finished livestock operations whose efficiencies are influenced by the degree of grass-fed genetics in the herd, the soil, climate and perennial vegetation dynamics of the pasture site, the pasture management regime, and the market into which the livestock are being placed. Let's look at some of these factors in more detail from our experience:

(1) Particular livestock breeds and even grass-fed selections within the same breed vary greatly in the efficiency with which they convert grass and browse into meat, and in their production of greenhouse emissions. The more a cattle herd is built upon 'grass-fed genetics' that are adapted to the particular ecological mix of browsing and grazing resources in a given climate, the more efficient (and less carbon-costly) the meat production of that herd and that land may be;

(2) Even within the same vegetation type – grassland versus savanna versus woodland – there may be huge differences in the digestibility of plant species eaten by livestock, and therefore in conversion efficiencies and methane production as well. Even within western rangelands, current estimates of carbon sequestration per acre vary wildly, depending upon the methodology used as much as it is on the intrinsic capacity of the vegetation to sequester carbon;

(3) There are 'gene-forage interactions' that favor higher efficiencies of some breeds in certain pastures over others. This issue is not solely about genetics (e.g., Angus) or land management (perennial pasturelands) but the place-based interactions between the two;

(4) Even within the same vegetation type, the management strategy—time-controlled grazing such as high density/short duration foraging, for example---can shift efficiencies over time by increasing or decreasing foragability;

(5) Depending upon whether one moves a livestock herd between grazing allotments by horseback or by truck, the foodprint of the livestock operation increases or decreases accordingly.

Getting It Right About Carbon Sequestration

The term carbon sequestration is ultimately about how much organic matter is stored above and below the soil surface of rangelands, how much water soil carbon can absorb, and how much atmospheric carbon is taken out of the air in a manner that slows global warming. The key thing for a western rancher to know is the simplest of facts: the more carbon and organic matter you have retained in soils, the better your moisture-holding capacity will be. Organic farmer Fred Kirschenmann reminds us that how we manage soils, and crops or livestock dwelling on those soils can make a 200-fold difference in the moisture-holding capacity of the land. To buffer a working landscape from drought and global climate change, the most prudent

thing a rancher may do is to manage the land to improve its moisture-holding capacity.

LaSalle (2009) has argued that "On just one acre of biologically healthy grassland soil, there can be between 0.5 to 1.5 tons of carbon deposited in the soil annually. This is equivalent to taking up to 5.5 tons of CO_2 out of the atmosphere and sinking it into an acre of soil. While this impressive level of carbon sequestration may be impossible in the high desert of New Mexico with little rainfall, it is absolutely viable ...where there is rain or available water to grow pasture.... This amazing ecological interaction on 11 billion global acres of grazed land would equate to sequestering 60% of human-caused CO_2."

Although LaSalle may be confusing acres with hectares, it is true that intact perennial grasslands and other working wildlands sequester large amounts of carbon. We contend that wherever there are perennial grasses, seasonal forbs and browse-able shrubs in wild working landscapes, their carbon sequestration value is likely to be far more than that for plowed agricultural fields of irrigated annual crops grown on the same soils.

Unfortunately, the value of a healthy working landscape is currently being reduced to a single carbon sequestration value with a (presumed) dollar sign to be attached to it. There are few actual measurements for particular conditions that can currently guide the assessment of carbon credits (Lal 2008; Lucas 2002; Tinnigkeit and Wilkes 2008; Sala and Parahuelo 1997). Nevertheless, the working wildlands of the semi-arid West are projected to absorb as much as 190 million tons of carbon per year (Scientific American 2008), which is no small potatoes.

How perennial vegetation is managed for food production and carbon sequestration has unprecedented significance for how we mitigate the effects of climate change. It is our contention that the process of grazing does not simplistically usurp carbon from plants and soils, but that certain intensities and durations of grazing put organic matter back into the soil, which thereby allows for subsequent root growth. Again, we ask those who are keen to set policy on carbon credits for rangelands to assign such values based on the specific conditions under which these lands and their livestock are being actively managed, rather than assuming, for example, that all sites within the plains grasslands biome inherently have but a single carbon signature of value to society.

What Can Be Done on the Ranch to Reduce Carbon Foodprints and Increase Carbon Sequestration?

Assuming that ranchers are even willing to critique themselves and their industry in terms of its carbon footprint, it would be valuable for them to be democratically and economically engaged in shaping what happens to their livestock once they leave the ranch. Here's why:

(1) If more than half of livestock's long shadow comes from finishing them on irrigated corn or other grains in dry feedlots, grass-finishing in perennial pastures or in more complex forage chains may be advisable;

(2) The larger the number of cattle moved in a single (preferably diesel) vehicle the shortest distance, the more fossil fuel costs are reduced per head. While reduced food miles per se is not always a panacea (Weber and Mathews 2008), it is certainly one of several interlocking factors that must be taken into account to reduce carbon footprints;

(3) If ranchers are once again given drop credit from hides, tallow, bloodmeal fertilizer and organ meats, these secondary markets will not only make livestock production more profitable, but the carbon footprint per product will be reduced as well when there is less waste;

(4) If ranchers can direct-market an increasing percentage of their animals to butchers and chefs that feature "snout to tail" use of meat and bones, they will reduce the carbon foodprint per pound of edible product. These artisanal butchers and chefs are likely to tell the stories of grass-fed producers in their pamphlets, on their websites, and on their menus, thereby building more public support as well.

While the U.S. Southwest has modest experiments with small-scale meat processing linked to grass-fed production in Cortez, Colorado, Chino Valley, Arizona, Taos, New Mexico, and Willcox, Arizona, it would be useful to move toward a regional model not unlike the Tallgrass Beef Company, begun in Sedan, Kansas,

by Bill Kurtis. This company maintains beef quality and land stewardship by strict production protocols for cattle produced completely on the open range or in improved perennial pastures dominated by native forages. Their beef contains no synthetic growth hormones, no animal by-products and no antibiotics. They place High Select and Low Choice grades of meats as niche products in many high-end restaurants which tell their story to tens of thousands of customers. Most importantly, they are focused on partnering with family-owned small to medium-sized ranches.

A Modest Proposal: Tacos Sin Carbon

Through a 2009 grant to reconsider the implications of our regional foodways work, a work group emerged within our Sabores Sin Fronteras/Flavors Without Borders Foodways Alliance that wanted to address borderland ranching issues from a fresh perspective. We began to envision a low carbon food economy for the Southwest borderlands that would mitigate or even reverse the impacts of our 'foodprint' on climate change. In particular, ranchers in our group requested that we collectively examine the assumption – noted above – that grass-fed cattle production should be phased out in the West due to its supposedly high carbon footprint.

As a case study, we decided to focus not merely on grass-fed beef production per se, but on the entire food production and transfer chain that results in the quintessential meal of the borderlands, tacos al carbon. This meal is part of a three-hundred year-old culinary tradition in Sonora, Arizona, New Mexico and Chihuahua that emerged from combining grass-fed beef with wild chiltepin peppers and Sonora wheat. In Sonora and southern Arizona in particular, this traditional meal is typically made with grass-fed beef grilled over mesquite wood or mesquite charcoal. The beef is usually chuck steak from shoulder cuts (called diezmillo in Sonora), and comes from herds with grass-fed genetics grazed and browsed in mesquite grasslands or oak-juniper savannas without much (or any) antibiotics, growth hormones or supplements. Once grilled, the meat is chopped into cubes, then stuffed into two or three tortillas made from dry-farmed wheat, and slathered with salsa made from wild chiltepin peppers.

The wheat – called White Sonora or Trigo Flor de America – was introduced into the Sonoran Desert in the 1690s and dry-farmed on a large scale until the 1970s, when Green Revolution hybrids displaced it. Its flour makes a soft, stretchable tortilla that gave rise to burritos and chimichangas. The wild pepper known as the chiltepin grows on both sides of the border, but is a commercial harvest only south of the international boundary. It requires no fossil fuel at all to produce the several tons of dried chiles that are hand-picked from canyons and washes in Sonora; they are then transported less than a hundred-and-fifty miles to Mexican-American markets in the borderlands. In essence, all three of these iconic ingredients are foods produced with a minimum of fossil fuel expenditures before they leave the ranch or farm.

"A serving of three tacos al carbon from grass-fed beef have only a quarter to a sixth of the carbon footprint of a corn-fed Angus quarter-pounder. That's why we are now calling them tacos sin carbon."

When we compare a lunch of three tacos al carbon with that of a typical American fast food, the quarter-pound hamburger, we can see some dramatic contrasts. The quarter pounder is a hamburger made from feedlot-finished, corn-fed beef from cattle breeds or herds with grain-adapted genetics. The quarter pounder is made from a frozen, four-ounce beef patty that weighs 113.4 grams before cooking into one serving. It is topped with lettuce, tomatoes and onions grown in flood-irrigated fields, and sandwiched into a bun made from hybrid wheat grown by center-pivot irrigation with pumped groundwater.

In contrast, the same number of grams of grass-fed beef chopped up from a chuck steak, the grilled and served with chiltepin salsa provides enough substance to produce six tacos al carbon, or two health servings. Toss in pickled cabbage, tomatoes or onions,

and your vegetable to meat ratio rises per serving. In other words, it can be safely contended that the carbon footprint of three tacos al carbon is at least half that of a quarter pounder made with the same amount of meat. But let's take into account the fact that all beef does not have the same carbon footprint. If Pimental is correct that producing grass-fed beef creates only half to two-thirds of the carbon footprint that corn-fed beef does when finished in a feedlot, then we have an even more dramatic contrast. A serving of three tacos al carbon from grass-fed beef have only a quarter to a sixth of the carbon footprint of a corn-fed Angus quarter-pounder. That's why we are now calling them tacos sin carbon.

We wish to take this projection a step further, by promoting Sonoran-style tacos sin carbon in a mobile taco stand that will double as a free-standing educational kiosk which tells the story of beef, wheat and chile producers and users who are incrementally reducing their 'foodprints.' With a second mini-grant, we will begin to design a mobile taco stand that will be transported by a biodiesel truck, and sell regionally-produced chiltepins, Sonora wheat and grass-fed beef in tacos at food festivals, conferences and regional ranching gatherings. While customers are waiting for their tacos to be grilled, they will view short film clips of ranchers, farmers and foragers telling of the ways they are working to reduce their foodprints. We envision an educational kiosk where murals, photos and pamphlets will get urban consumers back in touch with where their food comes from.

To fully implement this project, we are currently looking for additional investors and donors to help fund its start-up, and for-profit investors who can work with the short-order cooks who will lease the wagon to initiate their own local foods micro-enterprise following our protocols. We are now building a coalition of ranchers, meat processors, carniceria butchers, caterers and vendors to see this low-carbon vision bear fruit. To contact us, visit www.saboresfrontera.com.

We are neither missionaries nor salesmen. We simply want to see ranching survive on a planet where life other than our own survives as well. If we can incrementally move toward that goal by opening up dialogue about options for reducing our carbon foodprints that offer choices other than large feedlots or enforced vegetarianism, we will be delighted. One need not eat at our taco truck or join a grass-finishing collective to be part of this dialogue, but it is a dialogue that needs to occur soon. We propose that roundtables be organized at the next Quivira Coalition, SWGLA, American Livestock Breeds Conservancy and American Grassfed Association meetings to chart out what other options may be.

Literature Cited

Coleman, Eliot. 2009. *Debunking the meat/climate change myth*. Grist e-magazine. http://www.grist.org/article/2009-08-07-debunking-meat-climate-change-myth.

Food and Agriculture Organization of the United Nations. 2006. *Livestock's Long Shadow: Environmental Issues and Options*. FAO, Rome.

Koneswaran, Gowri and Danielle Nierenberg. 2008. Global farm animal production and global warming: impacting and mitigating climate change. *Environmental Health Perspectives* 115(5): 578-582.

Lal, R. 2008. Promises and limitations of soils to minimize climate change. *Journal of Soil and Water Conservation* 63: 113-118.

La Salle, Tim. 2009. *In defense of the cow: How eating meat could help slow climate change*. Rodale Institute, Kutztown, Pa. http://www.treehugger.com/files/2009/07/in-defense-of-the-cow-eating-meat-could-slow-climate-change.php.

Lucas, T. 2002. *Carbon sequestration: a conservation income opportunity. Future Farms 2002: A supermarket of ideas*. NRCS, Buffalo, OK.

Niman, N. Hahn. 2009. The omnivore's dilemma. Op-ed. New York Times, October 30.

Pimental, David. 1997. *Livestock Production: Energy Inputs and the Environment*. Canadian Society of Animal Science Annual Meetings, Montreal, Canada. Cited in http://www.Cornell Science News.edu/Livestock Production.htm.

Pimental, David and Marcia H. Pimental. 2008. *Food, Energy and Society*. Third Edition. CRC Press, Boca Raton, FL.

Tinnigkeit, T. and A. Wilkes. 2008. *Carbon Finance in Rangelands: An Assessment of Potential in Communal Grasslands*. Global Environment Facility, UN Development Programme and IUCN, Kunming, China.

Weber, C. L. and H. S. Mathews. 2008. Food miles and the climate impacts of freight transportation in American food consumption. *Environmental Science and Technology* 42(10): 3508-3513.

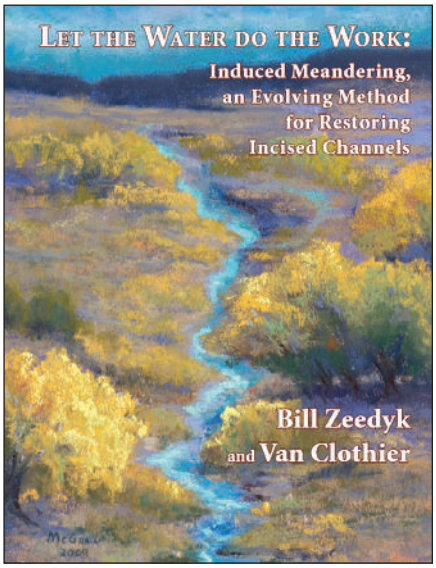
For more information visit the Sabores Sin Fronteras website: http://saboresfronteras.com/tag/taco-diplomacy. *Contact Gary Nabhan at* gpnabhan@email.arizona.edu.

A New Publication from The Quivira Coalition!

Let the Water Do the Work:

Induced Meandering, an Evolving Method for Restoring Incised Channels

by Bill Zeedyk and Van Clothier



"Let the Water Do the Work" is an important contribution to riparian restoration. By 'thinking like a creek,' one can harness the regenerative power of floods to reshape stream banks and rebuild floodplains along gullied stream channels. Induced Meandering is an artful blend of the natural sciences – geomorphology, hydrology and ecology – which govern channel forming processes. Induced Meandering directly challenges the dominant paradigm of river and creek stabilization by promoting the intentional erosion of selected banks while fostering deposition of eroded materials on an evolving floodplain. The river self-heals as the growth of native riparian vegetation accelerates the meandering process. Anyone with an interest in natural resource management in these uncertain times should read this book and put these ideas to work. Let's go with the flow!

Not all stream channel types are appropriate for Induced Meandering, yet the Induced Meandering philosophy of "going with the flow" can inform all stream restoration projects. Induced meandering strives to understand rivers as timeless entities governed by immutable rules serving their watersheds, setting their own timetables, and coping with their own realities as they carry mountains grain by grain to the sea. Rivers are to be treasured and respected, never bullied or coerced. What would life be if there were no rivers to sustain us?

Eight chapters, 238 pages, lushly illustrated with 300 color photos, drawings, diagrams and graphics. Examples of successful treatments are described in detail. The book contains annotated references, a glossary, an appendices that includes field forms, worksheets and other tools for collecting and interpreting information pertinent to river and wetland restoration issues.

Topics include:

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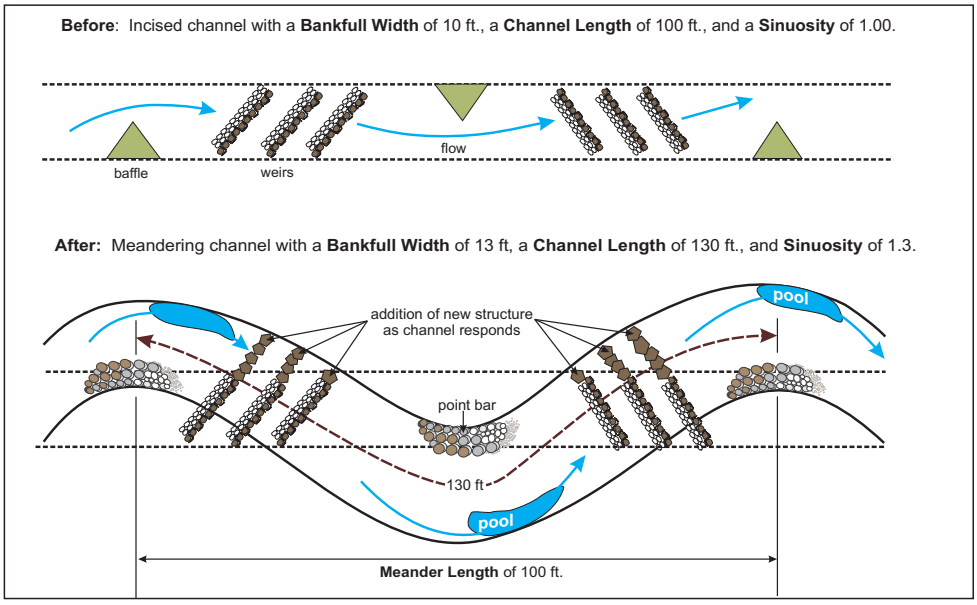
- Basic Fluvial Geomorphology, Stream Survey and Classification
- Induced Meandering Concepts: Actions, Reactions and Processes
- Stream Restoration Structures and Practices
- Reading the Landscape
- Project Design and Implementation
- Monitoring, Modification and Maintenance

The Induced Meandering Process



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