Section: Synthesis

The Role of Rangelands in Diversified Farming Systems: Innovations, Obstacles, and Opportunities in the USA

Version: 1
Submitted: 2011-09-12
PDF Created: 2011/09/14

ABSTRACT

Discussions of diversified farming systems (DFS) rarely mention rangelands: the grasslands, shrublands and savannas that make up roughly one-third of Earth's ice-free terrestrial area, including some 312 million hectares of the United States. Although ranching has been criticized by environmentalists for decades, it is probably the most ecologically sustainable segment of the US meat industry, and it exemplifies many of the defining characteristics of DFS: it relies on natural ecological processes, non-crop plantings, and semi-natural communities of plants and animals as the basis of production, drawing primarily on ecosystem services generated and regenerated on site, rather than external, often non-renewable, inputs. Rangelands also provide other ecosystem services, including watershed functioning, wildlife habitat, recreation and tourism. Even where non-native or invasive plants have encroached on or replaced native species, rangelands retain unusually high levels of plant diversity compared to croplands (or plantation forests), and those rangelands that have never been plowed also retain much of their soil and microbial diversity. At landscape and regional scales, ranching helps prevent habitat fragmentation by linking public and private lands together into large management units. Innovations in marketing, incentives and easement programs that augment ranch income, creative land tenure arrangements, and collaborations among ranchers all support diversification. Some obstacles include lack of accessible USDA certified processing facilities, tenure uncertainty, fragmentation of rangelands, and low and variable income, especially related to land costs. Taking advantage of rancher knowledge and stewardship, and aligning incentives with production of diverse goods and services, will support the sustainability of ranching and its associated public benefits. The creation of feedbacks that result in more sustainable and diverse systems should be the ultimate goal.

Key words: rangelands; ranching; diversification; ecosystem services

INTRODUCTION

Discussions of diversified farming systems (DFS) rarely mention rangelands: the grasslands, shrublands and savannas that make up roughly one-third of Earth's ice-free terrestrial area, including some 312 million hectares of the United States. The omission may reflect the fact that rangelands are not cultivated, and therefore seem unrelated to farming; most US rangelands are used for extensive livestock production. To achieve sustainability and high productivity, however, DFS must find ways of connecting crop and livestock production at scales from individual farms to larger landscapes and regions, and rangelands can and should be a part of this endeavor. Although ranching has been criticized by environmentalists for decades, it is probably the most ecologically sustainable segment of the US meat industry, and it exemplifies many of the defining characteristics of DFS: it relies on natural ecological processes, non-crop plantings, and semi-natural communities of plants and animals as the basis of production, drawing primarily on ecosystem services generated and regenerated on site, rather than external, often non-renewable, inputs. Rangelands also provide other ecosystem services, including watershed functioning, wildlife habitat, recreation and tourism. Even where non-native or invasive plants have encroached on or replaced native species, rangelands retain unusually high levels of plant diversity compared to croplands (or plantation forests), and those rangelands that have never been plowed also retain much of their soil and microbial diversity (Havstad and Peters 1999). At landscape and regional scales, ranching helps prevent habitat fragmentation by linking public and private lands together into large management units.

The economic sustainability of ranching is more precarious than its ecological sustainability, however. Profit margins are notoriously thin, and one can argue that ranching persists in the US because, and insofar as, more industrial methods of livestock production have thus far been unable to render it economically uncompetitive and obsolete. There are three key elements to this resistance/persistence. (1) Technologies for confined breeding of cattle, sheep and goats have not yet been developed (in contrast with broiler chickens, turkeys, and hogs). Extensive ranching thus remains economically competitive as a source of young animals, most of which are subsequently fattened in confined feeding operations. (2) On remaining US rangelands, the economic costs of intensive inputs and land manipulations (e.g., irrigation, fertilization, or cultivation) are prohibitively high, relative to returns, due to low biological productivity, rugged topography, limited water supplies, etc. (3) There remain large areas of rangelands available for grazing that are not deemed more valuable for other uses, although this is changing due to pressures for energy development, tourism and recreation, and residential (exurban and suburban) land uses. The market price of ranch land far exceeds what livestock production alone can justify economically (Torell et al 2005), driving margins still lower, and roughly half of ranchers who lease federal lands rely on off-ranch sources for 50 percent or more of their income (Gentner and Tanaka 2002).

This combination of ecological and economic circumstances makes rangelands a valuable source of insights and opportunities for DFS. Compared to the rest of US agriculture, ranching is a very tightly coupled social-ecological system. Ranchers must adapt their production to the highly variable conditions of climate and vegetation characteristic of rangelands, and they must do so under

economic constraints that preclude resorting to expensive external inputs. Because roughly half of US rangelands are publicly owned and governed by multiple use mandates, many ranchers must also manage for a range of public goods and services as well as their livestock.

Across the western US, countless examples can be found of individual ranchers, or groups of ranchers, who are finding innovative ways to cope and persist by diversifying their operations. Table 1 provides a sample of these innovative ranches, categorized by the types of diversification they illustrate: management practices, land tenure arrangements, products, marketing, and services, including ecosystem services that are not (yet) marketable. In the text that follows, we discuss each of these categories of rangeland diversification, exploring the opportunities they represent and the corresponding obstacles to diversified management of rangelands in the US. We conclude with policy recommendations to facilitate rangeland DFS.

DIVERSIFICATION THROUGH INNOVATIVE MANAGEMENT PRACTICES

The constitutive moment of range livestock production is the animal's act of consuming forage—*herbivory*—and the sustainability of the operation as a whole depends on the plants' ability to withstand this disturbance. The co-evolutionary relationship between ruminant grazers and the world's rangeland plants, especially grasses, is tens of millions of years old, and in principle, range livestock production could occur almost without human labor at all (except that the harvest of the animals would then be classified as hunting (Ingold 1988)). Range livestock managers have only indirect control over herbivory and plant response, and they face an extraordinarily wide spectrum of potential management strategies for doing so, from constant co-presence or herding, to the placement of water sources, salt licks, or other supplements to attract livestock to certain areas, to fixed delimitation of pastures with fencing. All of these strategies involve trade-offs between costs (for labor, infrastructure, or both) and benefits measured in forage production and its effects on the health, growth, and successful reproduction of the livestock being managed.

This rather abstract discussion serves to isolate a key point regarding rangelands and DFS: namely, that range livestock production intrinsically involves alternations and interactions of herbivory and plant growth at scales ranging from individual plants to entire landscapes and from days to years. If diversified farming typically denotes multiple crop species grown in combination or in alternating sequences or "rotations," in range livestock production a pre-existing and self-perpetuating diversity of plants stays put while the animals move, distributing their impacts spatially and temporally, whether or not the manager is consciously "rotating" them. Put another way, livestock grazing is an ecological disturbance that can be managed in terms of timing, frequency, and intensity (Sayre 2001).

The recommended management practices of the mid-20th century on US rangelands were oriented towards homogenization of livestock impacts and range landscapes, both spatially and temporally (Fuhlendorf and Engle 2001). Grazing took place

year-around or throughout the growing season and stocking rates were normalized at static levels based on estimates of average annual forage production. Watering points and fences were constructed, and predators controlled, to encourage and enable livestock to be as evenly distributed as possible and thereby to utilize all available forage. It is now recognized that these strategies were poorly suited to the natural spatial and temporal heterogeneity of many rangelands, and that recommended stocking rates were generally too high, especially in drier years. Generally speaking, in most areas US rangeland conditions have improved relative to the acute degradation of the late-19th century cattle boom period, but have not recovered to their pre-boom conditions (Fredrickson et al. 1998).

In response to these circumstances, diversification through management innovation on US rangelands can take many forms but is unified by a few common themes. (1) Reducing operating costs by relying less on inputs and human labor and more on natural processes of plant and animal (re)production. Giving up expensive hay-cutting, storage, and winter feeding in favor of direct livestock herbivory is an example. (2) Restoring or remediating past degradation to improve the underlying productivity of rangelands. Riparian areas are a common target for such efforts. (3) Diversifying the goals of one's operation to include conservation or environmental values such as wildlife habitat, predators, pollinators, or endangered species of plants and animals. Many of these goals can have economic benefits through government programs that subsidize conservation on rangelands, or through marketing advantages such as "predator-friendly" meat products (see Diversification of marketing and Diversification of services, below).

The management innovations themselves are as diverse as the landscapes, managers, and goals in question. *Grazing systems* are strategies that manipulate the timing, frequency, and intensity of livestock herbivory to achieve specific goals. The most widespread grazing systems involve planned rotation of herds, often through permanent or temporary fencing and sometimes at rapid frequencies (measured in days). Concentrating livestock in smaller areas (and therefore higher densities) for shorter periods reduces grazing selectivity and is believed to reduce plant competition in more mesic rangelands where competition is not constrained by aridity. For example, Chet Vogt of Three Creeks Ranch in Glenn County, CA, rotates his 500 cow/calf pairs among 32 fenced paddocks and a handful of riparian "special management zones," which receive short-duration grazing treatments intended to benefit native plants. *Multi-species grazing* incorporates multiple kinds of livestock (e.g., goats and/or sheep alongside cattle) to diversify herbivory impacts (browsing and grazing). Joel Salatin's "Polyface" system is perhaps the best-known example of this type of diversification, but there are numerous others (Table 1). Finally, *matching livestock numbers and needs to variable* forage conditions involves a kind of temporal diversification and innovation, recognizing that high variability in both production and nutritional content of rangeland vegetation can be tracked by managers and accommodated through flexible stocking (adjusting herd sizes frequently) and careful timing (e.g., scheduling breeding for the time of year when forage quality and quantity are highest). Seedstock producer Kit Pharo and his 28,000-member "herd quitter" newsletter and list-serv focus on this forage balancing act as the cornerstone of sound ranch planning. (It should be noted that season-long

and year-long grazing remain viable strategies where selective herbivory produces outcomes sought by the manager, or where more complex systems show no benefit (Briske et al. 2011).)

DIVERSIFICATION OF LAND ACCESS AND TENURE ARRANGEMENTS

Sometimes by choice, but more often by necessity, ranchers in the western US manage a diverse checkerboard of land tenure arrangements, frequently relying on both public and private land to support their herds. While market opportunities may lead ranchers to acquire additional grazing area, this diversification is more commonly a means of simply getting by, e.g., finding forage for animals in case of drought, wildfire, land sale or subdivision, or judicial mandate – and it is often a key basis for diversified management practices.

Nearly 30,000 US ranchers utilize federal grazing leases from the US Forest Service and Bureau of Land Management (Gentner and Tanaka 2002), and in regions where private land predominates (such as the San Francisco Bay Area), many ranchers lease grazing from private landowners. Federal leases are linked to parcels of private land and typically transfer when these parcels change hands, reflecting the reality that the public lands are often an indispensible part of the ranch. Most Forest Service grazing allotments are used seasonally, and some ranchers move their herds between public and private land every year. For example, many ranchers operating in the foothills of the Sierra Nevada put their animals on private land — either their own or leased from another — during the winter months, and move their herd to a Forest Service allotment during the summer (Huntsinger et al. 2010).

Ideally, public and private components of a ranch are adjacent, but this is not always the case. In regions where competition for leases is stiff (often due to development pressure), ranchers piece together a hodgepodge of non-contiguous parcels to make their operation viable (Sulak et al 2007). Hence, rights of way for moving livestock (under their own power or with trucks) are essential. Public stock driveways remain crucial to some large range sheep and cattle operations, and many western states' open range and right-of-way laws favor livestock over cars on public rural roads (Fisher 2011). Tantamount to diverse land tenure arrangements is ranchers' ability to move their livestock within or between these parcels. For ranches fragmented and contiguous alike, human assistance in livestock movement is essential. Mobility has been highlighted globally as a central component of livestock production systems and is beginning to find a place in the literature on North American working landscapes (Huntsinger 2011). The Ellison Ranching Company, based in Tuscarora, Nevada, moves sheep by their own power over 200 miles on a round trip between summer and winter grazing allotments, and is dependent on trailing permits and long-established stock driveways for these movements.

Grazing lands are owned and managed by a wide variety of other landlords, including munipical, state and county parks, utility districts, the US Fish and Wildlife Service, public and private universities, state land boards or departments, branches of the military, land conservancies, partnerships, and corporations (notably precious metal mining companies and oil/diversified

holding companies. All of these ownerships may offer profitable leasing opportunities, and could present ranchers with the opportunity to diversify products, services, and management. For example, animal unit months (AUMs, in which federal leases are administered) on BLM allotments can be converted between cattle and sheep (or horses, as is current being done with a proposal for a wild horse sanctuary).

In the case of private property, the various property rights appurtenant to land (often described with the metaphor of a bundle of sticks) represent a significant opportunity for diversification. *Conservation easements*, in which development rights are sold to a land trust or a government entity, have generated considerable enthusiasm in the environmental community and significant, if sometimes hesitant, adoption by ranchers (Rissman and Sayre 2011; see Table 1). Similarly, ranchers may sell habitat mitigation easements, or credits from mitigation banks, to public or private developers to offset damage caused by construction projects elsewhere (Bonnie 1999; Merenlender et al. 2004). For mixed-tenure ranchers, interest in easements often depends on the security of tenure to public grazing allotments, since loss of an allotment could leave a private parcel that is not viable for ranching by itself (Rissman and Sayre 2011). On their private lands, ranchers may also sign long-term leases for communication towers, oil and gas wells, hunting or wildlife observation access, and wind or solar energy development.

Ancient in origin but somewhat innovative in modern US ranching are *shared or* common property regimes. Federal grazing allotments are sometimes leased by associations of up to 40 ranchers who run their stock in common. Taking advantage of the economy of scale in labor (it takes as much work to run 10 cows as it does 100), these ranchers pool their cattle and collectively hire cowboys to take care of the animals. At the end of the grazing season, animals are sorted back out and moved home or to other pastures. For example, the Green River Drift in Wyoming is an association of ranchers that collectively moves cattle along a 70 mile stock driveway between summer and winter pasture, collecting animals on the way to a Forest Service allotment and redistributing them according to ownership on the way down in the fall (Magagna, pers. comm). The Beaty's Butte Grazing Association in southeast Oregon is a collection of ranchers who send cattle during the summer to a BLM allotment of roughly 200,000 hectares and pool labor for gathering and sorting. On a smaller scale, the North Fork Group Allotment in Elko County, Nevada includes half a dozen cattle operations and two sheep ranchers. *Grassbanks* are another form of common pool resource, although they are used less regularly and by operators who do not necessarily act collectively. The "bank" is an area of rangeland set aside by a public agency or a conservation organization, with forage managed as an asset that can be "lent" to applicant ranchers to help support conservation objectives such as drought management, fire or grassland restoration (White and Conley 2007; Gripne 2005; See Table 1).

DIVERSIFICATION OF PRODUCTS

Since the mid-20th century, American rangeland livestock production has been oriented toward the sale of a single commodity: calves destined for feedlots. The genetic diversity of beef cattle has been reduced dramatically, as cattle

buyers and processing firms demand animals of uniform size, color, and shape. More recently, however, many ranchers have diversified away from this norm to improve the sustainability of their operations. *Mixed or minor breed cattle* (e.g. Murray Gray, British White, Criollo, Loala, Belted Galloway) are the clearest instance of this type of diversification, but a number of ranchers also pursue greater genetic variability *within* conventional breeds, by culling for "locally adapted" herds (e.g., smaller animals that thrive during drought or on limited available forage). Ranches may also raise *multiple* livestock species (sheep, goats, hogs, bison, chickens) which may be minor or mixed breed as well. Rehoboth Ranch, 40 miles northeast of Dallas, combines these two strategies by raising Red Angus, Angus cross breed, and Red Devon cross breed cattle alongside pastured lamb, pork, and poultry (see Table 1). Ranching with multiple species and breeds can provide ecological benefits, maximize forage utilization, and minimize producer risk (Barnes 2011).

Ranchers may also enter the market either earlier in the animal life cycle (by selling breeding stock to other producers, (as Pharo Cattle Company does) or later (by finishing and even marketing their own animals). The USDA does not currently track on-ranch animal finishing, but recent estimates of US grass-fed beef production range from 50,000-100,000 head per year (Gwin 2009). Ranchers who finish their own animals may also diversify into *value-added animal* products: Colorado's McNeil Ranch, for example, sells jerky, pet food, burritos, and tamales (see Table 1).

Many rangeland livestock producers also sell *non-meat animals* (horses, dogs, rodeo steers or bulls) or *non-meat animal products* (dairy, eggs, leather, wool, dog bones). *Mixed crop and livestock* operations, less common in the United States since World War II, may be making a comeback as well (Barbieri et al. 2008). Durango, Colorado's James Ranch, for example, sells raw milk, cheese, and eggs, as well as vegetables from their market garden. Potential benefits of this type of integrated crop and livestock production include nutrient cycling, risk spreading, and greater local food security.

Finally, a number of ranches produce *wood products* or *non-agricultural products* (oil and gas, renewable energy, minerals, photos, merchandise). The petroleum, mining, and forestry industries have historically relied heavily on both public and private rangelands, while renewable energy generation has emerged more recently as a non-agricultural source of ranch income. Ranches with agritourism enterprises may also sell photos or ranch-related merchandise.

DIVERSIFICATION OF MARKETS AND MARKETING

Many practices that conserve diversity on ranches in the U.S. offer opportunities (and sometimes imperatives) to capture added value via alternative markets. A variety of *third-party certification and marketing* systems have emerged to help capture added value from niche markets such as grass-fed, organic, humane, local, predator-friendly, or wildlife-friendly. Certified Humane's website (www.certifiedhumane.org, accessed June 6, 2011) lists 68 producers nationwide, American Grassfed Association lists 53 certified producers, and as of the last agricultural census (2008), 2.16 million acres of

rangeland/pastureland were certified organic, as were 15.5 million poultry animals and nearly half a million head of cows, hogs, and sheep (www.ers.usda.gov/Data/Organic/). Price premiums for niche meats can be 10-30 percent over conventional meat products (Gwin and Hardesty 2008), and though niche markets only represent 4.2 percent of total beef sales, that number has grown steadily, up from 1.1 percent in 2003 (Clause 2010, National Cattleman's Beef Association 2011).

Alternative marketing arrangements are growing to take advantage of these premiums. *Cooperatives and producer marketing boards*, as well as a companies that source by contract from multiple operations, can help small-scale producers capture more downstream value, maintain ownership of new technologies, and give producers more market power than would otherwise be the case (Moran et al 1996). They can also help producers access niche markets for locally produced or sustainable products. The Country Natural Beef cooperative, for example, enables 120 ranches in 12 states to sell on national and international markets under a brand that testifies to a common set of sustainability and animal welfare standards.

At the local and regional level, marketing strategies range from direct local sales to consumers, restaurants, and retail outlets, to farm stands, farmers markets, local online sales, and local produce aggregation and delivery services. For example, Door to Door organics is a local produce aggregator serving Colorado, Kansas City, Michigan and Chicago (doortodoororganics.com). McNeil Ranch sells its grassfed beef through a members only weight loss plan (see Table 1). *Direct to consumer food marketing* grew 104 percent between 1997 and 2007, and 135 percent in the Rocky Mountain and far Western states (USDA 2009a), with consumers increasingly endeavoring not only to “know their farmer” but their rancher as well. The number of farmers markets has increased dramatically, with 16 percent growth from 2009 to 2010 and over 6100 markets currently in operation nationwide (USDA 2010). Additionally, the 2007 USDA agricultural census indicated that 12,549 farms in the United States market products via community supported agriculture (CSA) programs (USDA 2009b), although the true number may be significantly lower (Galt forthcoming). Many CSAs include meat, or deal exclusively with meat products, often based on ecologically sensitive production practices. Another means by which ranchers “put a face” on their products is the development of *local and* regional brands. Beef from Marin Sun Farms, in Point Reyes, California, for example, is sold exclusively in the San Francisco Bay Area under the ranch’s own label, which highlights grass-fed and sustainable practices. The company contracts for products from multiple operations in the region to take advantage of differing prime harvest times for their products, e.g., grass fed beef.

DIVERSIFICATION OF SERVICES

There is a long history of Western ranches providing *agricultural tourism and* recreation related services for payment, most famously on ‘dude’ ranches where visitors pay to ride horses and experience the mythic ranching lifestyle. Many ranches sell access to their private lands for *hunting and* fishing or *horse boarding*, and a growing number support *education and research*.

The Mormon Church-owned Deseret Land and Livestock Company combines these classic service diversification strategies, providing guided fishing, birdwatching, and natural history tours, offering a mix of fee and free hunting access, and hosting researchers and educational groups (see Table 1).

Other marketable services have emerged more recently. One prominent example is grazing for *control of fire risk and invasive weeds*. Companies have sprung up offering to provide goats specifically for vegetation management, and they may charge as much as $160/ha for this service (see Table 1). Goats will consume some invasive species that other livestock refuse, and they like brush, which is sometimes invasive on some rangelands. Some ranchers who traditionally only produced cattle have acquired herds of goats specifically to rent out. Cattle can also be used for fire hazard management; in fact, one reason cited by public agencies for permitting grazing on their lands is reduction of fuel loads. However, in these cases cattle owners usually pay for the privilege of grazing grass even if reduced fire hazard is a recognized service. Finally, ranchers may also sell *services for other ranchers*. For example, the Arrow T Ranch in Conifer, CO provides cow-horse training facilities, while Whatcom County's Matheson Farms offers consulting, monitoring, group facilitation, and even video production (See Table 1).

Ranches also produce a wide variety of ecosystem services that are more difficult to sell, but of growing interest and importance (Havstad et al. 2007). Some are produced incidentally, as by-products of range livestock production; others are produced intentionally by ranchers for personal and public consumption. As the demand to protect and increase ecosystem services grows, and competition for land intensifies, ranchers' interest in being compensated for ecosystem services as a way of diversifying their income streams will likely increase.

Of the ecosystem services that benefit the public, those provided at the landscape scale are the most universally appreciated. The "wide open spaces" of ranch country are a cherished part of the quality of life in the United States. Because range livestock production typically requires a lot of land to support enough stock for a livelihood, ranches tend to be extensive; because it does not generally require cultivation of the soil and conversion of ecosystems, the land looks unaltered to most people, even though it is being managed and used for agricultural production. As large, unfragmented, and relatively intact landscapes, rangelands provide *habitat for wildlife,* pollinators, and plants, as well as watershed functioning and *carbon storage and* sequestration, among other services. In much of the West, ranch lands serve to buffer parks and reserves from more intensively settled areas (Maestas et al. 2003) and may play an active role in *restoration* projects.

Within the ranch, at the pasture scale, the priorities, practices, and tradeoffs among ecosystem services become more complex. Although large-scale ecosystem functions are less altered in ranching than in other forms of agriculture, livestock production has short- and long-term impacts on the land: grass and water are consumed, trails and fences are created, and soils may be affected. Some types of vegetation and wildlife may flourish as a result, while others may

decline. Increasingly, though, livestock producers are finding that grazing can be used as a tool to create vegetation and soil conditions that favor the co-production of various ecosystem services.

Most recently, the value of California rangelands for pollination services—as habitat for wild bees that pollinate a third or more of the state's crops—has been estimated at between $937 million and $2.4 billion (Chaplin-Kramer et al. 2011). Pollinators can be managed for at the landscape scale by keeping ranches intact and hence large swaths of land unfragmented, which provides refuge and habitat for large numbers of pollinators. At the pasture scale, on some ecological sites, grazing can be managed to benefit the broad-leaved plants (i.e., flowers) that pollinators need.

Many other examples can be adduced, albeit without dollar estimates of their values. In the San Francisco Bay region, half of the available habitat for the endangered California tiger salamander is provided by stockponds managed by ranchers. In this case, grazing seems to benefit the animals (Didonato 2007), as it does in the vernal pools that are its native habitat (Marty 2005; Pyke and Marty 2005). In a more complex case, more than half of the habitat for the state-threatened California black rail comes from the leaky ponds, pipelines, and troughs associated with ranching (Richmond 2010), although at the pasture scale, grazing must be excluded or carefully managed so as not to change the structure of the vegetation in the small mesic areas that are the rail's habitat. Other examples of habitat improvement with grazing include burrowing owls (Green and Anthony 1989), endangered kangaroo rats (Kelt et al. 2005), and butterflies (Weiss 1999). There have been notable cases where grazing exclusion has caused the species being "protected" by the exclusion to leave or disappear (Weiss 1999; Didonato 2007).

Ranchers have captured some of the value of these services through cost-share and incentives programs like the Wildlife Habitat Incentives Program (WHIP), the Environmental Quality Incentives Program (EQIP), and the Conservation Stewardship Program (CSP). The CSP provides technical and financial assistance to farmers and ranchers to manage and maintain existing conservation systems and to implement additional conservation activities on land in agricultural production. About $85 million were allocated through WHIP, $1.18 billion through EQIP, and $230 million though CSP in 2010 to ranchers and farmers. In addition, the Farm and Ranchland Protection Program provided about $121 million for conservation easements in 2010.

OBSTACLES AND POLICY RECOMMENDATIONS

It is clear from this brief review that rangelands are significant sites for agricultural diversification in the western US. Innovative ranchers have found ways to persist under severe economic and ecological conditions. Numerous barriers remain to be overcome, however, if these innovations are to move from the margins to the mainstream.

In many parts of the country, the largest barrier to diversified marketing, especially for small to mid-sized ranches, is the lack of accessible USDA certified processing facilities (Barnes 2011). The U.S. beef packing industry is one of the most concentrated in American agriculture: four companies control 83.5 percent of the total market (Hendrickson 2007). Many commercial slaughtering facilities will not process small herds of locally finished cattle, or smaller than standard cattle. This can preclude ranchers from selling directly to local customers, or from diversifying the genetics of their herds. Criollo cattle, for example, travel farther from water sources and consume more diverse vegetation types, and ranchers also claim the breed is more adapted to heat stress. But cattle adapted to arid lands are typically several hundred pounds smaller than conventional (mostly British) breeds (Barnes 2011). Policies to certify and support smaller processing facilities would help more ranchers diversify in these kinds of ways.

Uncertainty around land tenure can also inhibit diversification by discouraging long-term investments in diversified production or marketing. On private land, encroachment of other land uses (residential, commercial, industrial, or energy-related) complicates ranch management and may inhibit or preclude range improvement projects (e.g., prescribed fire). Associated rising land values make it more likely that ranchers will sell out or evaluate decisions on shorter timeframes. On public lands, meanwhile, uncertainty of renewal of leases similarly inhibits investments in innovation, and may prevent ranchers from considering conservation easements on their private parcels. Policies to stabilize land use and land tenure arrangements through tax incentives, such as California's Williamson Act, can help provide ranchers with the long-term confidence to diversify.

At landscape scales, collaboration among ranchers, and between ranchers, agencies, and environmental groups, can help promote innovative management practices and rangeland DFS (Sayre 2005; York and Schoon 2011). Local flexibility and collaboration from federal agencies can help grow diversified management practices spatially, though initiatives like grassbanking; temporally, through matching livestock numbers and needs to variable forage conditions; and at the patch or pasture scale, through adaptive, monitoring based habitat management. Coordinated management of the mosaic of unfragmented public and private land is a practical challenge, but it can help conserve landscape scale ecosystem processes, especially where rangelands persist with minimal fragmentation by urban or ex-urban development (Sayre 2005). Habitat conservation plans to meet regulatory requirements for endangered species can also be more readily undertaken at the scale of multiple ranches working collaboratively with the relevant wildlife agencies.

Markets and incentives for production of ecosystem services can make profound changes in ranches and ranching. At present, most ranch enterprises have little chance of capturing their value in monetary terms other than by selling the land at inflated values (i.e., far in excess of what livestock production can economically justify). Tax relief programs and conservation easements that provide some compensation for keeping land open are the main opportunities for "marketing" the ecosystem services of ranching landscapes today. A few ranchers are marketing ecological restoration, carbon sequestration, and

provision of habitat (see Table 1), but more research is needed to understand the complex ecological processes that support the production of clean air and water, wildlife habitat, carbon sequestration, recreation, and amenity values associated with extensive, unfragmented rangelands. Policy frameworks for remunerating land managers who successfully provide these public goods and services are still in their infancy, but may represent important ways of sustaining rangelands and encouraging diversification.

CONCLUSIONS

Rangelands are an important site for studying and developing diversified agricultural systems. The social-ecological system of ranching is a potential model for other sites, due to its tight coupling of ecological and economic processes and the innovations that this coupling has provoked across a wide variety of highly biodiverse ecosystems. In conversations with ranchers, some general themes come up repeatedly. One is that if they were paid for it, they could produce plenty of the plants and animals that society desires to see conserved. Another is that the threat of regulation sometimes causes them to avoid contact with anyone who might bring their resources, habitat, or species to the attention of authorities. But what is most striking is ranchers' desire to have society recognize the stewardship they provide and appreciate how much they aspire to do the right thing. Encouraging and rewarding the ecosystem services that ranchers produce would be a form of this needed acknowledgement, and would also shape the direction of management in socially desired directions.

Previous research has shown that most ranches are already managed for a variety of goals (Gentner and Tanaka 2002). Ranchers rarely identify profit as a primary motivation for ranching; instead, they cite the benefits of a place to raise a family, enjoy nature, work autonomously, and work with animals (Liffman et al 2000; Torell and Bailey 2000; Rowe et al 2001). Such "multiple goal" ranchers make decisions that reflect their own personal balance of financial returns and the other benefits of ranching (Campos et al 2009). Efforts to encourage further diversification of ranching goals and practices must be cognizant of this core set of ranching values, sometimes termed "ranch fundamentalism" (Smith and Martin 1972).

Many ranchers are keepers of local ecological knowledge that can contribute unique insights regarding rangeland health and management (Knapp and Fernandez-Gimenez 2009). Rancher local knowledge can complement scientific knowledge to produce site-specific information on management practices and ecological responses (Knapp and Fernandez-Gimenez 2009) and thus provide the basis for diversified, locally-adapted management. This knowledge base is threatened, however, as ranchland is converted to residential and other uses with higher economic returns; land use change currently poses the greatest threat to rangeland biodiversity (Havstad and Peters 1999), and *cultural* preservation of ranching traditions and land-based livelihoods thus constitutes a significant co-benefit for society (Table 1).

In summary, many ranchers are already involved in diversified agriculture, intentionally and incidentally. More will follow with the appropriate

incentives, technical assistance, and education. Ranchers have responded well to education programs (Huntsinger et al 2010), and they have often expressed a desire for more direct, one-on-one technical assistance. Such incentives, coupled to the "ranch fundamentalism" that leads ranchers to tolerate relatively low returns on their investment, may have a multiplicative, rather than only additional, effect on ranchers' stewardship. This is a positive social-ecological feedback with great potential for the environment.

LITERATURE CITED

Barbieri, C., E. Mahoney, and L. Butler. 2008. Understanding the Nature and Extent of Farm and Ranch Diversification in North America. *Rural Sociology* **73**(2): 205-229.

Barnes, Matthew. 2011. Low-Input Grassfed Livestock Production in the American West: Case Studies of Ecological, Economic, and Social Resilience. *Rangelands* 33(2):31-40.

Bonnie, R. 1999. Endangered species mitigation banking: promoting recovery through habitat conservation planning under the Endangered Species Act. *The* Science of the Total Environment 240: 11-19.

Chaplin-Kramer, R., K. Tuxen-Bettman, and C. Kremen. 2011. Value of Wildland Habitat for Supplying Pollination Services to Californian Agriculture. *Rangelands* 33: 33-41.

Clause, Reginald. 2010. Natural Beef Profile. Agricultural Marketing Resource Center. URL:http://www.agmrc.org/commodities__products/livestock/beef/natural_beef_profile.cfm (Accessed June 28, 2011).

Blench, R. (2001). Pastoralists in the New Millennium. Animal Production and Health Paper No. 150, FAO, Rome. URL: http://www.fao.org/docrep/005/y2647e/y2647e00.htm#toc

Didonato, J. 2007. Endangered amphibian research within grazed grasslands. Keeping Landscapes Working, A University California Cooperative Exten- sion Newsletter for Rangeland Managers Winter:4–6. Available at: http:// cesantaclara.ucdavis.edu/newsletterfiles/newsletter710.htm. Accessed 5 October 2007.

Fisher, G..S. 2011. Stock Driveways on Federal Land*:* Legal, Practical, and Ecological Foundations of Routes for Livestock Movement in the Western United States. Unpublished manuscript.

574. Fredrickson, E., K. Havstad, R. Estell, and P. Hyder. 1998. Perspectives on
575. desertification: south-western United States. *Journal of Arid Environments* 39:
576. 191-207.

577. Fuhlendorf, S. D. and D. M. Engle (2001). "Restoring heterogeneity on
578. rangelands: Ecosystem management based on evolutionary grazing patterns."
579. Bioscience **51**(8): 625-632.

580. Gentner, B.G. & Tanaka, J.A. (2002). Classifying federal public land grazing
581. permittees. *Journal of Range Management, 55*(1), 2–11.

582. Green, A.G. and R.G. Anthony. 1989. Nesting success and habitat relationships of
583. burrowing owls in the Columbia basin, Oregon. Condor 91:347–354.

584. Gripne, S. L. (2005). "Grassbanks: bartering for conservation." *Rangelands* **27**:
585. 24-28.

586. Gwin, Lauren. 2006. *New pastures, new food: building viable alternatives to*
587. conventional beef. PhD dissertation, University of California-Berkeley.

588. Gwin, Lauren. 2009. Scaling up sustainable livestock production: innovation and
589. challenges for grass-fed beef in the U.S. *Journal of Sustainable Agriculture*
590. **33**(2) 189-209.

591. Gwin, Laura and Shermain D. Hardesty. 2008. Northern California Niche Meat
592. Market Demand Study. University of California Extension Small Farm Program.
593. Available at *ucanr.org/sites/UC_Calaveras/files/86110.pdf. (Accessed June 28,*
594. 2011).

595. Havstad, K. M., and D. P. C. Peters. 1999. People and rangeland
596. biodiversity—North America. *Proceedings of the VIth International*
597. Rangeland Congress, vol. 2, pp. 634-638.

598. Havstad, K. M., D. P. C. Peters, R. Skaggs, J. Brown, B. Bestelmeyer, E.
599. Fredrickson, J. Herrick, and J. Wright. 2007. Ecological services to and from
600. rangelands of the United States. *Ecological Economics* 64: 261-268.

601. Hendrickson, Mary and William Heffernan. 2007. Concentration of Agricultural
602. Markets. Department of Rural Sociology, University of Missouri. URL:
603. http://www.foodcircles.missouri.edu/07contable.pdf

604. Huntsinger, L., M. Johnson, M. Stafford and J. Fried (2010). "Hardwood Rangeland
605. Landowners in California from 1985 to 2004: Production, Ecosystem Services, and

606. Permanence." *Rangeland Ecology & Management* **63**(3): 324-334.

607. Huntsinger, L., L. Forero and S. A. (2010). "Transhumance and pastoralist
608. resilience in the western United States." *Pastoralism: Research, Policy, and*
609. Practice **1**(1): 1-15.

610. Huntsinger, L., A. Sulak, L. Gwin, and T. Plieninger, T. 2004. Oak woodland
611. ranchers in California and Spain: conservation and diversification. In:
612. Schnabel, S. and Ferreira, A. (eds). Sustainability of Agrosilvopastoral
613. Systems: Dehesas, Montados. Chapter 6. *Advances in Geoecology* 37: 309-326.

614. Ingold, T. (1980). *Hunters, Pastoralists and Ranchers: Reindeer Economies and*
615. Their Transformations. Cambridge, UK, Cambridge Univ. Press.

616. Jesness, O.B. 1925. Relation of Cooperative Marketing to the Adjustment of
617. Agricultural Production. *Journal of Farm Economics*. 7 (2): 176-190

618. Kelt, D. A., E. S. Konno and J. A. Wilson (2005). Habitat management for the
619. endangered Stephens' kangaroo rat: The effect of mowing and grazing. *Journal of*
620. Wildlife Management **69**(1): 424-429

621. Knapp, Corrine Noel, and Fernandez-Gimenez, Maria E. 2009. Knowledge in
622. Practice: Documenting Rancher Local Knowledge in Northwest Colorado. *Rangeland*
623. Ecology and Management. 62(6): 500-509.

624. Liffmann, R. H., L. Huntsinger and L. C. Forero (2000). "To ranch or not to
625. ranch: Home on the urban range?" *Journal of Range Management* **53**(4): 362-370.

626. Maestas, J. D., R. L. Knight and W. C. Gilgert (2003). "Biodiversity across a
627. rural land-use gradient." *Conservation Biology* **17**(5): 1425-1434.

628. Magagna, J. President – Wyoming Stockgrowers Association. Personal
629. communication, May 2011.

630. Marty, J. T. (2005). "Effects of cattle grazing on diversity in ephemeral
631. wetlands." *Conservation Biology* **19**(5): 1626-1632.

632. Merenlender, A.M., L. Huntsinger, G. Guthey, and S.K. Fairfax. 2004. Land trusts
633. and conservation easements: who is conserving what for whom? *Conservation*
634. Biology 18 (1): 65-75.

635. Moran, Warren, Greg Blunden, and Adrian Bradly. 1996. Empowering Family Farms

through Cooperatives and Producer Marketing Boards. *Economic Geography*. 72 (2): 161-177.

National Cattleman's Beef Association. 2011. Natural/Organic Share of Total Beef (Dollar). The Beef Checkoff Retail Marketing. Available from http://www.beefretail.org/natural-organicshareoftotalbeefdollarandpound.aspx (Accessed June 28, 2011).

NMPAN 2011. MSUs Now Operating, Overview of Mobile Units. Niche Meat Processors Assistance Network. http://www.nichemeatprocessing.org/mobile-unit-overview

Plieninger, T. (2007). Traditional land-use and nature conservation in rural Europe. Encyclopedia of Earth. M. Hall-Beyer. http://www.eoearth.org/article/Traditional_land-use_and_nature_conservation_in_rural_Europe

Pyke, C. R. and J. Marty (2005). "Cattle grazing mediates climate change impacts on ephemeral wetlands." *Conservation Biology* **19**(5): 1619-1625.

Richmond, O.M.W., S. K. Chen, B.B. Risk, J. Tecklin, and S.R. Beissinger. 2010. California black rails depend on irrigation-fed wetlands in the Sierra Nevada foothills. California Agriculture 64(2): 85-93. http://californiaagriculture.ucanr.org

Rowe, H. I., E. T. Bartlett and L. E. Swanson Jr. (2001). "Ranching motivations in two Colorado counties." *Journal of Range Management* **54**(4): 314-321.

Sayre, Nathan. 2001. *The New Ranch Handbook: A Guide to Restoring Western* Rangelands. Santa Fe: Quivira Coalition.

Sayre, Nathan. 2005. *Working Wilderness: The Malpai Borderlands Group Story and* the Future of the Western Range. Tucson: Rio Nuevo Press.

Smith, A. H. and W. E. Martin (1972). "Socioeconomic behavior of cattle ranchers, with implications for rural community development in the west." *American Journal of Agricultural Economics* **54**(2): 217-225.

Sulak, A. and L. Huntsinger (2007). "Public lands grazing in California: untapped conservation potential for private lands." *Rangelands* **29**(3): 9-12.

Torell, L. A. and S. A. Bailey (2000). "Is the profit motive an important determinant of grazing land use and rancher motives?" *Journal of Agricultural*

and Resource Economics **25**(2): 725-725.;

Torell, L. A., N. R. Rimbey, O. A. Ramirez and D. W. McCollum (2005). "Income earning potential versus consumptive amenities in determining ranchland values." *Journal of Agricultural and Resource Economics* **30**(3): 537-560.

USDA 2009a. *Facts on Direct-to-Consumer Food Marketing: Incorporating Data from* the 2007 Census of Agriculture. United States Department of Agriculture Agricultural Marketing Service. Available from http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5076729&acct=wdmgeninfo

(Accessed June 28, 2011).

USDA 2009b. Table 44. Selected Practices: 2007. In *2007 Census of Agriculture* - State Data. p. 606. U.S. Department of Agriculture, National Agricultural Statistics Service. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_US_State_Level/st99_2_044_044.pdf

USDA 2010. Farmers Market Growth 1994 – 2010. Agricultural Marketing Service. U.S. Department of Agriculture. http://www.ams.usda.gov/AMSv1.0/farmersmarkets

Weiss, S. B. (1999). "Cars, cows, and checkerspot butterflies: Nitrogen deposition and management of nutrient-poor grasslands for a threatened species." *Conservation Biology* **13**(6): 1476-1486.

White, C. 2010. “The carbon ranch.” Quivira Coalition Report **36**: 3-18.

White, C. and C. Conley (2007). "Grassbank 2.0." *Rangelands* **29**(3): 27-30.

York, A. M. and M. L. Schoon. 2011. Collective action on the western range: coping with external and internal threats. *International Journal of the Commons* (accessed online).

Table 1. Types and examples of diversification on ranches in the USA, with links and references to further information. The table is not exhaustive, and is intended to illustrate the points made in the text.

DFS Attribute	Case Studies	Website/Reference
Diversification through innovative management practices		
Grazing systems	Holistic Management International	http://www.holisticmanagement.org/index.php?option=com_content&view=article&id=77&Itemid=45
	JX Ranch Natural Beef	http://www.leannaturalbeef.com/about-us.htm
	Blue Range Ranch	http://bluerangeranch.com
	Three Creeks Ranch	http://www.sandcounty.net/initiatives/LCA/Winners/CA/?ID=159
	Ray Banister	Provenza 2007
	47 Ranch	Barnes 2011
	Empire Ranch	http://www.empireranchfoundation.org
	Nicasio Native Grass Ranch	http://www.marinorganic.org/producers/producers_nicasio_native.html
Multi-species grazing	Tamarack Lamb and Wool	http://tamaracksheep.com/
	Fox Fire Farms	http://www.foxfirefarms.com/
	47 Ranch	Barnes 2011
	Polyface	http://www.polyfacefarms.com
	James Ranch	http://www.jamesranch.net
	Ladder Ranch	http://www.ladderranch.com
	Hobo Ranch	http://www.hoboranches.com
	Marin Sun Farms	http://www.marinsunfarms.com
	Parker Pastures	http://parkerlandmanagement.com
	Rehoboth Ranch	http://www.rehobothranch.com
Matching livestock numbers and needs to variable forage conditions	Pharo Cattle Company	http://pharocattle.com/
	Lasater Ranch	http://www.lasaterranch.com
	Ray Banister	Provenza 2007

(con'd)

Diversification of land access and tenure arrangements		
Conservation easements	California Rangeland Trust	http://www.rangelandtrust.org/conservation.php
	Carrizo Valley Ranch	http://www.carrizovalleyranch.com/aboutus.html
	47 Ranch	Barnes 2011
	Matador Grassbank	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/montana/placesweprotect/matador-ranch.xml
	Malpai Borderlands Group	http://www.malpaiborderlandsgroup.org/
	Tejon Ranch	http://www.tejonranch.com
	Marin Agricultural Land Trust	http://www.malt.org
Shared or common property regimes	Green River Drift (Wyoming)	Fisher 2011
	Beaty's Butte Grazing Association (Southern Oregon)	Fisher 2011
	North Fork Group Allotment (Elko, NV)	Fisher 2011
Grassbanks	Matador Grassbank	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/montana/placesweprotect/matador-ranch.xml
	Valle Grande Grassbank	http://quiviracoalition.org/Land_and_Water_Program/Valle_Grande_Ranch_-_Rowe_Mesa_Grassbank/
	Heart Mountain Grassbank	www.partnershipresourcecenter.org/.../heart-mountain-grassbank.pdf
	Malpai Borderlands Group	http://www.malpaiborderlandsgroup.org
Federal, state, tribal, or college/university ownership	Empire Ranch	http://www.empireranchfoundation.org
	Valles Caldera National Preserve	http://www.vallescaldera.gov
	Chico Basin Ranch	http://www.chicobasinranch.com
	Arapaho Ranch	http://www.arapahoranch.com
	Sinte Gleska Bison Ranch	http://www.sintegleska.edu/bison/
	Swanton Pacific Ranch	http://spranch.org
	Deep Springs Ranch	http://www.deepsprings.edu/labor/ranch
Diversification of products		
Mixed or minor breed cattle	Carrizo Valley Ranch	http://www.carrizovalleyranch.com/aboutus.html

(con'd)

	47 Ranch	Barnes 2011
	Pharo Cattle Company	http://pharocattle.com
	Windsor Dairy	http://www.windsordairy.com/
	Marin Sun Farms	http://www.marinsunfarms.com
	Effertz EZ Ranch	http://www.loala.com
	American Criollo Beef Association	http://www.leanandtenderbeef.com
	Rehoboth Ranch	http://www.rehobothranch.com
	Shire Gate Farm	http://www.shiregatefarm.com
	Montana Grasslands Beef	http://montanagrasslandsbeef.com
Multiple livestock species	Fox Fire Farms	http://www.foxfirefarms.com/
	47 Ranch	Barnes 2011
	Polyface	http://www.polyfacefarms.com
	James Ranch	http://www.jamesranch.net
	Ladder Ranch	http://www.ladderranch.com
	Marin Sun Farms	http://www.marinsunfarms.com
	Parker Pastures	http://parkerlandmanagement.com
	Rehoboth Ranch	http://www.rehobothranch.com
	Meadows Family Farms	http://meadowsfamilyfarms.com
	Arriola Sunshine Farm	http://www.arriolasunshinefarm.com/
Breeding stock	Pharo Cattle Company	http://pharocattle.com
	Lasater Ranch	http://www.lasaterranch.com
	Tamarack Lamb and Wool	http://tamaracksheep.com/
	Effertz EZ Ranch	http://www.loala.com
	Matheson Farms	http://www.mathesonfarms.com
	Montana Grasslands Beef	http://montanagrasslandsbeef.com
	Arriola Sunshine Farm	http://www.arriolasunshinefarm.com/
Value-added animal products (pet food, jerky, bacon, sausage, tamales)	JX Ranch Natural Beef	http://www.leannaturalbeef.com/about-us.htm
	McNeil Ranch	http://www.grassfedandhealthy.com
	Sinte Gleska Bison Ranch	http://www.sintegleska.edu/bison/

(con'd)

	Marin Sun Farms	http://www.marinsunfarms.com
	Meadows Family Farm	http://meadowsfamilyfarms.com
Non-meat animals/animal products (dairy, eggs, horses, dogs, leather, wool, dog bones, rodeo bulls)	JX Ranch Natural Beef	http://www.leannaturalbeef.com/about-us.htm
	Fox Fire Farms	http://www.foxfirefarms.com/
	Tamarack Lamb and Wool	http://tamaracksheep.com/
	Windsor Dairy	http://www.windsordairy.com/
	Polyface	http://www.polyfacefarms.com
	James Ranch	http://www.jamesranch.net
	Ladder Ranch	http://www.ladderranch.com
	Hobo Ranch	http://www.hoboranches.com
	Marin Sun Farms	http://www.marinsunfarms.com
	Parker Pastures	http://parkerlandmanagement.com
	Rehoboth Ranch	http://www.rehobothranch.com
	Thunder Heart Bison	http://www.thunderheartbison.com
	Arriola Sunshine Farm	http://www.arriolasunshinefarm.com/
Mixed crop and livestock (crops, honey, timber, agricultural products [e.g. compost, feed])	Tamarack Lamb and Wool	http://tamaracksheep.com/
	Fox Fire Farms	http://www.foxfirefarms.com/
	James Ranch	http://www.jamesranch.net
	Work Ranch	http://www.workranch.com
	Tejon Ranch	http://www.tejonranch.com
	Swanton Pacific Ranch	http://spranch.org
	Nicasio Native Grass Ranch	http://www.marinorganic.org/producers/producers_nicasio_native.html
	Shire Gate Farm	www.shiregatefarm.com
	Meadows Family Farm	http://meadowsfamilyfarms.com
	Thunder Heart Bison	http://www.thunderheartbison.com
	Arriola Sunshine Farm	http://www.arriolasunshinefarm.com/

(con'd)

Wood products	Polyface	http://www.polyfacefarms.com
	Swanton Pacific Ranch	http://spranch.org
Nonagricultural products (energy production, mining, boats and trailers, merchandise, photos)	Carrizo Valley Ranch	http://www.carrizovalleyranch.com/aboutus.html
	47 Ranch	Barnes 2011
	James Ranch	http://www.jamesranch.net
	Lava Lake Lamb	http://www.lavalakelamb.com
	McNeil Ranch	http://www.grassfedandhealthy.com
	Tejon Ranch	http://www.tejonranch.com
	Cherokee Hills Ranch	http://www.cherokeehillsranch.com
Diversification of markets and marketing		
Third party certification and marketing	American Grassfed Association certified producers	http://www.americangrassfed.org/producer-profiles/
	Eat Wild Directory of grassfed meat and dairy	http://www.eatwild.com/products/index.html
	Certified Humane	http://www.certifiedhumane.org/
	Arapaho Ranch	http://www.arapahoranch.com
Cooperatives and producer marketing boards	Country Natural Beef	http://www.countrynaturalbeef.com/story.php
	Mountain States Lamb	http://www.mslamb.com/
	Pharo Cattle Company	http://pharocattle.com
	Grassfed Livestock Alliance	http://www.grassfedlivestockalliance.com
Direct to consumer food marketing (farmer's markets, CSA, retail operation, mail order, restaurants, institutions, weight loss program)	Eatwild	http://www.eatwild.com/products/index.html
	American Grassfed Association directory	http://www.americangrassfed.org/producer-profiles/producer-members-by-state/
	JX Ranch Natural Beef	http://www.leannaturalbeef.com/about-us.htm
	Blue Range Ranch	http://bluerangeranch.com
	Carrizo Valley Ranch	http://www.carrizovalleyranch.com/aboutus.html

(con'd)

	Tamarack Lamb and Wool	http://tamaracksheep.com/
	Fox Fire Farms	http://www.foxfirefarms.com/
	Windsor Dairy	http://www.windsordairy.com/
	47 Ranch	Barnes 2011
	Polyface	http://www.polyfacefarms.com
	James Ranch	http://www.jamesranch.net
	Lava Lake Lamb	http://www.lavalakelamb.com
	Ranney Ranch	http://www.ranneyranch.com
	Hobo Ranch	http://www.hoboranches.com
	McNeil Ranch	http://www.grassfedandhealthy.com
	Sinte Gleska Bison Ranch	http://www.sintegleska.edu/bison/
	Swanton Pacific Ranch	http://spranch.org
	Marin Sun Farms	http://www.marinsunfarms.com
	Parker Land Management	http://parkerlandmanagement.com
	Rehoboth Ranch	http://www.rehobothranch.com
Local and regional brands	Blue Range Ranch	http://bluerangeranch.com
	Fox Fire Farms	http://www.foxfirefarms.com/
	Lava Lake Lamb	http://www.lavalakelamb.com
	Marin Sun Farms	http://www.marinsunfarms.com
	Thunder Heart Bison	http://www.thunderheartbison.com
	Arriola Sunshine Farm	http://www.arriolasunshinefarm.com/
Diversification of services		
Agricultural tourism and recreation (including rodeo, filming)	JX Ranch Natural Beef	http://www.leannaturalbeef.com/about-us.htm
	Diablo Trust	http://www.diablotrust.org
	Deseret Land and Livestock Company	http://www.dlandl.com
	Fox Fire Farms	http://www.foxfirefarms.com/
	Polyface	http://www.polyfacefarms.com
	James Ranch	http://www.jamesranch.net

(con'd)

	Ladder Ranch	http://www.ladderranch.com
	Work Ranch	http://www.workranch.com
	Empire Ranch	http://www.empireranchfoundation.org
	Valles Caldera National Preserve	http://www.vallescaldera.gov
	Chico Basin Ranch	http://www.chicobasinranch.com
	Tejon Ranch	http://www.tejonranch.com
	Marin Sun Farms	http://www.marinsunfarms.com
	Madroño Ranch	http://madronoranch.com
	Rainstein Ranch	http://www.reinsteinranch.com
	Arrow T Ranch	http://arrowtranch.com
Hunting and fishing	Carrizo Valley Ranch	http://www.carrizovalleyranch.com/aboutus.html
	Deseret Land and Livestock Company	http://www.dlandl.com
	Ladder Ranch	http://www.ladderranch.com
	Valles Caldera National Preserve	http://www.vallescaldera.gov
	Tejon Ranch	http://www.tejonranch.com
	Madroño Ranch	http://madronoranch.com
Horse boarding	Work Ranch	http://www.workranch.com
	Tejon Ranch	http://www.tejonranch.com
	Reinstein Ranch	http://www.reinsteinranch.com
	Cherokee Hills Ranch	http://www.cherokeehillsranch.com
	Arrow T Ranch	http://arrowtranch.com
Education and research	Blue Range Ranch	http://bluerangeranch.com
	Diablo Trust	http://www.diablotrust.org
	Deseret Land and Livestock Company	http://www.dlandl.com
	47 Ranch	Barnes 2011
	CARLY Ranch Apprentice Program	http://quiviracoalition.org/Capacity_Building___Mentorship/CARLY_Ranch_Apprentice_Program_/index.html
	Polyface	http://www.polyfacefarms.com
	James Ranch	http://www.jamesranch.net

(con'd)

	Lava Lake Lamb	http://www.lavalakelamb.com
	Work Ranch	http://www.workranch.com
	Empire Ranch	http://www.empireranchfoundation.org
	Malpai Borderlands Group	http://www.malpaiborderlandsgroup.org/
	Ute Creek Cattle Company	http://www.utecreekcattlecompany.com
	Wind River Ranch	http://windriverranch.org
	Valles Caldera National Preserve	http://www.vallescaldera.gov
	Chico Basin Ranch	http://www.chicobasinranch.com
	Tejon Ranch	http://www.tejonranch.com
	Sinte Gleska Bison Ranch	http://www.sintegleska.edu/bison/
	Swanton Pacific Ranch	http://spranch.org
	Deep Springs Ranch	http://www.deepsprings.edu/labor/ranch
	Nicasio Native Grass Ranch	http://www.marinorganic.org/producers/producers_nicasio_native.html
Control of fire risk and invasive weeds	Livestock for Landscapes	http://www.livestockforlandscapes.com
	Goats R Us	http://www.goatsrus.com
	Blue Range Ranch	http://www.bluerangeranch.com
	Rocky Mountain Woolly Weeders	http://woolyweeders.com/
Services for other ranchers (consulting, monitoring, video production, cow horse training facilities)	Matheson Farms	http://www.mathesonfarms.com
	American GrazingLands Services	http://www.americangrazinglands.com
	Pharo Cattle Company	http://www.pharocattle.com
	Arriola Sunshine Farm	http://www.arriolasunshinefarm.com/
	Arrow T Ranch	http://arrowtranch.com
Habitat for wildlife, pollinators, and plants	JX Ranch Natural Beef	http://www.leannaturalbeef.com/about-us.htm
	Blue Range Ranch	http://bluerangeranch.com
	Three Creeks Ranch	http://www.sandcounty.net/initiatives/LCA/Winners/CA/?ID=159
	Diablo Trust	http://www.diablotrust.org

(con'd)

	Deseret Land and Livestock Company	http://www.dlandl.com
	Lasater Ranch	http://www.lasaterranch.com
	Ute Creek Cattle Company	http://www.utecreekcattlecompany.com
	Malpai Borderlands Group	http://www.malpaiborderlandsgroup.org/
	Wind River Ranch	http://windriverranch.org
	Valles Caldera National Preserve	http://www.vallescaldera.gov
	Chico Basin Ranch	http://www.chicobasinranch.com
	Tejon Ranch	http://www.tejonranch.com
Carbon storage and sequestration	Nicasio Native Grass Ranch	http://www.marinorganic.org/producers/producers_nicasio_native.html
Restoration	Blue Range Ranch	http://bluerangeranch.com
	Carrizo Valley Ranch	http://www.carrizovalleyranch.com/aboutus.html
	Rafter F Cattle Company	http://www.theshiftofland.org/interviews/roger-bowe/
	Diablo Trust	http://www.diablotrust.org
	Windsor Dairy	http://www.windsordairy.com/
	Malpai Borderlands Group	http://www.malpaiborderlandsgroup.org/
	Ute Creek Cattle Company	http://www.utecreekcattlecompany.com
	Wind River Ranch	http://windriverranch.org
	Devil's Spring Ranch	http://www.holisticmanagement.org/index.php?option=com_content&view=article&id=329:devils-spring-ranchpartnering-with-oil-companies&catid=63:usa-southwest&Itemid=31
Cultural preservation	Deseret Land and Livestock Company	http://www.dlandl.com
	47 Ranch	Barnes 2011
	Wind River Ranch	http://windriverranch.org
	Arapaho Ranch	http://www.arapahoranch.com
	Sinte Gleska Bison Ranch	http://www.sintegleska.edu/bison/