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

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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."

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. …" — Eliot Coleman (2009)

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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.

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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.

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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.

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.

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