

THESIS

DIVERSIFYING RANCH BUSINESS MODELS: CHALLENGES AND OPPORTUNITIES IN
LARIMER COUNTY, COLORADO

Submitted by:

Megan Christensen

Department of Human Dimensions of Natural Resources

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Master's Committee:

Advisor: Joshua Goldstein

Robin Reid

Maria Fernandez-Gimenez

ABSTRACT

DIVERSIFYING RANCH BUSINESS MODELS: CHALLENGES AND OPPORTUNITIES IN LARIMER COUNTY, COLORADO

Private, working ranches provide valuable “ecosystem services,” the benefits people derive from ecosystems including food, water, open space, carbon sequestration, recreational opportunities, and many more. While ranchers are compensated for services such as food and other livestock products, they are generally not compensated for other public benefits derived from their land stewardship. Development pressure compounded by low profit margins in the livestock industry make ranching an economically difficult undertaking, and conversion of working ranches to other land uses is a well-established trend across the western US. New income sources are being explored to create more diversified ranch business models in order to deliver financial benefits to ranchers and conservation benefits to the public.

The objective of this study was to investigate the barriers and opportunities for developing more diversified business models for working ranches that integrate traditional livestock income sources with additional conservation-oriented sources. As part of this investigation, we examined the potential role of payments for ecosystem services (PES), a major new market-based tool for conservation in working landscapes. We investigated this topic through a detailed case study of ranchers and natural resource practitioners in Larimer County, Colorado – a region with a long tradition of ranching that continues today amidst escalating pressures that threaten the viability of ranching and conservation values in the region.

Using a qualitative semi-structured interview approach, we interviewed 18 ranchers (comprising 16 ranch operations) and 7 natural resource practitioners who work closely with ranchers in the study region. We concentrated on topics including current ranch business models and practices, challenges ranches are facing, and barriers and opportunities for more diversified future ranch business models, including a particular focus on PES. Participants identified 58 current challenges, 70 concerns for the future, and 85 opportunities for diversification in the future. Costs of inputs, unprofitability, development pressure, time and energy, and water scarcity were mentioned most often within the wide range of challenges. Invasion of privacy, traditional thinking or fear of change, and regulations emerged as concerns important to participants. Future business opportunities were divided into three main categories: (1) reducing costs (e.g. tax credits), (2) enhancing revenue (e.g. carbon credits) and (3) building regional capacity (e.g. capitalizing on the increasingly collaborative ranch culture). After discussion regarding a hypothetical PES program, all participants were at least potentially interested in a new payment program. This interest was tempered, however with caution and questions about how such a program would be structured. Any new program developed would need to provide complete, transparent information regarding costs, benefits, rules, and requirements.

This research contributes to diverse efforts at local (e.g., rancher coalitions) to national (e.g., USDA Office of Environmental Markets) scales working to develop a model for the “ranch of the future”, which aims to integrate conservation and agricultural production practices on working ranches.

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CHAPTER I
INTRODUCTION AND LITERATURE REVIEW

Introduction

Private, working rangelands are becoming an increasingly important component of conservation efforts across the western United States, mirroring the expanding role of private lands in landscape-scale conservation efforts in other parts of the world (Goldman et al. 2008). Unfortunately, development pressures compounded by low profit margins in the livestock industry make ranching an economically difficult undertaking (Bohlen et al., 2009; Brunson & Huntsinger, 2008; Ernst & Wallace, 2008). Research has shown that most ranchers remain in the business due to lifestyle values, a land ethic, or family tradition, with financial profitability being important but not necessarily the sole or primary motivation (Bartlett, Taylor, McKean, & Hof, 1989; Gentner & Tanaka, 2002; Jackson-Smith, et al., 2005; Kennedy & Brunson, 2007; Liffman, et al., 2000; Peterson & Coppock, 2001; Rowe, et al., 2001).

As human population increases and open space decreases, wildlife habitat is becoming more fragmented and less land is available to provide valuable ecosystem services – a term encompassing the life-sustaining and life-fulfilling benefits that people obtain from nature, such as carbon sequestration, water filtration, food and fiber production, and recreational opportunities, among many others (Millennium Ecosystem Assessment (MEA), 2005). Of these services, ranchers generally obtain the largest fraction of their income from the production of food and fiber, but there are few opportunities, if any, for landowners to receive direct compensation for most other ecosystem services provided by land stewardship (Turner & Daily, 2007). While largely not integrated into the market system, these services are nonetheless recognized as underpinning human well-being (MEA, 2005). Efforts are being pioneered across the world to develop financial and policy mechanisms to reward landowners for the currently

non-market ecosystem services provided by their land stewardship and maintenance of intact ecosystems (Daily, et al., 2009).

Objective

The objective of this research was to investigate the barriers and opportunities for developing more diversified business models for working ranches that integrate traditional livestock income sources with additional conservation-oriented sources. As part of this investigation, I examined the potential role of payments for ecosystem services (PES), a major new market-based tool for conservation in working landscapes (Daily et al. 2009; Goldman et al. 2008). I investigated this topic through a detailed case study of ranchers and natural resource professionals in Larimer County, Colorado – a region with a long tradition of ranching that continues today amidst escalating pressures that threaten the viability of ranching and conservation values in the region. My project contributes to diverse efforts at local (e.g., rancher coalitions) to national (e.g., USDA Office of Environmental Markets) scales working to develop a model for the “ranch of the future”, which aims to integrate conservation and agricultural production practices on working ranches.

Literature Review

Covering over 33% of the United States’ land base, and 54% of the 11 western states (USDA Forest Service, 1989), rangelands provide valuable environmental benefits such as wildlife habitat, forage for livestock, water filtration, carbon sequestration, and many more (Skaggs, 2008). Collectively, these benefits are termed *ecosystem services*, which are defined as the “conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life” (Daily, 1997). The Millennium Ecosystem Assessment (MEA)

identified four categories of ecosystem services (ES): (1) provisioning services include food, water, timber, fiber, and other consumables; (2) regulating services are those that regulate climate, hydrologic flows, disease, natural disaster mitigation, and other ecological processes of importance to humans; (3) cultural services provide recreational, educational, aesthetic, and spiritual values; and (4) supporting services, which are precursors to more tangible ecosystem services, including, for example, nutrient cycling, soil formation, and photosynthesis (MEA, 2005).

The western U.S. contains large tracts of open rangelands, many of which are privately owned and which are integral to conservation management for biodiversity and ecosystem services. Although much of the western U.S. is conserved as public land, the majority of preserved areas occur at higher elevations, largely excluding grasslands (Wallace, Theobald, Ernst, & King, 2008).

In order to achieve landscape-scale ecosystem function, private working ranches need to be included in conservation planning. While there is evidence that private ranches are a necessary complement to public lands in supporting native biodiversity (Hansen, et al., 2002; Knight, Wallace, & Riebsame, 1995; Maestas, Knight, & Gilgert, 2001; Maestas, Knight, & Gilgert, 2003), these lands are rapidly being converted to development. This situation is part of a larger trend nationally in land development and urbanization. Between 1990 and 2000, over 29 million acres of land in the nation were developed at a density of one house per 10-40 acres. This low-density, rural residential development is considered “exurban” development (Maestas, et al., 2003; Theobald, 2001). Colorado alone lost over 600,000 acres to development between 1987 and 1997 (Maestas, et al., 2001; Rowe, Bartlett, & Swanson, 2001), and this appears to be a

continuing trend. According to the USDA 2007 Agricultural Census, Colorado lost over one million acres of agricultural land in the previous ten years (USDA, 2007).

Rangelands are changing ownership in the West due to a variety of issues including land development pressure, economic hardship, loss of public grazing allotments, conflicts with neighbors, and lack of successors to take over the business (Bartlett, et al., 1989; Brunson & Huntsinger, 2008; Gosnell & Travis 2005; Havstad, et al., 2007; Jackson-Smith, Kreuter, & Krannich, 2005; Kreuter, Nair, Jackson-Smith, Conner, & Johnston, 2006; Liffmann, Huntsinger, & Forero, 2000; McKean, & Hof; 1989; Rowe, et al., 2001; Sulak & Huntsinger, 2007). In light of these financial and institutional factors, it is important to understand why some ranchers are willing to implement innovative practices to remain in business, while others choose to sell. In order to preserve these working lands, we need to understand more of the underlying reasons for why ranches are sold and why ranchers in some cases choose to remain stewards of the land. While profit maximization may not be the sole or even primary goal for many landowners, financial viability – in the near-term and longer term – remains a necessary condition for maintaining ownership. This reality highlights the need for ranch business models to continue evolving to address current and expected future challenges and opportunities that could create more profitable and resilient strategies.

Many interrelated factors affect the ability of ranchers to maintain their operations, both economically and environmentally. The literature review portion of this thesis is an effort to understand current knowledge regarding several important aspects of maintaining working ranches as viable livelihoods. Key questions addressed in this literature review include: What is the value of open space and rangelands to conservation objectives? Why is it important to practice conservation on private land? What motivates ranchers to continue ranching or to sell

their property? What factors affect the adoption of innovative conservation practices? How might emerging PES programs assist ranchers in remaining economically viable?

The Value of Open Space and Rangelands to Conservation Objectives

Twenty-five percent of land in the West has been converted to exurban development (defined as one house per approximately 40 acres) (Talbert, Knight, & Mitchell, 2007), which creates ecological as well as economic concerns. Residential infrastructure causes increased water runoff, soil erosion, and the suppression of natural fire (Jensen, 2001). In Larimer County, CO, when ranches are subdivided, there is a resulting tenfold increase in road and housing density (Knight, 2007). Low-density developments may appear more natural than urban areas, but research has shown that exurban land attracts invasive species and supports less native biodiversity than open or undeveloped land (Knight, et al., 1995; Knight, & Gilgert, 2006; Lenth, et al., 2001; Maestas, et al., 2003; Talbert, et al., 2007). Private ranches have been found to have greater vegetative cover, less non-native vegetation, and more native bird species than exurban developments (Maestas, et al., 2001; Maestas, et al., 2003). It has also been found that development is a leading cause of declining threatened and endangered species populations, and that private grazing lands form important buffers around public land (Brunson & Huntsinger, 2008; Talbert, et al., 2007). Grazing can also be used to reduce fuel loads, thereby reducing the risk of destructive wildfires and invasive species (Brunson & Huntsinger, 2008).

In addition to ecological values, open space has been shown to have financial benefits for communities. The cost of municipal services generally causes a fiscal deficit with residential development, while open space creates a surplus (Fausold & Lilieholm, 1999). Additionally, home and property values generally increase when located near open space, parks, or even

undeveloped rangeland. These open spaces create recreational opportunities near population centers. Migration to the West has been shown to be more related to the value of natural amenities and recreation opportunities than to financial reasons (Brown, Johnson, Loveland, & Theobald, 2005; Fausold & Lillieholm, 1999; Hansen, et al., 2002; Shumway & Otterstrom, 2000). Although open space values are not always evident in traditional markets, votes on state and tax bond measures indicate that communities do value open space, and these values increase with population growth and development (Kline, 2006). Between 1999 and 2004, the State of Colorado approved over \$1 billion in measures to preserve open space (Kline, 2006). According to Sargent-Michaud (2010), the State of Colorado has invested \$595 million in conservation easements since 1994, and has made a return on investment of \$6 for every \$1 when factoring in the worth of protected ecosystems and their associated ecosystem services.

Conservation development, which considers the ecological characteristics of a site, has been proposed as a way to protect the most important pieces of a property while simultaneously building new homes (Milder, 2007; Pejchar, Morgan, Caldwell, Palmer & Daily, 2007). This development technique has the potential to preserve open space and species habitat, but needs to be implemented using appropriate scientific knowledge of local ecosystems. Cluster developments, a type of conservation development, generally contain the same number of houses as a regular development, but use smaller plots, leaving the remainder of the land in a conservation easement. While cluster developments have the potential to decrease impacts on natural areas, their design and implementation needs improvement. Most cluster developments are either placed in the middle of a land tract or are long and narrow, meaning that much of the “open space” is still affected by homes as well as increased human traffic and animals (Lenth, et al., 2006). If planning and management of these developments are improved, including

connecting undeveloped areas across the landscape and performing land stewardship activities, they may help create ecosystem buffers (Fausold & Lilieholm, 1999; Lenth, et al., 2006; Liffman, et al., 2000; Milder, 2007; Pejchar et al., 2007).

As these studies suggest, working rangelands have many values including supporting biodiversity, increasing nearby home prices, and providing other unmeasured or more intangible values such as quality of life and aesthetic beauty. These factors contribute to the importance of conserving private, as well as public, lands.

Expanding Conservation on Private Lands

Over half of the land in the United States is privately owned, with 40% in Larimer County under private ownership (Ernst & Wallace, 2008). While this means that 60% of land in Larimer County is public, private lands have certain characteristics that make them vital for landscape-scale conservation. Private lands generally have better water, more productive soil, and, in some cases, more biodiversity than public lands (Knight, 2007; Hilty & Merenlender, 2003; Odell & Knight, 2001). In Colorado, private lands are also located in the more productive lower elevations (Knight, 2007). Livestock grazing mimics historic disturbance regimes, creating a more heterogeneous environment that increases biodiversity and habitat values for some species (Toombs & Roberts, 2009). In the U.S., private lands provide at least some habitat for 95% of endangered species, and they are the only suitable habitat for 19% of these species (Hilty & Merenlender, 2003).

The disparity in quality between public and private lands in the West can be traced back to the federal government's push to advance westward land settlement. Settlers in the arid West built their homesteads in the lower elevations where the soil and water were more abundant,

leaving the mountainous areas under federal control (Wiebe, Tegene, & Kuhn, 1999). In the 1930s, overgrazing and inappropriate crop cultivation in the Midwest and Great Plains led to the Dust Bowl; the major concern now is development overtaking farmland and rangeland (Wiebe, Tegene, & Kuhn, 1999; USDA Forest Service, 2007). In the USDA Forest Service Open Space Conservation Plan, an explicit goal is “conserving working lands as sustainable forests and grasslands” (USDA Forest Service, 2007, p. 3). Additionally, the Forest Service cites emerging PES programs from private lands as a necessary component of a nationwide conservation strategy.

Urban land uses generally have the highest market value, meaning the opportunity costs of not developing an area are extremely high. Agriculture has the second highest land-use value and also accounts for many acres, but profit margins are often so low that it can be difficult for ranchers or farmers to allocate resources to non-market activities such as conservation (Ingram & Lewandrowski, 1999). Conservation policies that allow landowners to benefit from the value of ecosystem goods and services from their property are being increasingly used (Ingram & Lewandrowski, 1999). The USDA Natural Resources Conservation Service (NRCS) implements some of the largest voluntary conservation programs in the world. For example, the Environmental Quality Incentives Program (EQIP) promotes the integration of agricultural practices with environmental improvement (Toombs & Roberts, 2009). Incorporating payments for public environmental benefits into ranch business models can increase the likelihood that landowners will voluntarily adopt conservation practices.

Rancher Motivations

Multiple factors, internal and external to a ranching operation, have been identified as playing integral roles in decisions made by ranchers about whether to continue in their traditional livelihood or sell their property. While profitability factors into the decision for ranchers to remain in the business, most respondents indicate that they are more influenced by family tradition, lifestyle values, and connection to the land (Bartlett, et al., 1989; Gentner & Tanaka, 2002; Liffman, et al., 2000; Menke & Bradford, 1992; Smith & Martin, 1972; Rowe, et al., 2001). The majority of ranchers rank tradition and family values as primary reasons for remaining in the ranching business (Bartlett, et al., 1989; Gentner & Tanaka, 2002; Liffman, et al., 2000; Menke & Bradford, 1992; Smith & Martin, 1972; Rowe, et al., 2001). Most ranchers also feel strong ties to the land and have a strong land stewardship ethic (Bartlett, et al., 1989; Jackson-Smith, et al., 2005; Knapp & Fernandez-Gimenez, 2009).

Many new ranch owners purchase land for amenities such as natural beauty and recreation opportunities, rather than profit (Gosnell & Travis, 2005; Liffman, et al., 2000; Peterson & Coppock, 2001; Rowe, et al., 2001), and often ranchers depend on off-ranch income to maintain their lifestyles (Jackson-Smith, et al., 2005; Kennedy & Brunson, 2007; Peterson & Coppock, 2001; Rowe, 2001). For instance, Jackson-Smith, et al. (2005), found that only 30% of ranchers surveyed in Utah and Texas realized a profit directly from their ranching operation, and the majority of these ranchers relied on off-ranch income. Ranchers also place importance on profit, but this value is more prevalent when the landowner relies on the ranch for his or her livelihood and also views finding an outside job as difficult (Bartlett, et al., 1989; Rowe, et al., 2001).

In general, social, economic, and political factors seem to affect ranchers' decisions more than technology and information (Coppock & Birkenfeld, 1999; Peterson & Coppock, 2001; Sayre, 2004). For instance, ranchers in Utah identified access to public land as a major threat because it would severely limit the grazing land available to them. Access to information and technology was cited as far less important (Coppock & Birkenfeld, 1999).

Ranchers face many threats and reasons for choosing to leave the ranching business. Encroaching development causes a feeling of "impermanence," and can lead to land sales due to the perceived inevitability of urbanization (Liffman, et al., 2000; Rowe, et al., 2001; Sulak & Huntsinger, 2007). Development also creates peripheral problems for ranchers such as regulatory changes (e.g., noise ordinances) (Berry & Plaut, 1978; Rowe, et al., 2001) and loss of a "critical mass" of producers (Rowe, et al., 2001). When a community loses enough agricultural producers, many suppliers and supporters go out of business. Ranchers can also lack neighbors who traditionally pool resources and share in heavy work (Rowe, et al., 2001). When faced with policy changes such as decreased access to public land or increased grazing fees, ranchers may sell the ranch before diversifying (Coppock & Birkenfeld, 1999; Peterson & Coppock, 2001).

Other perceived threats to ranching include the presence of threatened and endangered species, wilderness designations, regional planning, increasing recreation on public land, trespassing, (Liffman, et al., 2000; Rowe, et al., 2001; Sulak & Huntsinger, 2007), increased grazing fees, and reduction of grazing allotments (Coppock & Birkenfeld, 1999; Didier & Brunson, 2004; Gentner & Tanaka, 2002; Liffman, et al., 2000). Agriculturists are an aging population (Brunson & Huntsinger, 2008; Gale, 2003), and the lack of a successor after impending retirement is also cited as a common reason for selling a ranch (Lambert, Sullivan,

Claassen, & Foreman, 2007; Liffman, et al., 2000; Rowe, et al., 2001; Sulak & Huntsinger, 2007).

Factors Affecting Adoption of Innovative Practices

Despite the many challenges facing ranchers today, some producers are willing to adopt innovative practices expected to enhance their traditional ranching operation as well as provide conservation benefits. Innovations are practices or ideas that are perceived as new and are generally adopted more quickly if they are simple to implement, more effective than current practices, and in line with existing values (Rogers, 1995). Innovative ranching practices may include fencing, water development, rotational grazing, monitoring, or diversification of business practices such as hunting leases, ecotourism, enhancement of soil carbon sequestration, or protection and improvement of wildlife habitat. Researchers have tried to pinpoint factors that influence ranchers to adopt conservation-enhancing innovative practices. Studies have shown that innovative practices are more likely to be adopted if they are simple to implement, low cost, have a direct connection to production, and are under the landowner's control (Coppock & Birkenfeld, 1999; Daniels, 2001; Didier & Brunson, 2004). Olenick, Kreuter, and Conner (2005) found that flexibility, a relatively short program time limit, and voluntary participation were important factors for landowners to enroll in a cost-sharing land management program. More innovative producers also tend to have higher income, a greater stated concern for land stewardship, (Peterson & Coppock, 2001; Selfa, Jussaume, & Winter, 2008) and are more likely to hold a public grazing permit (Peterson & Coppock, 2001). Permittees generally depend more on livestock for their income, which may account for taking more innovative actions in their business as they attempted to adapt to new federal regulations. They have fewer revenue

alternatives than producers who earn more off-ranch income. Ranchers who depend on livestock and expect their children to continue in the business are also likely to be more innovative (Didier & Brunson, 2004; Kennedy & Brunson, 2007).

Coppock & Birkenfeld (1999) categorized ranchers into five groups: Large-Scale Operators, Private Hobbyists, Public Hobbyists, Private Ranchers, and Public Ranchers. The Large-Scale Operators tended to have higher incomes, higher education, more land and livestock, and considered themselves innovators. This group had the highest rate of use of innovative management practices. Private Ranchers, who depended on livestock for income and used less public grazing land than other groups, followed the Large-Scale Operators on innovative practices. Both groups of Hobbyists, who depended the least on livestock for income, did not consider themselves innovators and tended to use fewer innovative practices.

Rogers (1995) defined five types of innovation adopters: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. In order for an innovation to diffuse throughout a community, a heterogeneous mix of these individuals is needed. Innovators tend to be better off financially and willing to take risks; it appears that the Large-Scale Operators may fill this role by being profit-driven and having the ability to take financial risks. Early Adopters are willing to try new things but are more connected to the community, so are essential for spreading an innovation to the majority. The Private Ranchers may act as Early Adopters after witnessing positive results experienced by the Large-Scale Operators. Didier and Brunson (2004) interviewed a subset of those in the Rancher categories who were identified as innovators by key informants. Along with concern for the land and maintaining a traditional lifestyle, respondents indicated that having large social networks and contact with extension agencies prompted them to innovate. This supports Rogers' (1995) hypotheses that innovators tend to have many social

connections and will adopt practices after they have observed others' results. Rogers (1995) also identified that innovations are adopted more quickly when they have a relative advantage over current practices, are compatible with the adopter's values, are fairly simple, are able to be implemented on a trial scale, and have quickly observable results. Ranchers appear to fit this model (Didier & Brunson, 2004).

Ranchers may innovate to increase profits, but also to demonstrate good land stewardship to communities and public agencies (Didier & Brunson, 2004; Ernst & Wallace, 2008; Kennedy & Brunson, 2007). Ranchers may also choose to adopt innovative conservation strategies to protect open space, scenic views, and wildlife habitat (Ernst & Wallace, 2008; Wallace, Theobald, Ernst, & King, 2008). Motivations for innovation adoption also include preservation of rangeland health, forage production, and water quality (Ernst & Wallace, 2008; Kennedy & Brunson, 2007). Additionally, landowners who form clear goals regarding their operations are more likely to implement change (Ernst & Wallace, 2008; Kennedy & Brunson, 2007; Kreuter, et al., 2006). Finally, adoption of innovative conservation practices has been linked to the propensity for business diversification, which has also been linked to agriculturalists relying on their farm or ranch for their livelihood (Barbieri, Mahoney, & Butler, 2008).

Ranchers are more likely to heed new information when it comes from close sources such as peers, family, or trusted agency members (Kennedy & Brunson, 2007). This information should also be clear and easily accessible (Kreuter, et al., 2005). Consequently, they are more likely to adopt innovative practices when information encouraging them to do so is provided by trusted sources, or if they see positive results on neighboring properties (Didier & Brunson, 2004; Kennedy & Brunson, 2007; Kreuter, et al., 2005). The most trusted sources generally include other ranchers, relatives, peers, cattle growers' associations, and range consultants

(Fernandez-Gimenez, McClaran & Ruyle, 2005a). Ranchers also tend to prefer receiving information in-person at workshops or individually (Fernandez-Gimenez, Ruyle, & McClaran, 2005b).

Demographic factors such as education and income have weak correlations with adoption of innovative practices, but results are not consistent. For example, Selfa et al. (2008) and Lambert et al. (2007) found that younger, more educated farmers were more likely to adopt sustainable agricultural practices. However, Talbert et al. (2007) found that younger, more educated ranchers were more likely to have disagreements with the BLM or USFS, and therefore, they were less likely to cooperate with recommended best management practices. Jackson-Smith et al. (2005) also found that intermediate income, education, and age levels were associated with interest in protecting private property rights, meaning that these producers were less willing to manage for wildlife, water quality, or weeds.

Barriers to innovation include uncertainty about policy regarding public land permits, competition with wildlife, and liability if allowing hunting or recreation (Didier & Brunson, 2004). Time and money constraints have also been cited as barriers to changing management practices (Didier & Brunson, 2004; Kennedy & Brunson, 2007; Lambert et al., 2007). Beliefs about property rights may also affect management decisions made by ranchers (Brunson & Huntsinger, 2008; Jackson-Smith et al., 2005; Kreuter et al., 2006), and may preclude some landowners from participating in government payment programs or conservation practices. Most ranchers believe their rights include exclusive access to and use of resources on their land and the ability to sell it (Jackson-Smith et al., 2005). Most also believe that societal regulations threaten property rights (Jackson-Smith et al., 2005). However, in conjunction with property rights, most ranchers also believe they have the responsibility to be good stewards of the land.

These beliefs tend to be more related to environmental values than social responsibility values, but, due to wide variation, information and education need to be disseminated in ways that address different belief systems (Jackson-Smith et al., 2005).

Decreasing ecosystem degradation may depend on well-defined property rights, regulation of common pool resources, and capitalizing on community leaders with high social responsibility (Kreuter, et al., 2006). If trusted local leaders demonstrate social responsibility, other community members may be more likely to follow suit (Kennedy & Brunson, 2007; Kreuter et al., 2006). Understanding property rights orientations will be important in affecting positive land management changes. Those areas with stronger feelings of private property rights protection may need more individual incentives. It will also be important to enhance property rights for those who feel they are being eroded and to increase social responsibility (Kreuter et al., 2006).

In summary, ranchers are more likely to adopt innovative practices if they depend on livestock for income and believe that their family traditions will continue in the future. They are also more likely to adopt conservation management practices if they feel high land stewardship responsibility or high social responsibility. It is important to understand community dynamics in each locality in order to tailor education and technology transfer of new conservation practices. Innovative practices involving conservation have the potential to enhance revenue for ranchers in the form of existing and emerging payments for ecosystem services, discussed in the next section.

Payments for Ecosystem Services and Working Lands

A possible solution to protecting ecosystem services is to bring these public goods into the market arena. Wunder (2005) formally defined *payments for ecosystem services* (PES) as

1. A *voluntary* transaction where
2. A *well-defined* ES (or a land use likely to secure that service)
3. Is being ‘bought’ by a (minimum one) ES *buyer*
4. From a (minimum one) ES *provider*
5. If and only if the ES provider secures ES provision (*conditionality*)

(Wunder, 2005, p. 3).

Payments for ecosystem services may present opportunities for landowners to develop more diversified ranch business models that achieve financial and conservation outcomes by “stacking” livestock revenue with PES revenue (Daily et al., 2009; Goldstein, et al., 2006). In Hawaii, a ranch-level financial analysis showed that stacking of revenue streams including government conservation subsidies, payments for carbon sequestration, and development of forest resources could increase cash flow for ranchers (Goldstein et al., 2006). In Montana, Sun Ranch was the first ranch to receive a payment of \$30,000 for selling rangeland carbon offset credits through the Chicago Climate Exchange (Ahearn, 2009; Skaggs, 2008). This activity was layered on top of continued livestock grazing.

As an example of a pilot PES program in a livestock context, the Florida Ranchlands Environmental Services Project pays ranchers to increase water storage and reduce phosphorus loads draining into Lake Okeechobee. This program attempts to base payments from state agencies on services actually measured and delivered, rather than basing payments on management actions. Problems have included high transaction costs and difficulty with service

verification (Bohlen et al., 2009). High transaction costs often stemmed from the need to negotiate through regulations managed by multiple state and federal agencies. Bohlen et al. found that effectively negotiating with outside regulatory agencies helped reduce paperwork, increase participation, and reduce transaction costs. Additionally, Bohlen, et al. (2009) discussed that ranchers requested post-contract flexibility in order to retain the option of returning their property to its pre-contract state. Another barrier often cited when implementing PES programs is providing transparency in contract rules to the participants, both buyers and sellers (Bohlen et al., 2009). In order to maintain transparency and build trust among new partners in a PES programs, collaboration is needed among all participants, and it is helpful to employ innovative leaders across the public, private, nonprofit, and academic sectors (Bohlen et al., 2009).

For a PES program to be considered legitimate, payments must result in additionality, or provision of a service that would not have been provided otherwise (Asquith, Vargas, & Wunder, 2008; Engel, Pagiola, & Wunder, 2008). Additionality is important because it is not economically efficient to pay a landowner to utilize land management practices that would have been implemented anyway. However, it is also important to consider the moral hazard of only compensating landowners who were poor land stewards in the past. Those landowners who have been consistently responsible may want a legitimate way to participate in a PES program as well (Kaimowitz, 2008).

Research questions

Motivated by recognition of the need to better understand current ranch business models and how they can be enhanced or modified to incorporate conservation-oriented income sources (e.g., PES) alongside livestock income, my thesis project investigated the following research questions:

1. What are the general types of business models currently supporting working ranches, and how are conservation practices integrated into these models?
2. What are the major challenges facing working ranches, and how are ranchers thinking of addressing these challenges through new business models involving changes to management practices or incorporating new income streams?
3. Given the growing interest in and implementation of PES programs in working lands contexts, what are the barriers and opportunities for using PES as a tool to support, and likely diversify, business models for working ranches that are linked with enhanced conservation outcomes?

Thesis Organization

Chapter 1 (this chapter) provided an introduction to the research and an in-depth literature review of pertinent knowledge regarding the value of working rangelands, rancher motivations, factors

affecting adoption of innovative practices, and current knowledge of PES programs. This chapter ended by stating the primary research questions that are addressed in my thesis project.

Chapter 2 describes the methodology, results, and discussion of the research undertaken for my thesis project.

Chapter 3 is a summary report written for an audience of ranchers, natural resource professionals, and other stakeholders in the study system, and in the conservation and rangelands communities more broadly, who may be interested in better understanding the challenges and opportunities for developing more diversified ranch business models that deliver financial and conservation outcomes, including a particular focus on PES programs.

CHAPTER 2

DIVERSIFYING RANCH BUSINESS MODELS: CHALLENGES AND OPPORTUNITIES

IN LARIMER COUNTY, COLORADO

RESEARCH METHODS, RESULTS, AND DISCUSSION

Introduction

The objective of this research was to investigate the challenges and opportunities for developing diversified ranch business models that could align conservation and financial outcomes for working ranches across the western United States. Our analysis reports on a case study from Larimer County, Colorado of ranchers and practitioners working closely with the ranching community and affiliated with a regional collaborative stakeholder group. To restate, the primary research questions are as follows:

1. What are the general types of business models currently supporting working ranches, and how are conservation practices integrated into these models?
2. What are the major challenges facing working ranches, and how are ranchers thinking of addressing these challenges through new business models involving changes to management practices or incorporating new income streams?
3. Given the growing interest in and implementation of PES programs in working lands contexts, what are the barriers and opportunities for using PES as a tool to support, and likely diversify, business models for working ranches that are linked with enhanced conservation outcomes?

Study System

Larimer County, located in north central Colorado, encompasses 2,640 square miles and is the seventh largest county in Colorado by population. While 60% of the county is publicly owned, it also contains productive irrigated farmland, ranchland, and several urban areas, with Fort Collins being the largest city at 298,392 people in 2009 (U.S. Census Bureau, 2010). Private

lands are predominantly found in the lower elevations, and the working agricultural lands are subject to multiple factors (e.g., development pressure, marginal profitability of livestock grazing) that threaten their conversion to other uses. In Larimer County, only 40,000 acres (3%) of private lands, which are predominantly found in the lower elevations, are conserved under an easement or other method (Wallace et al., 2008). Across Colorado, 2.89 million acres were developed between 1992 and 2006, and the state is projected to lose a total of 3.1 million acres by 2030 (Environment Colorado Research and Policy Center, 2006). This situation is part of a larger national trend of loss of working landscapes to development.

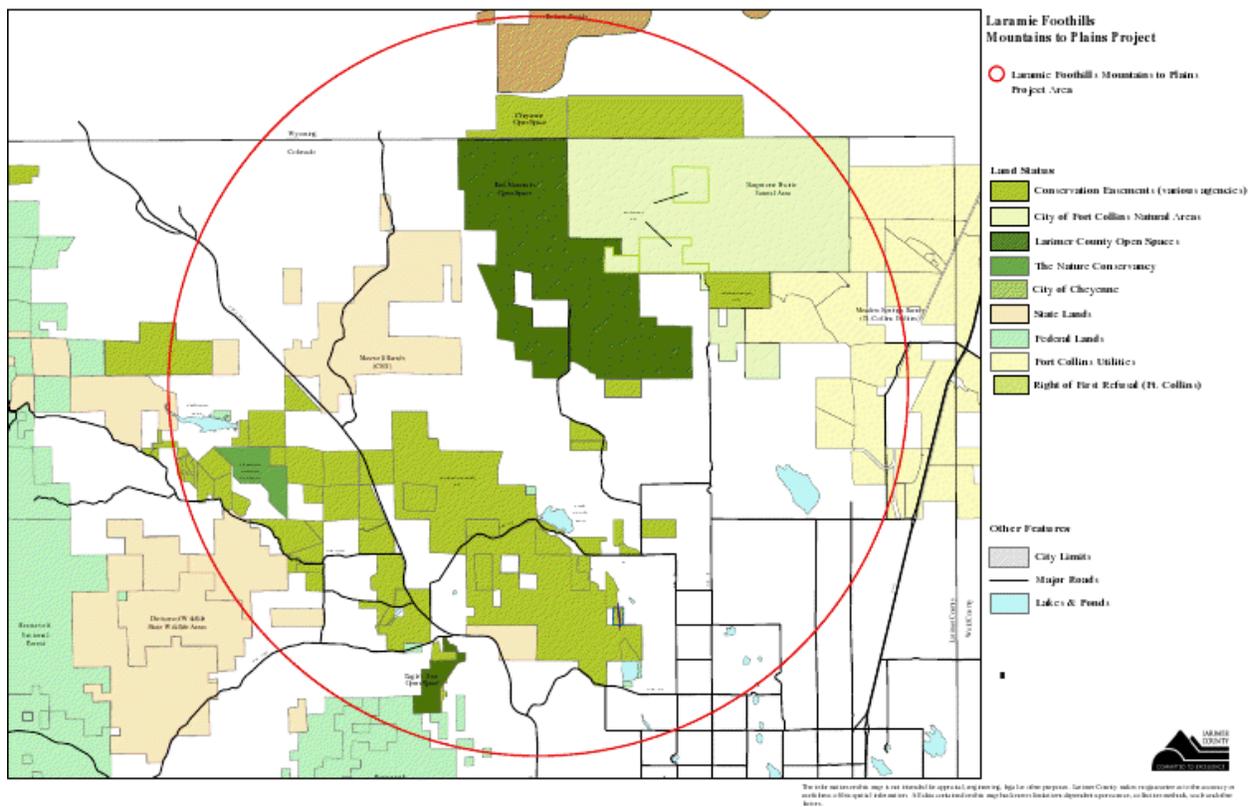


Figure 1 Map depicting Larimer County's "Mountains to Plains" corridor. Larimer County website: http://larimer.org/naturalresources/laramie_foothills.htm

Larimer County is part of the Laramie Foothills “Mountains-to-Plains” corridor, a 220 square mile conservation-production landscape on the Colorado-Wyoming border (Fig. 1). The landscape includes shortgrass prairie, foothills shrublands, and numerous riparian areas. In an

effort to conserve undeveloped land for biodiversity and recreation purposes, Larimer County has partnered with the City of Fort Collins, The Nature Conservancy, and Great Outdoors Colorado to purchase or protect over 50,000 acres (Resnik et al., 2006).

This landscape provides an excellent study system to investigate the challenges and opportunities of developing diversified business models that achieve conservation and livelihood objectives on working ranches. First, the region is representative of the dynamic land use and socioeconomic changes occurring throughout rangeland systems in the western US that are in close proximity to urban populations. Second, there is a sustained history of livestock grazing in the region, with some lands having been used for cattle production for over 100 years. Most livestock operations are currently run as cow/calf operations. Third, from a conservation perspective, this region represents a major habitat corridor linking mountains to plains along the Colorado Front Range. Finally, this region contains an active collaborative stakeholder group called the Laramie Foothills Advisory Committee (LFAC), which served as the basis of our study population, as well as a connection to other landowners in the region (described below). LFAC involves participation from private landowners, public agencies (city, county, state, and federal), The Nature Conservancy, land trusts, researchers, and local food organizations. LFAC is working collaboratively across public and private lands to identify strategies to sustain agricultural production and enhance landscape-scale conservation.

We have participated as researchers in LFAC meetings since fall 2008, and this study's focus on investigating the potential for new, more diversified ranch business models that integrate livestock and conservation income streams originated from stakeholder discussions. As an exploratory study with a targeted, nonrandom study population, the information that we report should be interpreted primarily upon the range of issues identified by project respondents that

will be important to consider in exploring new ranch business models. An important caveat is that we do not imply that our results are generalizable or comprehensive of viewpoints across the western US. Rather, our exploratory findings are designed to provide an initial scoping from a group actively considering new ranch business models that can inform future research.

Methods

We engaged two target populations involved in LFAC: private ranchers and practitioners from public agencies and nongovernmental organizations. We asked practitioners for answers based on their knowledge and perceptions of ranchers in their community, rather than their agency perspectives. Accordingly, we chose to include practitioner responses not to compare their responses in either range or frequency with ranchers, but rather to develop a more complete set of responses for the rancher study population. We used a combination of a purposive and snowball sampling methods (Neuman, 2003) to identify potential participants. For the purposive sampling, we worked with a key informant who has been living and working in the Laramie Foothills for over 20 years. This person provided us with a list of ranchers in the area, representing small, medium, and large producers, as well as practitioners working with these ranchers. We used this list of 37 individuals (30 ranchers, 7 practitioners) as our sampling frame and attempted to contact all 37 potential interviewees. The initial contact was made by either the key informant or a contact with the Colorado Cattlemen's Association (CCA) to briefly explain the purpose of the study by a trusted person. If the potential interviewee agreed to be contacted by the researcher, we then called him or her to explain the objective of the study, to describe the interview content, and to schedule an in-person meeting time and location. We conducted a total of 23 interviews (~62% response rate) between August 2010 and February 2011. These

interviews involved a total of 25 individuals, as two rancher interviews had two people participate. There were 18 ranchers (comprising 16 ranch units) and 7 practitioners. Three ranchers declined to participate after being contacted by the initial representative, and we did not hear back from the remaining 11 ranchers after leaving three phone messages at various times of day. We conducted analysis concurrently with gathering data, so we discontinued making additional phone calls when we felt that no new information was emerging (Strauss & Corbin, 1998).

We collected information through a topic-driven semi-structured interview followed by a short, quantitative survey. Combining qualitative and quantitative methods in a research study can be a valuable way to collect a wider array of information to provide new insights beyond a single method approach (Russell & Harshbarger, 2003; Miles & Huberman, 1994). We pilot tested the integrated interview-survey instrument with our key informant to ensure that questions were clear, comprehensive, and of a reasonable length. The feedback obtained from this test resulted in a minimally revised question set. Participant interviews lasted between 45 and 120 minutes, and the surveys took between 2 and 5 minutes. All interviews but one were audio-recorded and transcribed. One participant did not wish to be recorded, so detailed notes were taken by hand. The interview and survey instruments are provided in the Appendix.

Analysis

Audio-recorded interviews were transcribed and notes from the non-recorded interview were typed to enable coding in NVivo 8.0 software. We used the three level coding procedure of open coding, axial coding, and selective coding (or coding for process) (Strauss & Corbin, 1998; Neuman, 2003). Open coding was performed on a line-by-line basis during the first pass through each transcript. We developed codes as we discovered new themes and topics, for example,

when a participant mentioned water scarcity as a major challenge, this was coded under *Challenges: Ecological: Water scarcity*. Open coding helped identify themes and also provided a signal for data saturation (Strauss & Corbin, 1998), as fewer and fewer new codes were uncovered with each successive interview. Axial coding involved making a second pass through the transcripts in order to identify broader themes, which were then related back to codes and subcategories. For example, participants identified various cost reducing strategies to increase profitability, which led to the broader theme of *Reducing costs*. We also re-examined codes for appropriateness and clarity during this analysis. Strauss & Corbin (1998) describe coding for process as identifying a central category and integrating concepts; essentially, this is developing the final theory. However, as our research objectives were geared more towards a set of findings than developing an overarching theory, integration was less relevant (Strauss & Corbin, 1998). Therefore, we followed Neuman's (2003) approach of selective coding. This involved scanning our data, codes, and themes for illustrative and comparative cases, as well as connecting related themes. We used selective coding to identify illustrative quotes interwoven in our results section. In addition to qualitative coding, we used quantitative frequency counts to document the number of participants who discussed each challenge, practice, barrier, opportunity, or other important factor. As noted above, since this is exploratory research, we considered the range of responses in addition to the frequency each response was given.

Results

Study Population

Of the 18 ranchers interviewed (comprising 16 ranch units), age ranged from 38 to 80, with an average age of 60 years. Eight of the rancher interviewees were female and ten were

male; both of the two-person interviews were with one female and one male. In terms of highest-level of education, two ranchers had a PhD, four had a Master's degree, four had a Bachelor's degree, two had an Associate's degree, three had high school diplomas, and two had not completed high school. Of those with advanced degrees, educational programs included animal science, biochemistry, agricultural economics, sociology, business administration, physiology, marketing, nursing, and divinity. Throughout the remainder of this paper, we will refer to the number of ranchers according to the 16 ranch properties, not the 18 individuals, as those who participated in double interviews did not differ in their interview responses regarding their operation. When considering only the ranch's deeded acres, seven ranches were small (0 to 999 acres), six were medium (1,000 to 11,999 acres), and three were large (12,000 or more acres). Four ranches only consisted of deeded acres with no private or public leased land. Two ranches depended on only private leases, five depended on both private and public leases, and five depended on only public leases. When considering the deeded as well as leased acres, three ranches were small (0 to 999 acres), seven ranches were medium (1,000 to 11,999 acres), and six ranches were large (12,000 or more acres). Thirteen of the ranchers had active cattle herds, and the remaining three leased pastures to other ranchers for cattle grazing. In terms of ranch history, six ranches had been in the family for multiple generations (at least 40 years), six had been under the same ownership for at least 20 years (but less than 40), and four had been under the current operation for less than 20 years.

The seven practitioners worked for the City of Fort Collins Natural Areas, Larimer County Natural Resources, The Nature Conservancy's Colorado chapter, City of Fort Collins Water Utility, the USDA Forest Service, the USDA Natural Resource Conservation Service (NRCS), and the Colorado Division of Wildlife. All worked closely in some capacity with

ranchers and landowners in our study region. Ages ranged from 33 to 62, with an average of 44 years. Four interviewees were male, and three were female. Regarding highest-level education, three had a Master's degree and four had a Bachelor's degree in educational programs including industrial science, ecology, wildlife biology, natural resources, and range science. Practitioners had been working in a natural resource related field from seven to 35 years, with an average of 20 years.

Current Situation

Ranchers and practitioners discussed the current situations that ranchers in the Laramie Foothills are experiencing. We first describe current ranch business models, meaning the general strategies that ranchers use to earn income and the financial profitability of the operation. Then we discuss current management practices used by ranchers in our study region, focusing on those practices that are related to land or natural resource stewardship.

Current Ranch Business Models

We identified three general business models among our participants that describe the income ranches receive from livestock, other on-ranch income sources, and off-ranch income sources. The first business model is that the ranching operation loses money and is financed through outside income (4 ranches in our study population). One ranch had an active cattle herd, but most income came from an investment property that the rancher leased back to graze cattle. Two ranches had fairly large cattle herds which were generally sold through the regional cattle auction, but most income came from off-ranch jobs. The final ranch was part of a landowner's association, in which some landowners owned cattle, but much of the common ground was

leased out to other ranchers. These leased pastures provided a small amount of income for the landowner.

The second general business model is that the ranching operation earns a minimal amount of money which supplements other on-ranch and/or off-ranch income (8 ranches). One ranch earned most of its income from its hospitality business, and it also sold grassfed beef. Another ranch earned some income from a small cattle herd grazed on leased property, but the majority of revenue for this ranch came from the rancher's off-ranch employment. Two ranches had active cattle herds but only during certain months; generally a partner would manage the herd during the other months and the interviewees earned most of their income through off-ranch sources. These cattle were sold at the auction. Two other ranchers had a small active herd for a few months, and these cattle were sold privately as grassfed beef and brought in a minimal amount of revenue. One of these ranchers had an off-ranch job, and the other worked as the ranch manager. The latter landowner's business model fits this category but not as clearly as the other examples. Two ranches leased their land out to other ranchers for grazing purposes only, which brought in some supplemental income to their off-ranch jobs.

The third general business model is that the ranching operation is the main source of income for the rancher, with little or no other on-ranch or off-ranch income (4 ranches). One ranch earned most of its income from livestock and crops, but also had numerous other small revenue contributions, such as a cell phone tower and government Environmental Quality Incentives Program (EQIP) money. Three ranches earned almost all of their income from livestock, but one sold cattle using a video auction, one used contracts with a private buyer, and one held its own sale.

The majority of ranchers stated that they earned most of their income from off-ranch sources, and all had at least some income provided by activities unrelated to cattle. Practitioners gave their responses based on their observations of ranchers' income sources in the community. Of the 32 income sources cited, *other jobs* (cited by 11 ranchers and 4 practitioners), *land sales* (5 ranchers, 2 practitioners), *investments* (3 ranchers, 1 practitioners), and *hospitality* (1 rancher, 1 practitioners), were the only non-cattle sources reported by ranchers as providing a substantial amount of revenue to the ranch operation (Table 1). Selling *hay* (6 ranchers, 4 practitioners) and participation in *federal government programs* (6 ranchers, 5 practitioners) were mentioned by several ranchers, but these sources did not provide much income.

Table 1: Income sources mentioned by interviewees other than traditional cattle; listed in order from most to least mentioned by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

Other Income Source	Ranchers (N = 16)		NR Professionals (N = 7)	
Other jobs	11	69%	4	57%
Conservation Easements	7	44%	6	86%
Any Government Grant	6	38%	5	71%
Hay	6	38%	4	57%
EQIP Grant	5	31%	4	57%
Land sales	5	31%	2	29%
Hunting Licenses	3	19%	5	71%
Investments	3	19%	1	14%
Rental houses	3	19%	0	0%
Cell tower	2	13%	1	14%
Grazing lease	2	13%	0	0%
Government Grant (general)	2	13%	0	0%
Habitat Partnership Program	1	7%	2	29%
Crops	1	6%	1	14%
Hospitality	1	6%	1	14%
Conservation Stewardship Program	1	7%	1	14%
Chickens	1	6%	0	0%
Lack of debt	1	6%	0	0%
Loan backs	1	6%	0	0%
Natural Beef	1	6%	0	0%
Pigs	1	6%	0	0%
Ranch Preservation Community	1	6%	0	0%

Refinance	1	6%	0	0%
State Rebate	1	6%	0	0%
Subsidized crop insurance	1	6%	0	0%
Team roping	1	6%	0	0%
Goats	1	6%	0	0%
Lease land to gun club	1	6%	0	0%
Moss rock	1	6%	0	0%
Oil	1	6%	0	0%
Vertical Integration	1	6%	0	0%
Conservation Reserve Program	1	7%	0	0%
Increased Carrying Capacity	0	0%	3	43%
Diversifying livestock, bison	0	0%	1	14%
Sheep	0	0%	1	14%
Weed Coop Seed Sharing	0	0%	1	14%
DOW Access Lease	0	0%	1	14%

Interviewees discussed seven different government programs being utilized by ranchers, either for additional income (such as grants) or cost-share assistance (such as the Environmental Quality Incentives Program, or EQIP). Six ranchers discussed involvement with at least one government program, and five practitioners mentioned programs that ranchers participated in. Government programs mentioned were *EQIP* (5 ranchers, 4 practitioners), the *Conservation Reserve Program (CRP)* (1 rancher), the *Conservation Stewardship Program (CSP)* (1 rancher, 1 practitioner), and the *Habitat Partnership Program (HPP)* (1 rancher, 2 practitioners). Also mentioned by one practitioner was *Colorado Division of Wildlife access leases*. EQIP seemed most often to be related to conservation practices such as water development for the cattle operation; ranchers stated that this was related to rotational grazing, as water development can allow more pastures to have a water source and therefore be better utilized. Furthermore, several participants stated that this practice could increase carrying capacity, which could lead to income enhancement.

Additionally, seven ranchers had conservation easements on their properties, held by various organizations including The Nature Conservancy, Larimer County, and Legacy Land Trust (a local land trust active in the study region.) Six practitioners discussed conservation easements as contributing to ranchers' income, because of the ability of landowners to take advantage of Colorado's income tax credit for eligible easements.

Current Management Practices

Interviewees mentioned 28 different management practices related to land or water stewardship. Of these, the most frequently mentioned practices were *rotational grazing* (14 ranchers, 5 practitioners), *weed management* (12 ranchers, 3 practitioners), and *water development* (9 ranchers, 5 practitioners). As noted by one participant, these practices are amongst a set of relatively "standard" practices employed by ranchers in the study region. Four participants discussed the fact that improved conservation practices have the potential to increase carrying capacity on the ranch, which could increase income through selling more pounds of beef. Another benefit of grazing, mentioned by four interviewees, is that cattle grazing can help control weeds. Fire mitigation was cited as another benefit of grazing by two participants, as grazing reduces fuel loads that can feed wildfires.

Table 2: Current conservation practices used by ranchers in the study region listed in order from most to least mentioned by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

	Ranchers (N = 16)		NR Professionals (N = 7)	
Rotational grazing	14	88%	5	71%
Weed Management	12	75%	3	43%
Water development	9	56%	5	71%
Conservation Easements	7	44%	6	86%
Grazing management plan	5	31%	4	57%
Fencing riparian areas	4	25%	3	43%
Erosion Control	4	25%	1	14%
Wildlife friendly fencing	3	19%	1	14%
Efficient Irrigation	3	19%	0	0%
Planting trees or grass	3	19%	0	0%
Solar pump	3	19%	0	0%
Change calving season	2	13%	1	14%
Grassfed beef	2	13%	1	14%
No antibiotics	2	13%	0	0%
Using horses for transportation	2	13%	0	0%
Lease pasture to other ranchers	2	13%	2	29%
Developing Wildlife Habitat	1	6%	2	29%
Cattle to control weeds	1	6%	1	14%
Organic crops or fertilizer	1	6%	1	14%
Windrow grazing	1	6%	1	14%
Composting	1	6%	0	0%
Goats for weed control	1	6%	0	0%
Integrated crops and livestock	1	6%	0	0%
Manure Management	1	6%	0	0%
Night friendly lighting	1	6%	0	0%
Pine beetle control	1	6%	0	0%
Sheep to control larkspur	1	6%	0	0%
Prescribed Fire	0	0%	2	29%
Wind energy	0	0%	1	14%

Current challenges and future concerns facing working ranchers

We asked interviewees to discuss current challenges facing working ranchers in our study region, as well as concerns they foresee in the future. As a matter of terminology for the remainder of this chapter, *current* challenges will be referred to as “challenges”, while *future*

challenges will be referred to as “concerns”. We have divided challenges and concerns into five general categories: ecological, financial, legal and policy, personal, and social. Participants identified a total of 58 current challenges (Table 3) and 70 future concerns (Table 4).

Table 3: Current challenges facing ranching operations discussed by interviewees organized into the five general categories of ecological, financial, legal and policy, personal and social challenges. Within each category, challenges are organized from most to least cited by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

	Ranchers (N = 16)		NR Professionals (N = 7)	
Ecological				
Water scarcity	12	75%	1	14%
Weeds	6	38%	0	0%
Wildlife conflict	4	25%	0	0%
Disease	3	19%	0	0%
Pine beetle	3	19%	0	0%
Rocky ground	3	19%	0	0%
Climate change	2	13%	1	14%
Floods	2	13%	0	0%
Larkspur	2	13%	0	0%
Fire	1	6%	1	14%
Ecosystem connectivity	1	6%	0	0%
High elevation weather	1	6%	0	0%
When to move cattle	1	6%	0	0%
Petroleum inputs required for agriculture	0	0%	1	14%
Financial				
Cost of inputs	15	94%	5	71%
Unprofitable	13	81%	6	86%
Scale	8	50%	3	43%
Taxes	7	44%	1	14%
Enough land	6	38%	3	43%
Insurance	6	38%	0	0%
Market prices	4	25%	1	14%
Marketing	4	25%	1	14%
Purchasing reliable livestock	1	6%	0	0%
Legal or Policy				
Regulations	8	50%	2	29%
Red tape (Bureaucracy)	5	31%	3	43%
Endangered Species Act	3	19%	1	14%
DOW kill deer due to CWD	2	13%	0	0%
Liability	1	6%	1	14%
Fees	1	6%	0	0%
Laws about hunting on own property	1	6%	0	0%
Mineral rights	1	6%	0	0%
No sheep grazing	1	6%	0	0%
Refinancing policies	1	6%	0	0%

Government owned land	1	6%	0	0%
Water rights	1	6%	0	0%
Focus on short term	0	0%	1	14%
Processing	0	0%	1	14%
Personal				
Time and energy	11	69%	3	43%
No heirs	4	25%	4	57%
Invasion of privacy or trespassing	3	19%	0	0%
Uncertainty	2	13%	0	0%
Finding information	1	6%	1	14%
Suspicious of recreational ranchers	1	6%	0	0%
Social				
Development pressure	10	63%	6	86%
Problems with neighbors	8	50%	3	43%
Regional changes	8	50%	2	29%
Public perception	5	31%	1	14%
Ranching vs recreation and wildlife	3	19%	2	29%
Few processors	3	19%	1	14%
Multiple landowners	3	19%	0	0%
Responsibilities, landowners and lessees	3	19%	0	0%
Keeping cattle where they belong	2	13%	2	29%
Fewer services	2	13%	1	14%
Grassfed beef characteristics	2	13%	0	0%
Theft	2	13%	0	0%
Access to property	1	6%	0	0%
Gender bias	1	6%	0	0%
Water competition ag vs municipal	1	6%	0	0%

Table 4: Future concerns expressed by interviewees organized into the five general categories of ecological, financial, legal and policy, personal and social challenges. Within each category, challenges are organized from most to least cited by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

	Ranchers (N = 16)		NR Professionals (N = 7)	
Ecological				
Additionality	4	25%	1	14%
Nothing to offer for carbon market	3	19%	0	0%
Overgrazing	2	13%	1	14%
Antibiotic resistant bacteria	2	13%	0	0%
No services to offer public	2	13%	0	0%
No water for water PES	2	13%	0	0%
Not enough grazing	2	13%	0	0%

Tradeoffs in new practices	2	13%	0	0%
Fragmentation	1	6%	1	14%
Petroleum inputs required for agriculture	1	6%	1	14%
4-wheelers	1	6%	0	0%
Effects of oil drilling	1	6%	0	0%
Pollution by trespassers	1	6%	0	0%
Trees in Colorado	1	6%	0	0%
Water quality for irrigation	1	6%	0	0%
Wolf reintroduction	1	6%	0	0%
Water Scarcity	1	6%	0	0%
Grassland carbon storage	0	0%	2	29%
Wind power vs wildlife	0	0%	2	29%
Feedlot nitrification	0	0%	1	14%
Financial				
Taxes	8	50%	1	14%
Financial profitability of PES	7	44%	0	0%
Broader economy	5	31%	1	14%
Economic sustainability	3	19%	5	71%
Price of carbon	3	19%	2	29%
Ranch as retirement fund	2	13%	0	0%
Infrastructure cost	1	6%	1	14%
Continuous production	0	0%	1	14%
Marketing	0	0%	1	14%
Quantifying ecosystem services	0	0%	1	14%
Legal and Policy				
Regulations	9	56%	3	43%
Red tape (Bureaucracy)	6	38%	1	14%
Ethical implementation of conservation easements	3	19%	0	0%
Lack of tax dollars	2	13%	1	14%
Liability	2	13%	1	14%
Monitoring and Verification	2	13%	1	14%
New practices required with programs	2	13%	1	14%
Reservoir projects	2	13%	1	14%
35 acre ranchettes	1	6%	0	0%
Conservation easement restrictions	1	6%	0	0%
Municipal control of water	1	6%	0	0%
Flexibility in projects	0	0%	1	14%
Implementation	0	0%	1	14%
Receiving a PES on a lease	0	0%	1	14%
Personal				
Invasion of privacy	8	50%	5	71%

Suspicious of government	7	44%	2	29%
Suspicious of carbon market	7	44%	0	0%
Uncertainty	6	38%	4	57%
Traditional thinking or fear of change	5	31%	7	100%
Time and energy	4	25%	4	57%
Changing ranch operation	4	25%	2	29%
Dubious heir	3	19%	1	14%
Grassfed characteristics	3	19%	0	0%
Suspicious of some NGOs	2	13%	1	14%
Multiple landowners	2	13%	0	0%
Lack of knowledge	1	6%	4	57%
Legitimacy of funding source	1	6%	0	0%
Suspicious of neighbors	1	6%	0	0%
Suspicious of oil companies	1	6%	0	0%
Suspicious of research	1	6%	0	0%
Lack of capacity	0	0%	2	29%
Social				
Ranches being subdivided	5	31%	4	57%
Public perception	4	25%	4	57%
Visual impact	3	19%	1	14%
Losing grazing lease	2	13%	1	14%
Moral hazard	2	13%	1	14%
Safe and healthy food supply	2	13%	0	0%
Growing population	2	13%	0	0%
Stuck at gathering information	1	6%	1	14%
Concentration of agriculture	1	6%	0	0%

Current Ecological Challenges

Ecological challenges were categorized as those challenges caused by or directly related to natural resources, natural disasters, climate, or wildlife. Fourteen ecological challenges in total were identified by interviewees (Table 3). The ecological challenge mentioned most often was *water scarcity* (12 ranchers, 1 practitioner), followed by *weeds* (6 ranchers), and *wildlife conflict* (4 ranchers). One rancher discussed water scarcity as being his biggest challenge: “Drought! In the last 20 years we only had a couple years where we had any moisture... this past year wasn’t too bad... for 15 years before that, we don’t run very many cows anyway, and we were hardly able to run what we’ve got. In fact, we haven’t even brought ‘em all over here cause it was so

dry.” Practitioners mentioned four of the 14 ecological challenges: *water scarcity, climate change, fire, and petroleum inputs*.

Future Ecological Concerns

Twenty total future ecological concerns were mentioned, referring to ecological challenges that participants discussed facing in the future (Table 4). *Additionality* (4 ranchers, 1 practitioner) is defined as the increase in an ecosystem service that is provided due to a PES program. Interviewees expressed concern regarding additionality because many of them believe that ranchers already provide ecosystem services, and are unsure that this can be enhanced in a way that would earn a payment. One rancher said “It’s going to be very difficult to get somebody to pay for what we’re already providing, and what most ranches are providing, actually.” Related to this concern is the perception that ranchers would have *nothing to offer the carbon market* (3 ranchers, 0 practitioners), as some respondents connected carbon more closely with forests than rangelands: “my country doesn’t grow much grass. Wouldn’t it be... someplace that grows a lot trees ... I think a lot of properties would be more suited for that than mine.” Two ranchers and one practitioner also expressed concern regarding *overgrazing*. Overgrazing concerns focused on cattle concentrating on riparian areas or keeping excess cattle in order to qualify for an agricultural tax bracket.

Current Financial Challenges

Financial challenges were those challenges directly related to the economics of operating a ranch, including costs, operational resources, and markets. Nine financial challenges were identified (Table 3). Of these, at least four ranchers or two practitioners identified eight of the nine. *Cost of inputs* (15 ranchers, 5 practitioners) was mentioned the most often, and included

items such as feed prices, transportation costs, and equipment. As one rancher noted: “Labor and feed’s our big expenses. And we’re not, we’re not high on the salary side, I mean (laughs), you don’t come here to get rich! Labor and feed are big costs, actually.” The challenge of *unprofitability* (13 ranchers, 6 practitioners) was categorized as general discussion about the ranching business earning little to no net profit. Two related challenges were *scale* (8 ranchers, 3 practitioners) and *enough land* (6 ranchers, 3 practitioners). The challenge of *scale* was discussed by interviewees as the fact that larger ranching operations seem to be more profitable than smaller operations. One rancher said: “For me to make ... enough money just to live on, where I didn’t have an outside job, I would have to have a lot more cattle.” *Enough land* was related to the difficulty of procuring enough land to graze a profitable number of cattle, whether those pastures be owned or leased. As one practitioner discussed: “I think the access to large grasslands, large patches of grasslands is one [challenge]... Certainly if they were to buy property, I think having access to affordable property... that you could actually ranch, and make a profit from, is pretty limited right now.” *Taxes* also emerged as an important challenge (7 ranchers, 1 practitioner), and are related to policy as well as financial barriers that face ranchers in making a profit. One rancher cited property taxes as his third biggest expense, and another mentioned that property taxes are upwards of \$60,000 per year. *Insurance* (6 ranchers, 0 practitioners) was mentioned as being another large expense, along with taxes and input costs. *Market prices* (4 ranchers, 1 practitioner) and *marketing* (4 ranchers, 1 practitioner) were also discussed. The challenge of *market prices* was defined as discussion related to regional prices received for agricultural products, generally concentrating on livestock but also including hay and other crops. *Marketing* was a challenge directly related to the strategy each individual ranch employed to sell its products to buyers. Marketing strategies employed by ranchers included

selling cattle at a public auction, direct sales to local consumers, video auction sales, and contracts with private buyers (not local).

Future Financial Concerns

Ten different future financial concerns were discussed by participants (Table 4). The financial concern mentioned by the most participants was *taxes* (8 ranchers, 1 practitioner). The next two mentioned by the most participants were *financial profitability of PES* (7 ranchers, 0 practitioners) and *the broader economy* (5 ranchers, 1 practitioner). Ranchers were worried about the financial profitability of potential PES programs: “It seems like the payment, you know, if you’re talking a few bucks an acre or whatever, it isn’t worth the interference, so to speak.” They also discussed concerns about the health of the broader economy, including the continuation of current programs and developing new ones. One rancher said “How do you get additional income from a system that’s almost broke? You know, these are not economic times. I can’t see how you can generate more money through other entities.”

Current Legal and Policy Challenges

Legal and policy challenges were those challenges that related directly to institutional factors (such as local or federal laws) that affected the ability of a rancher to run a profitable operation. Fourteen legal or policy-related challenges were mentioned by interviewees (Table 3). *Regulations* (8 ranchers, 2 practitioners) were mentioned the most often and were characterized as a law or policy affecting a rancher’s ability to run a profitable operation by creating restrictions on their management practices. For example: “We have a staff position now called Human Resources... well, back in the 90’s, that never was the case, but it takes a person now, at least part time, to keep track of the wage requirements and so forth.” Another rancher discussed

the discrepancy between the number of animals an NRCS agent had determined could graze a leased pasture, and the much smaller number he was allowed to graze there. Closely related is the concept of *red tape*, (5 ranchers, 3 practitioners) defined here as the actual paperwork or other process a rancher would have to go through in order to participate in a potentially beneficial program or undertake a certain management practice. One rancher said, referring to conservation easements: “Now the paperwork we’re finding on this new one that we’re doing this year is you know, about triple what it was.” Another rancher discussed red tape in the context of potential endangered species habitat, referencing specifically the case of Preble’s meadow jumping mouse (*Zapus hudsonius preblei*): “Local ranchers... spent a couple hundred thousand dollars to do a whole bunch of paperwork and there was... none of it spent to do anything about the habitat for the mouse! It was spent for attorneys and accountants and so on.”

Future Legal and Policy Concerns

Legal and policy concerns were institutional concerns that participants discussed in future terms. Fourteen legal or policy-related concerns were mentioned by interviewees (Table 4), with *regulations* and *red tape* mentioned the most often, reflective of current legal and policy challenges. *Regulations* (9 ranchers, 3 practitioners), similar to current regulatory challenges, were mentioned the most often. This concern was expressed by one practitioner as: “in the past there has been some discussion about non-point discharge to rivers and streams, which potentially... if there were new regulations surrounding that, that would potentially affect farmers and ranchers both.” A rancher said, in reference to possible changes in management due to endangered species habitat: “What we don’t want is somebody telling us that, um, what has worked for a century now doesn’t work and we’re gonna have to change things.” *Red tape* was also a concern expressed by participants, (6 ranchers, 1 practitioner). As one rancher said

regarding participation in a potential PES program: “I think if it’s beneficial and it doesn’t create more paperwork and nightmares, I might consider it.”

Current Personal Challenges

Personal challenges were those that related directly to individual ranchers’ situation or lifestyle, and which also could not be attributed to broader economic or regional factors. Six different personal challenges were discussed by interviewees (Table 3). Of these, *time and energy* (11 ranchers, 3 practitioners) was mentioned the most often. This challenge referred to the hard work or long hours required by a working ranch: “... it’s a full time job. I mean, you don’t have a hobby... we don’t play golf, we don’t bowl, you don’t have time.” *No heirs* (4 ranchers, 4 practitioners) also emerged as an important personal challenge; this related to aging ranchers who either have no children to take over the ranch, or whose children are not interested in working on the ranch. As one rancher stated: “I think that’s a big problem today, that kids don’t want to stay on the ranch... It’s definitely happening here.”

Future Personal Concerns

Seventeen future personal concerns were mentioned by participants, with the majority of these being related to suspicion of either a potential funding source or a PES program itself (Table 4). *Invasion of privacy* (8 ranchers, 5 practitioners) was mentioned the most often, and was defined as concern regarding the potential interference by outsiders in ranch operations. One rancher stated: “There’s just so many things that ... to generate any money or to do something that people would pay, you actually to do, interferes with the day to day operations.” *Suspicious of government* (7 ranchers, 2 practitioners) and *Suspicious of carbon market* (7 ranchers, 0 practitioners) were personal concerns regarding entering into a contract with the government or

other organization, as interviewees questioned the legitimacy of these contracts and the funding behind them. One rancher said: “You never know what the government’s gonna do. The state could change... the rules, or how they fund it and everything.” Another rancher said specifically regarding carbon markets: “If it’s a long term contract, and you have a relationship with a company, then I would always worry about them changing the rules of the game.” Four ranchers also questioned the legitimacy of the theory behind carbon credits, referring to carbon markets as “schemes” or “fiction.” *Uncertainty* (6 ranchers, 4 practitioners) was related to fear of change, but was more focused on potential risks involved with change rather than just the change itself. One rancher explained why he might sell his cattle early given a firm offer from a buyer: “You know, the risk and that is tremendous. And, you know, we’re fighting the risk, with high input costs and everything anymore.” *Traditional thinking or fear of change* (5 ranchers, 7 practitioners) was discussed as a barrier to implementing a new program resulting from reluctance to changing ranch operations. One practitioner discussed a particular mentality she saw occasionally among ranchers: “... the mentality that I’ve always done it this way, we just like this one kind of cattle, we just like grazing like this, it’s easy, this is what I do, I make enough money to live on, and I don’t want to get embroiled in this complicated... eco-what?” *Time and energy* (4 ranchers, 4 practitioners) was the concern that a new payment program may require more time or energy from a rancher than would be worthwhile. One practitioner said: “If 90% of your ranching operation is sort of that traditional, you know, calve in the spring ... to take a little bit of that operation and shift it into a different market may require a whole lot of work that they may just not have the time or the land or the ability to do for whatever reason. So you’re almost running two different ranches in some ways in terms of when they calve and how they produce and how they sell.”

Current Social Challenges

Social challenges were defined as those current challenges discussed by ranchers that involved interactions with other people. Participants mentioned 15 different social challenges (Table 3). *Development pressure* (10 ranchers, 6 practitioners) was defined as discussion regarding incentives for ranchers to sell their land to developers, often related to population growth or increasing operational costs. One rancher said: “We’ve had the situation where the neighbors sell their property, there’s no more ranchers around us, basically, you know they’re all gone. Except us. And... most of their property has been bought for development...” *Problems with neighbors* (8 ranchers, 3 practitioners) was often related to development pressure, as the problems discussed seemed to emerge from the increase in population in the area, and the fact that much of the growing population is unfamiliar with livestock operations. According to one rancher, “There’s a grazing allotment... up by us that has been grazed for a long time... And some of it is going through changes... We have a lot of small communities of summer homes... and there’s a certain perception to some people that cattle stink, that cattle bring flies, that cattle are just leaches on the land”. *Regional changes* (8 ranchers, 2 practitioners) were discussed as a change from past years to recent years; this was often connected with population growth, increasing operational costs, or decreasing regionally-available services for agriculture. For example, one rancher said: “Fort Collins used to have a lot of [agricultural services] and simply has much less of it. Um, things like getting horses shod is much more expensive than other places. It’s simply that there’s so much demand from people who have so much more money than the typical ranch ... can justify”. *Public perception* (5 ranchers, 1 practitioner) was similar to *problems with neighbors*, but related more to the general population of the region, not just the immediate community. Closely related to these challenges is *ranching versus recreation and*

wildlife (3 ranchers, 2 practitioners), a challenge that emerged in discussion about competing interests for land and resources. According to one rancher, “[People] like to see the deer, and the elk, and the bobcats and everything... They want to manage for that, and don’t like the cows, because the cows, they don’t have the proper water sources, they get into the river and they muck it up... people like to fish”.

Future Social Concerns

Nine different future social concerns related to interactions with people or larger regional factors were discussed by interviewees (Table 4). *Ranches being subdivided* (5 ranchers, 4 practitioners) was mentioned by the most participants, and was the concern that more large ranches would be sold to developers in the future and divided into housing sections. *Public perception* (4 ranchers, 4 practitioners) was related to concerns about the way the general public viewed ranching, as well as neighbors’ opinions of a ranching operation. Three ranchers were also concerned that a new payment program might be viewed as “welfare”, or “handouts.” One rancher said “they’d say, oh, these ranchers are making a killing because they’re getting these payments for doing nothing, or something trivial.”

Business strategies to address current challenges and future concerns

Given the current challenges and future concerns facing working ranches in our study region, we asked ranchers and practitioners to discuss strategies that are being used currently or could be undertaken in the future to develop diversified ranch business models that achieve conservation and financial objectives. Interviewees listed 3 current and 85 future opportunities, (Table 5) which we have grouped into three general categories: (1) reducing costs, (2) enhancing revenue and potential funding sources, and (3) building regional capacity. At the end of this

section, we include five additional personal opportunities that were mentioned, which represent byproducts of more sustainable business models.

Table 5: Opportunities discussed by participants for creating more diversified ranch business models that achieve conservation and financial objectives. Opportunities are categorized as reducing costs, enhancing revenue, building regional capacity, possible funding sources, and personal opportunities. Each category is organized in terms of most to least cited by ranchers.

	Ranchers (N = 16)		NR Professionals (N = 7)	
Reducing costs				
Fencing	3	19%	1	14%
Taxes	3	19%	0	0%
Water development	3	19%	0	0%
Conservation easements	2	13%	2	29%
Grassland restoration	2	13%	1	14%
Weed control	2	13%	1	14%
No debt	2	13%	0	0%
Vertical integration	1	6%	0	0%
Inheritance	1	6%	0	0%
Cost reduction for environmental stewardship	0	0%	1	14%
Enhancing revenue				
Carbon credits	6	38%	3	43%
Water	5	31%	4	57%
Wind energy	4	25%	3	43%
Hunting leases	4	25%	1	14%
Diversification general	3	19%	3	43%
Expand herd	3	19%	1	14%
Oil, natural gas, and minerals	3	19%	1	14%
Hospitality	3	19%	0	0%
Houses	3	19%	0	0%
Recreation general	3	19%	0	0%
Wildlife management	2	13%	1	14%
Cell or radio tower	2	13%	0	0%
Cultural or historical services	2	13%	0	0%
Moss rock	2	13%	0	0%
Grassfed beef	1	6%	2	29%
Conservation beef	1	6%	1	14%
Horseback riding fees	1	6%	1	14%
Timber	1	6%	1	14%
Backcountry guiding	1	6%	0	0%
Goats	1	6%	0	0%
Hay	1	6%	0	0%

Healing packages	1	6%	0	0%
Lease out goats	1	6%	0	0%
Livestock hauling	1	6%	0	0%
Maintaining enhancements	1	6%	0	0%
Manure management	1	6%	0	0%
Non tributary water	1	6%	0	0%
Organic crops	1	6%	0	0%
Organic price premium	1	6%	0	0%
Pine beetle wood	1	6%	0	0%
Poultry	1	6%	0	0%
Sheep	1	6%	0	0%
Storing campers	1	6%	0	0%
Water quality related to development	1	6%	0	0%
Riparian mitigation	0	0%	2	29%
Wetland mitigation	0	0%	2	29%
Bee hives	0	0%	1	14%
Birding	0	0%	1	14%
Bison	0	0%	1	14%
Cluster development	0	0%	1	14%
Grassbank	0	0%	1	14%
Habitat mitigation	0	0%	1	14%
Photography	0	0%	1	14%
Pollinator habitat	0	0%	1	14%
Specialty crops	0	0%	1	14%
Sustainable income	0	0%	1	14%
Possible Funding Sources				
Farm Bill programs general	3	19%	3	43%
Lottery money	2	13%	0	0%
Larimer County	1	6%	2	29%
NF Weed Coop cost share resources	1	6%	1	14%
Extension service	1	6%	0	0%
NGO's as funders for PES	1	6%	0	0%
City of Fort Collins	0	0%	4	57%
Government grants	0	0%	2	29%
CCA as funder	0	0%	1	14%
Conservation Stewardship Program	0	0%	1	14%
Denver water	0	0%	1	14%
Developer mitigation	0	0%	1	14%
Grassland Reserve Program	0	0%	1	14%
Other water municipalities	0	0%	1	14%
Wetland Reserve Program	0	0%	1	14%
Wildfire mitigation grant	0	0%	1	14%
Regional capacity				

Changing ranch culture	3	19%	4	57%
Collaboration in Laramie Foothills	1	6%	4	57%
Local markets	1	6%	4	57%
Increasing land value due to amenity demand	1	6%	0	0%
Present info at board meetings	1	6%	0	0%
Mobile slaughter	0	0%	1	14%
Conservation community marginal returns	0	0%	1	14%
Efficient use of funds	0	0%	1	14%
Personal				
Keep ranchers on land	2	13%	3	43%
Afford a ranch manager	1	6%	0	0%
Keep kids on land	1	6%	0	0%
Quit outside job	1	6%	0	0%
Retirement	1	6%	0	0%

Reducing Costs

Six ranchers discussed strategies they were currently employing in their ranching operations to reduce costs: windrow grazing, changing calving season, and direct sales to consumers. Two participants (1 rancher, 1 practitioner) discussed windrow grazing as a current example of reducing input costs. One rancher explained: “So the technique is along about the first of September... you do a windrow cutting and just leave it piled in windrows right there in the field... what you’re saving on then is the cost of baling the hay, of hauling it, of stacking it, and then of rehauling it, and feeding it.”

Two other ranchers discussed that changing calving season from the common regional practice of winter calving to spring calving helped reduce their feed costs, because the native range now provided most of the necessary feed when cattle nutritional requirements are the greatest. For one rancher, this also reduced fuel and labor costs for putting up hay, since the ranch was able to convert the hay pastures to calving grounds. The cows now eat the grass directly, rather than it being cut and baled. Changing the calving season also reduced one

rancher's manure management issues, since he no longer has the cattle in confinement for extended periods of time. Another example of reducing feed costs is that one rancher uses on-ranch crops to feed his cattle. He owns enough rangeland and cropland to either graze or feed using his own crops year round. As part of this, he allows the cattle to graze on cornstalks and sugarbeet tops after harvest.

Selling beef directly to private buyers, rather than going through a cattle auction, was also identified as a strategy to reduce marketing costs by six ranchers and one practitioner. Strategies for selling directly to consumers include selling to friends and neighbors by word of mouth (four ranchers), using email marketing (two ranchers), conducting a private sale (one rancher), or locating a private buyer who contracts for many cattle (one rancher).

Participants discussed ten cost reduction strategies that could be adopted in the future (Table 5). Of these, the three mentioned most often were *fencing* (3 ranchers, 1 practitioner), *water development* (3 ranchers, 0 practitioners), and *taxes* (3 ranchers, 0 practitioners). Both fencing and water development (such as drilling new wells in pastures) can be a major expense for ranchers, so income that could supplement fence construction and maintenance or water development were discussed as opportunities in the future to reduce operating costs.

Developing new opportunities for tax reductions to lower ranch costs were discussed by three ranchers. One rancher said: "I think it would behoove young people to use their programs to fight for the benefit of the farmer and the rancher, instead of trying to figure out ways to allow the taxation and the price increases which are driving them crazy, and then give him back a benefit, as if you're his best friend. It's counterproductive." Another rancher said: "If there was a way of logically lowering the property taxes... [that] would be a big benefit. I'm sure every rancher has that problem."

Enhancing revenue

Participants identified 46 revenue enhancing opportunities that could be integrated into ranch business models in the future. We include here all cases where participant responses were framed in a future way, even if there are examples of the revenue stream being implemented currently on some ranches in the region (Table 5). The two mentioned most often were *carbon credits* (6 ranchers, 3 practitioners), and *water quality enhancement* (5 ranchers, 4 practitioners). Carbon credits were defined as an organization, agency, or company providing financial incentives to landowners for practices that increase carbon storage on their land. Participants discussed this as a potential future opportunity, as current carbon markets are not fully developed or available. Water quality enhancement was discussed in terms of a funding source providing incentives to ranchers for management practices that would improve downstream water quality, such as fencing out riparian areas. One rancher said: “It seems to me... a number of utilities in the region are concerned about having to install new treatment equipment... it’s going to be quite costly and if farmers and ranchers can help them avoid those costs by making sure their runoff from their spread is not contributing to the problem and getting reimbursed for that some way.” Participants also frequently mentioned *wind energy* (4 ranchers, 3 practitioners), *hunting leases* (4 ranchers, 1 practitioner) and *diversification in general* (3 ranchers, 3 practitioners) as being potential business model opportunities. The complete list of revenue enhancing suggestions is provided in Table 5.

Participants identified 16 different possible funding sources for new revenue streams for ranchers (Table 5). Potential funding sources included local and national governments and organizations, as well as current government programs (such as the Wetland Reserve Program). Of those mentioned, *Farm Bill Programs* (3 ranchers, 3 practitioners), and *Larimer County* (1

rancher, 2 practitioners) were discussed the most often. These funding sources are hypothetical possibilities and would require further research and discussion to determine the feasibility of any new programs.

Building regional capacity

While participants discussed some regional changes as challenges (such as development pressure and fewer agricultural services) they also referred to other regional factors as opportunities (Table 5). Most often mentioned were *changing ranch culture* (3 ranchers, 4 practitioners), *collaboration in the Laramie Foothills* (1 rancher, 4 practitioners), and *local markets* (1 rancher, 4 practitioners). The changing ranch culture, according to interviewees, is represented by ranchers being more open and willing to try new business models and management practices, rather than implementing only the traditional cow-calf model. One practitioner said: “I think there is ... a shift from a lot of ranchers to ... move at least a little out of that traditional take the cows to the auction barn and sell them and what you get is what you get. I think they are looking for ways to diversify.” Collaboration in the Laramie Foothills was recognized by participants as a unique partnership between landowners and other organizations and agencies, which may provide more opportunities for programs which require partnership. One practitioner said: “I don’t think there’s many places in the country that you can... find the interaction and the cooperation between varied entities. From a rancher to a conservation organization to local governments... there’s been a lot of buy in and I think it’s been great because people have maybe opened their eyes to where an organization or government might have been threatening or scary ... turns out to be a partner.”

Three practitioners discussed the need to develop a larger local marketplace in Larimer County for grassfed or other value-added beef products. Even in the absence of such a local marketplace, as discussed above, three ranchers reported selling grassfed beef locally, and one other rancher was conducting a feasibility study on incorporating grassfed beef into his operation. Another rancher had also considered grassfed beef, but he was uncertain about marketing the product. According to one practitioner, a key component of a successful local market would be a leader to organize ranchers and create a market in such a way to dispel concerns about connecting supply and demand. Two of the three ranchers who currently raise grassfed beef cited concerns about the difficulty of marketing, or finding customers to purchase their product locally. Another issue with a local market is a lack of processors (3 ranchers, 1 practitioner). Two ranchers mentioned being required to schedule their animals for slaughter a year out, and another discussed the lack of options or competition for selling his livestock.

One practitioner discussed that the need for a local grassfed market will increase as people become more aware of the health benefits, as well as benefits to the local economy. The three ranchers who raise grassfed beef discussed their perceived benefits of this system, including healthier fat in the beef, fewer petroleum inputs from feed corn production, and fewer antibiotics or hormones used. Challenges included the longer time for cattle to reach an appropriate weight and a change in taste which some consumers dislike.

Personal Opportunities

Personal opportunities were those that related more to the quality of life improvement derived from a new revenue stream, rather than the actual economic gain (Table 5). *Keeping ranchers on the land* (2 ranchers, 3 practitioners) was discussed the most often as a benefit for

individuals who wanted to continue in the ranching business (or hoped their children would take over), and also as an opportunity for the community to maintain the ranching culture and open spaces. As one practitioner stated: “If we can keep people on the landscape because they’re doing all these great conservation practices that we’d like to see as well, then that would be a great strategy.”

Only one rancher mentioned each of four other personal opportunities, which were *keeping kids on the land, retirement, hiring a ranch manager, or quitting an outside job*. One rancher said regarding keeping kids on the land: “I think that... any way that you could make [income] changes for ... ranchers and their kids is gonna be something that would be very welcome. I think the kids... are kind of torn between the direction where they can go... and I think they have some interest in coming back and living where they grew up. But not in the traditional sense. So they’d have to have something different.”

Potential for payments for ecosystem services

Interwoven with discussion on future opportunities for income sources, we elicited thoughts from participants about the potential for a payment for ecosystem services (PES) program in our study region, as no such program currently exists.

Nine ranchers were *interested* in the concept of developing a PES program in the study region. The other seven ranchers interviewed were at least *potentially interested* in such a program. Ranchers were classified as being *potentially interested* if they expressed skepticism regarding a new PES program at any point during the interview, but they were still interested in obtaining information about any programs that are developed. For example: “I’d have to look at all the categories that are acceptable and then say, this one, we might fit in it. And then investigate it and see.” Six of seven practitioners believed that ranchers in general would be

interested in a PES program, and the remaining practitioner thought ranchers in general would be potentially interested.

Participants indicated that the two most exciting aspects of a new PES program to respondents were *enhancing conservation* (7 ranchers, 5 practitioners) and *increasing income* (7 ranchers, 1 practitioners) (Table 6). Two ranchers and three practitioners also mentioned *preservation of ranching* as being an exciting prospect for a new PES program. The two challenges mentioned most often were *lack of knowledge or information* (4 ranchers, 1 practitioner) and *transparency or trust* (4 ranchers, 1 practitioner) (Table 7). Possible *restrictions* (3 ranchers, 1 practitioner) and *unknown risk or cost* (2 ranchers, 2 practitioners) also emerged as potential barriers to a new PES program.

Table 6: Survey Results. Participants were asked to list their top one or two most promising aspects of a new PES program, as well as their top one or two perceived challenges. These answers were categorized and aggregated in the following table. *One rancher did not take the survey. Of the two two-person interviews, in one group only one person took the survey and in the other both did. This resulted in 16 total rancher surveys completed, but representing only 15 ranch units (whereas 16 ranch units are represented in all results provided above).

Promising Aspects	Ranchers (N = 15)		NR Professionals (N = 7)	
	Count	Percentage	Count	Percentage
Enhance conservation	7	47%	5	71%
Increase income	7	47%	1	14%
Preservation of ranching	2	13%	3	43%
Getting credit for ES	2	13%	0	0%
Income related to stewardship	2	13%	0	0%
Improve grazing conditions	2	13%	0	0%
Knowledge of ES/PES	1	7%	0	0%
Diversification	0	0%	3	43%
Efficient use of conservation dollars	0	0%	2	29%
Encourage local market	0	0%	1	14%
Guarantee services rendered	0	0%	1	14%
Challenges	Ranchers (N = 15)		NR Professionals (N = 7)	
	Count	Percentage	Count	Percentage
Lack of knowledge or information	4	27%	1	14%
Transparency or trust	4	27%	1	14%
Restrictions	3	20%	1	14%
Red tape	3	20%	0	0%
Unknown risk or cost	2	13%	2	29%
Multiple owners or decision makers	2	13%	0	0%

Additionality	2	13%	0	0%
Changes operation	1	6%	1	14%
Time and energy	1	6%	1	14%
Tax increase	1	6%	0	0%
Should concentrate on global issues	1	6%	0	0%
Public perception	0	0%	2	29%
Not profitable	0	0%	2	29%

Concerns regarding a PES program

Participants identified 30 concerns that relate specifically to a PES program. We note that some of these concerns were the same or similar to ones listed by participants as pertaining more generally to future concerns, as discussed above (Table 4).

Additionality (4 ranchers, 1 practitioner), is defined as the increase in an ecosystem service that is provided due to a PES program. Interviewees expressed concern regarding additionality because many of them believe that ranchers already provide ecosystem services, and are unsure that this can be enhanced in a way that would earn a payment. One rancher said “I’d wonder if... we actually have enough issues that we would qualify. We’re not intensively grazed... we’ve already worked very hard to maintain the ecosystem that we already have.” Related to this concern is the perception that ranchers would have *nothing to offer the carbon market* (3 ranchers, 0 practitioners), as some respondents connected carbon more closely with forests than rangelands: “We’re not heavily wooded. When I think of carbon, I think of sequestration of carbon from trees.”

Another concern that arose was the *economic efficacy of PES* (7 ranchers, 0 practitioners), or the financial effectiveness of potential PES programs: “I think [PES] could pay for themselves, but I don’t see them paying a lot over the costs of implementing them,

maintaining them, and so on... It may not be enough to keep a lot of ranches from being subdivided.”

Concerns about *regulations* (9 ranchers, 3 practitioners) were expressed regarding required changes in management practices that may hinder the profitable operation of a ranch. One rancher said regarding a potential carbon credit contract: “I was concerned about the limits signing that kind of contract would put on us as far as grazing practices. Because they were very specific... you needed to set up a grazing plan and you needed to stick to it and if you deviated from it ... you’d lose payments and you’d have to return the money.” *Red tape*, defined as the actual paperwork or other process a rancher would have to go through in order to participate in a potentially beneficial program or undertake a certain management practice was also a concern expressed by participants (6 ranchers, 1 practitioner). Participants brought up concerns about red tape both in the context of past experience with government programs, as well as the volume and complexity of paperwork that may be generated with a new program.

Six additional PES-related concerns were expressed by several participants. *Invasion of privacy* (8 ranchers, 5 practitioners) was defined as concern regarding the potential interference by outsiders in ranch operations. *Traditional thinking or fear of change* (5 ranchers, 7 practitioners) was discussed as a barrier to implementing a new program resulting from reluctance to changing ranch operations. *Uncertainty* (6 ranchers, 4 practitioners) was related to fear of change, but was more focused on potential risks involved with change rather than just the change itself. *Suspicious of government* (7 ranchers, 2 practitioners) and *Suspicious of carbon market* (7 ranchers, 0 practitioners) were personal concerns regarding entering into a contract with the government or other organization, as interviewees questioned the legitimacy of these contracts and the funding behind them. Four ranchers also questioned the legitimacy of the

theory behind carbon credits, referring to carbon markets as “schemes” or “fiction.” *Time and energy* (4 ranchers, 4 practitioners) was the concern that a new payment program may require more time or energy from a rancher than would be worthwhile. Three ranchers were also concerned that a new payment program might be viewed as “welfare”, or “handouts.”

Needs related to exploring a PES program

Given the vast array of concerns expressed by participants regarding a potential new payment program, 13 types of informational needs arose in the discussion (Table 7). Mentioned most often was the need for *general information* (12 ranchers, 5 practitioners) when deciding whether or not to participate in a new payment program. Some of the types of information that participants thought would be necessary were information on how a program would be implemented, a cost-benefit analysis, ecosystem services that would be targeted, and clear and concise information regarding qualifications, risks, and benefits. Many participants identified information presented at a workshop (6 ranchers, 1 practitioner) or information provided online (4 ranchers, 2 practitioners) as being the best ways to reach out to people. Most indicated that multiple strategies should be used when providing information. Three financial needs were mentioned, with *sustainable income* (3 ranchers, 4 practitioners) being mentioned most often. *Sustainable income* related to discussion about uncertainty in ranching, and that more defined and assured income sources might help ranchers stay in the business. One practitioner said “if they had a little bit more predictable annual income, that would make a difference economically for them and therefore would enable them to be more certain about staying in ranching.”

Table 7: Interviewee-identified needs regarding participating in a new payment for ecosystem services program. Needs are stratified by type of information, where to find information, ecological, financial, legal and policy, personal, and social. Each category is organized by most to least cited by ranchers and practitioners combined.

	Ranchers (N = 16)		NR Professionals (N = 7)	
Type of Information				
General information	12	75%	5	71%
Info on implementation	2	13%	4	57%
Targeted information	2	13%	1	14%
Info on cost benefit analysis	1	6%	4	57%
Info on capital cost	1	6%	2	29%
Info on local ES	1	6%	2	29%
Info on how to sign up	1	6%	1	14%
Concise information	1	6%	0	0%
Info on qualifications to participate	1	6%	0	0%
Training on internet usage	1	6%	0	0%
Info on clearly defined roles	0	0%	1	14%
Info on reporting	0	0%	1	14%
Info on social risk	0	0%	1	14%
Where to get information				
Workshop information	6	38%	1	14%
Online information	4	25%	2	29%
Hard copy information	2	13%	2	29%
Word of mouth information	2	13%	0	0%
Easy access information	1	6%	2	29%
County fair information	1	6%	0	0%
Ecological Needs				
Monitoring and verification of ecosystem service outcomes	3	19%	0	0%
Non destructive program	1	6%	0	0%
Seed driller for disturbance areas	1	6%	0	0%
Defined geographical area	0	0%	1	14%
Easily definable ecosystem services	0	0%	1	14%
Ecological sustainability	0	0%	1	14%
Water storage	0	0%	1	14%
Financial Needs				
Sustainable income	3	19%	4	57%
Minimize cost	2	13%	1	14%
Actual Markets	1	6%	1	14%
Legal and Policy Needs				
Program time limit	2	13%	2	29%

Minimize red tape	2	13%	0	0%
Lobbyist	1	6%	0	0%
Strict contracts	1	6%	0	0%
Weed control cost share	1	6%	0	0%
Targeted projects	0	0%	1	14%
Personal Needs				
Simple changes	4	25%	3	43%
Low risk	2	13%	4	57%
Motivation to participate	2	13%	2	29%
Landowner interests and knowledge	1	6%	3	43%
Minimize invasion of privacy	1	6%	0	0%
Culturally sensitive	0	0%	2	29%
Social Needs				
Successful examples	4	25%	3	43%
Guinea pig	2	13%	3	43%
Public education	2	13%	1	14%
Build trust	1	6%	2	29%
Leader for local market	1	6%	2	29%
Infrastructure to process and store	0	0%	1	14%
Communication about other programs	0	0%	1	14%
Enough interest	0	0%	1	14%

Six legal and policy needs were mentioned, with the most discussed need being a *program time limit* (2 ranchers, 2 practitioners). One rancher said: “If there were limits ... on how long we need to participate, it was something that could be renewed, like every 3 years or something, I think that would make it more encouraging.”

Six personal needs were also mentioned, with the most interviewees discussing *simple changes* (4 ranchers, 3 practitioners) as being important. Simple changes were discussed both in terms of easy changes in management, as well as minimization of regulations and paperwork. *Low risk* (2 ranchers, 4 practitioners) was also an important personal need. One practitioner said hypothetically “What happens if it all fails and the money runs out? ... Are we going to continue

to be subsidized for something that we did, or is the help still going to be available for us to continue doing what we're doing if the government money or whatever money... runs out?"

Eight social needs were mentioned, with *successful examples* (4 ranchers, 3 practitioners) discussed by the most participants. Successful examples would be peers or community members who had participated in a program and somehow benefitted from it, thus paving the way for other potential participants. One rancher said: "If a particular rancher starts doing this and then talks to the neighbors, that's going to be more effective than going to the ranchers... individually. So somehow, looking for a demonstration place... with the idea that the benefits, if there are benefits... that others will see them and copy them." Related to this was the idea of a *guinea pig* (2 ranchers, 3 practitioners), or a first person or group of people to try out a new program. The guinea pig may or may not be successful, but for a program to gain participants, some success would need to be demonstrated.

Seven ecological needs were mentioned, with *monitoring and verification of ecosystem service outcomes* (3 ranchers, 0 practitioners) being discussed most often. This need referred to verification that an ecosystem service being paid for is actually being delivered by a rancher. The other ecological needs were mentioned by one participant each, an example being *easily definable ecosystem services*.

Discussion

Our research objective was to investigate the barriers and opportunities for developing more diversified business models for working ranches that integrate traditional livestock income sources with additional conservation-oriented sources. As part of this investigation, we examined the potential role of PES programs, an expanding tool being deployed globally to align

conservation and economic incentives in land management (Engel et al., 2008). Our analysis reported upon a case study of a defined population of ranchers and practitioners in Larimer County, CO, with expected relevance to similar regions across the western U.S. As our project was exploratory in nature (since it emphasized scoping future opportunities), we examined the range and frequency of responses provided by ranchers and practitioners to provide information about the array of considerations in our study region.

The information we obtained from ranchers and practitioners highlighted the fact that there are many pressing concerns affecting working ranches in our study region, but also that our interviewees are actively thinking about strategies to create future opportunities that generate more diverse ranch business models. Because of our interest in diversification strategies that would add conservation-oriented revenue streams on top of current livestock revenue (e.g., PES), our results emphasize these opportunities in particular.

Levers related broadly to cost structure and revenue structure can be adjusted in seeking to develop viable business models for working ranches that achieve conservation and financial objectives. Ranchers and practitioners were not surprisingly concerned about factors driving increased ranch operational costs (e.g., rising feed and fuel prices), and multiple strategies were identified that could enable ranchers to reduce input costs and manage risks associated with inputs. These cost reduction techniques included windrow grazing, calving season changes, and using on-ranch crops to feed livestock. These cost reducing strategies are important to consider, especially for ranchers who perceive fewer opportunities to enhance revenue on their properties but may be in a position to implement changes to management practices that could reduce costs.

Ranchers and practitioners also readily discussed opportunities for revenue enhancement, which would involve activities at the ranch scale (e.g., shifting to a grassfed beef operation) and

the regional scale. One intriguing opportunity centered on the potential to develop a regional community marketplace that would provide a new location for ranchers to market their livestock products, and it could also conceivably be a forum for consumers to purchase carbon offset credits or other ecosystem service credits (e.g., water quality enhancement). Marketing can be a major challenge for value-added beef products given consumer expectations for cheap and convenient supermarket meat (Gwin, 2009). An upside of this marketplace could be providing ranchers with more certain and/or value-added marketing opportunities, and it would support the growing local foods movement in the study region.

At the same time, there would be many challenges to developing a community marketplace. One important one, with broader ramifications for the viability of livestock operations in our study region, is the current lack of meat processors. Indeed, there is evidence that this is becoming an increasing challenge for many ranching communities in the western US (Gwin, 2009). One rancher in our study mentioned the fact that there is only one processing plant that he can take his cattle to in Greeley, CO, because there are only a few big processors left. As there is little competition, he is forced to sell his product to one place. Two other ranchers with smaller operations also stated having trouble with processing. There are a few small processors in the region where they can take their cattle, but ranchers often have to book an appointment a year ahead of time, before they know if their cattle will be finished. This is an issue that will be especially difficult for larger producers who need processors with large capacity.

The paucity of processors in the Laramie Foothills may be related to changes in the region, such as population growth and shrinking numbers of agricultural producers. Discussion by our interviewees corroborated other research showing that community development can create peripheral problems for ranchers such as regulatory changes (e.g. noise ordinances) (Berry

& Plaut, 1978; Rowe, et al., 2001) and loss of a “critical mass” of producers (Rowe, et al., 2001). When a community loses enough agricultural producers, many suppliers and supporters go out of business. Ranchers can also lack neighbors who traditionally pool resources and share in heavy work (Rowe, et al., 2001). When faced with policy changes such as decreased access to public land or increased grazing fees, ranchers may sell the ranch before diversifying (Coppock & Birkenfeld, 1999; Peterson & Coppock, 2001;).

Stakeholder collaboration was discussed by several participants as a key opportunity in our study region. With regards to PES and other possible new directions, the presence of the LFAC stakeholder collaborative was identified as valuable, because it provides an organizational structure to support the design and implementation of new programs. Trust and cooperation that have been built through LFAC could help ranchers feel better supported in pursuing participation in a pilot PES project, or other new revenue stream. Supporting this opportunity is the perception of one practitioner who stated that people in this region are generally open-minded and ready to change their practices when opportunities arise.

Participants discussed multiple criteria that would need to be addressed for ranchers to consider participating in a new PES program in order to diversify their current business model. Our findings corroborate current analysis of existing PES programs described in the literature. First, easy access to descriptive information, as requested by our respondents, to inform decisions about program participation is critical, because some existing programs have reported that problems can arise if landowners are not fully informed about program rules (Corbera et al., 2007; Missrie & Nelson, 2005; Petheram & Campbell, 2010). Second, several interviewees discussed the need for success stories from existing programs or from pilot projects in our study region in order to undertake management changes and participate in a future PES program. This

request fits with Rogers (1995) theory that innovations are more likely to be adopted after there are positive results. Third, ranchers' concern about whether they would be in a position to adopt new management practices to generate enhanced ecosystem service benefits relates directly to the debate about additionality being a factor contributing to PES legitimacy (Asquith, Vargas, & Wunder, 2008; Wunder et al., 2008b). Additionality can come from both restoring ecosystem service flows, or as is being increasingly accepted, avoiding the loss or degradation of ecosystem service flows (e.g., reducing greenhouse gas emissions through avoided deforestation or avoided grassland conversion).

Limitations

Given the small sample size and non-random sampling method, it was not possible to perform rigorous statistical analyses on the data from this study. Therefore, the results that we found in our study region are not intended to be generalized to a broader population. Three potential interviewees declined to participate in this research, and we were unable to contact twelve more. This may indicate that our participants were either already interested in or knowledgeable about PES and diversified ranch business models. However, even if this is true, we believe that the range of challenges and opportunities identified by our interviewees is useful in sparking creative thinking about diversified ranch business models, and also that it suggests that our study population, despite being small and nonrandom, was sufficiently diverse to provide a broad range of perspectives.

Implications and Recommendations

All participants in this research were interested in learning about a new PES program in the study region, even when they expressed skepticism regarding the potential profitability of PES. Collaboration and innovation have already been demonstrated by ranchers and practitioners in this region, which may increase the chances for a new payment program to succeed.

According to the concerns and needs discussed by interviewees, a new program will need to be simple to implement, flexible, have transparent rules, provide a net economic benefit, and provide easily accessible information to participants.

Simple Implementation

Many interviewees viewed regulations and paperwork as challenges to operating a working ranch. Any new programs that are developed will have to be as simple and straightforward as possible. Although ranchers expressed willingness to try new diversification techniques, they also discussed the copious amounts of time and energy that a traditional ranching operation requires, and it would be difficult to devote more to new practices. This concern also highlights the fact that, all else equal, a PES program that integrates well with ranchers' existing livestock practices or requires only modest changes will likely be more attractive than a program that requires major changes.

Flexibility

Some interviewees expressed concern about strict regulations that may accompany a new program. These concerns included drastic changes in management practices, being locked into a program indefinitely or for a long period of time, or being forced to enter all of their acreage into

a program to qualify. Accordingly, to successfully engage ranchers, a pilot PES project in this region may benefit from requiring minimal changes in practices, a short time period for initial contracts, and the ability for ranchers to start with a small amount of acreage, rather than their entire ranch.

Transparency

Several interviewees discussed being suspicious of the government, NGO's, or PES programs like the carbon market. In order to encourage participation, a new PES program will need clearly defined rules, qualifications for participation, and evidence that participation will be profitable to ranchers. Additionally, a relationship will need to be built between ranchers (sellers) and buyers of ecosystem services. The buyers must appear legitimate to ranchers, and the ranchers must be able to demonstrate actual delivery of services. Interviewees brainstormed a valuable list of potential buyers, though the demand-side of a future PES program remains an important gap to address.

Profitability of PES to participating ranchers

Many ranchers were skeptical that a PES program would provide a net profit to their operation. In order to undertake the paperwork and management practices required with a new program, the financial incentive will have to be sufficient to compensate ranchers for their time and energy. Even those ranchers who were interested were not convinced that their property provided enough of a service for the public or private sector buyers to pay. A new PES program would require careful economic analysis to determine that the costs and benefits are fair for buyers and sellers.

Easy Access Information

Most interviewees wanted more specific information about a new PES program. Transparent information would need to be provided to ranchers in diverse ways in order to target diverse participants. Some preferred a workshop format, while others would rather access information online at their own convenience or receive hardcopy information in the mail. Additionally, the public will need to be informed about a new program, especially if they would be asked to provide funding.

Future Research Directions

This exploratory research project focused on the producer side of barriers and opportunities for creating more diversified ranch business models that achieve both conservation and financial objectives. Although ranchers are skeptical about the potential to be compensated for public benefits currently supplied for free, they are interested in learning about any new opportunities. If a PES program can be successfully implemented in the Laramie Foothills, this will provide another example to other regions and collaborative groups who are considering PES as a new revenue stream to enhance the economic sustainability of ranching operations while providing conservation benefits to the public.

First, a key gap that needs to be addressed in this study region is the consumer side of ranch business models. Are consumers (municipalities, government agencies, businesses, the general public) willing to pay for currently non-market ecosystem services? Are consumers willing to pay a higher price for a value-added livestock product?

Second, several participants in this study expressed the opinion that a more efficient method to increase the profitability of ranches would be to decrease their operating costs. Cost

reduction methods could include on-ranch management practices, such as windrow grazing, but are there also opportunities in this region for policy cost reduction strategies, such as property tax reform?

Third, this study focused on a specific region in Colorado that is already experimenting with collaboration and diversified revenue streams. Are there similar opportunities for diversification to achieve financial and conservation benefits in other regions that still rely on more traditional ranch business models?

Fourth, the costs and benefits of various income diversification strategies (e.g., cost reduction, enhancing revenue streams, building regional capacity, PES programs) to achieve both conservation and financial objectives will need to be closely examined. Business models will need to be targeted for diverse communities and regions, and the most efficient and beneficial development and implantation strategies for new revenue streams should be closely studied.

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APPENDIX A: INTERVIEW SCRIPT AND SURVEY INSTRUMENT (RANCHERS)

Semi-Structured Interview Questions: Rancher

Ranchers have always been an important part of communities, especially in the West. Not only do you provide food and other products through livestock sales, but you are also a steward of land, water, air, and wildlife. The resources you steward provide *ecosystem services*, which are benefits provided to the public as a result of good land and animal stewardship, such as food production, wildlife habitat, protection of open space, clean water, recreational activities, and much more. While markets for livestock products are well-established, markets for these other resources that you manage (namely public environmental benefits related to land, water, air, and wildlife) have historically not existed. In other words, livestock grazing can generate income but you are generally not paid for improvements made to natural resources. This is starting to change through government payment programs such as the Environmental Quality Incentives Program, conservation easements, and a new approach for compensating ranchers for resource stewardship called payments for ecosystem services (our focus for today).

Our goal is to help develop and encourage more opportunities for ranchers to combine income from livestock production with income from new and developing ecosystem services markets. We hope that in so doing, there will be more diverse future income streams to improve the economics of ranching. We hope that if ranching can be made more financially secure and be supported by positive market incentives for good land management and animal husbandry practices, this would combine to revitalize rural ranching economies and offer improved opportunities for future generations in ranching.

I would like to ask your permission to record this interview. Digital recording will allow me to accurately remember your answers and will also take less time as I will not have to take as many notes. If you are not comfortable with being recorded, I will only take notes by hand. Is it ok if I record this interview? Is it ok for me to take notes as well as I may think of something I would like to follow up on?

Section 1: Opening questions and setting the context

First I'd like to start with some questions that provide a general understanding of your ranching operation.

1. Could you tell me a little about the history of your ranching operation?
2. Can you generally describe your ranching operation?
3. What are the major challenges facing your ranch? [As relevant and needed, I will prompt the rancher to think about ecological, financial, personal/family, legal, and policy issues]
 - a. Are there any other financial issues that concern you, such as cost of feed or market prices?
 - b. Are there any other personal factors that are challenging such as approaching retirement?
 - c. Are there any legal or policy issues that concern you, such as regulations or federal agencies?
 - d. Are there any social issues that concern you, such as other ranchers leaving the area or the concentration of production (ie what are your neighbors doing, fewer number of buyers?)

Section2: Current conservation practices and overall business model

Let's now move on to some questions regarding current conservation practices and overall business approaches to ranching.

4. What types of management practices are you using (or have used in the past 10 years) that relate to stewardship of land, water, air, or wildlife resources? (prompt with an example if needed: rotational grazing, water development, manure management, etc.)

5. Do you have contracts that pay you for conservation-related management practices? (If needed, examples are Grasslands Reserve Program, Environmental Quality Incentives Program, hunting licenses, conservation easements, and carbon offset payments)

a. *If Yes:* Can you describe these contracts and where the payment comes from?

b. *If No:* Have you explored these options?

6. If you are comfortable discussing this -other than the income sources we just talked about related to conservation practices, what are your major sources of income?

7. Again, if you are comfortable discussing this, how do these income sources rank in terms of most to least contribution to your overall income?

Section 3: Current thinking about future of ranch operation

Next, I'd like to ask about your current thinking on the future of your ranching operation.

8. Are you considering any new income sources or diversification of your ranch operation?

9. Are there conservation management practices that you are considering for the future?

Section 4: Integration of PES into ranch operation

This is the second to last section, specifically about integrating payments for ecosystem services into your ranch operation. A little background might be helpful from me before I ask the questions...

Thinking about challenges facing your operation as well as opportunities to overcome these challenges, I would like to find out how you picture the future of your ranch as well as ranching in the Rocky Mountain region in general. As mentioned before, ecosystem services are benefits provided to the public as a result of good land and animal stewardship, such as food production, wildlife habitat, protection of open space, and many others. Most of these ecosystem-service benefits have not had payments attached to them in the past, but there are increasingly opportunities for ranchers to generate income for conservation-oriented management practices.

An example exists in a program being piloted in Florida called the Florida Ranchlands Environmental Services Project. This is a payment program operated by collaboration between ranchers, government, and NGO's, to help improve water quality in the Florida Everglades. Ranchers are paid to adopt new grazing and land management practices that reduce the runoff of phosphorous into nearby lakes and streams, reducing problems caused by too many nutrients polluting the water systems. Ranchers are able to generate a new source of income from this payment program by helping to protect the environmental health of the region, while continuing to stay in the livestock business.

(If other examples are needed: An example of carbon is being able to register your land through the Chicago Climate Exchange for carbon stored in the soil and vegetation. An example of biodiversity is a species mitigation bank. If endangered species are found in an area, a landowner can conserve the habitat and be paid by a developer or other person who wishes to develop similar habitat elsewhere to protect the species. These are just examples, and many different management practices can contribute to many different environmental benefits and result in payments to ranchers.)

10. Do you think payments for ecosystem services might work for your ranch in the future?

- a. Which ones?
- b. Why?
- c. Will they work for ranches in general?
- d. Which types of payments?
- e. Why?
- f. What characteristics do you think a ranch might need for these payments to work?

11. What opportunities, if any, would new income from payments for ecosystem services open up for your ranch?

- a. Financial
- b. Personal
- c. Legal/Policy
- d. Ecological

12. Could these new payments for ecosystem services help address challenges facing your ranch? If so, how?

13. What concerns do you have about effects income from payments for ecosystem services might have on your ranch?

- a. Financial
- b. Personal
- c. Legal/Policy
- d. Ecological

14. Carbon markets are a type of payment for ecosystem services that you could take advantage of today, if you thought it was appropriate for your ranching operation. For example, ranchers can sign up for a contract with the Chicago Climate Exchange to adopt grazing management practices that enhance the storage of carbon in rangeland soils, thereby contributing to efforts to reduce carbon dioxide emissions that are linked with global climate change. Power plants, car companies, and others are the ones who

would purchase the carbon credits through the market established by the Chicago Climate Exchange – again, as one example of how you could be paid for this conservation practice.

a. Do you currently have a contract to get paid for carbon credits, whether through the Chicago Climate Exchange or another source?

b. If so, can you share the general details of it?

c. If not, have you heard about this opportunity?

d. If yes, from where have you heard about it, and are there reasons why you have not enrolled in a carbon payment program?

e. What would be required for you to participate?

15. Given the potential income from payments for ecosystem services that we have talked about, what would be helpful to you as next steps in order to explore opportunities for your ranch?

Section 5: Demographic Information

Lastly, I have a few brief questions to ask you regarding your ranching operation and your own characteristics. This information will be kept confidential and is important to be able to describe my study population. If you are not comfortable answering any of these questions, please feel free to give a more general answer or to not answer at all.

16. What is your age? (Give range if necessary): 20-35, 36-45, 46-55, 56-65, 66-75, over 75

17. What is the highest level of education you have completed?

18. What is the general ownership structure of this ranch? (ie individual, family corporation, limited liability partnership, etc.)

19. What types of land ownership do you graze cattle on, ie you own it all, leases on public lands e.g., Forest Service, leases on private lands, etc.?

20. Approximately what percentage of your land is under different ownership types?

Survey Instrument (Ranchers)

- Thinking back to what we have discussed today, what do you see as being the one or two most exciting aspects about developing payments for ecosystem services that would provide new income for your ranch alongside livestock production?

- What are the one or two most important challenges that you envision related to integrating payments for ecosystem services into your ranch operation?

- How important are the following possible advantages to pursuing new opportunities related to payments for ecosystem services? (PLEASE CIRCLE ONE NUMBER FOR EACH)

Not important					Very Important
1	2	3	4	5	

Increased income:

1 2 3 4 5

Diversify income beyond livestock:

1 2 3 4 5

Enhance conservation practices on your ranch:

1 2 3 4 5

Aligns with personal goals for your ranch:

1 2 3 4 5

Aligns with current management practices on your ranch:

1 2 3 4 5

<p>Other</p> <p>PLEASE LIST: _____</p> <p style="text-align: center;">1 2 3 4 5</p> <p>PLEASE LIST: _____</p> <p style="text-align: center;">1 2 3 4 5</p>
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4. How important are the following possible disadvantages that might prevent you from pursuing new opportunities related to payments for ecosystem services? (PLEASE CIRCLE ONE NUMBER FOR EACH)

Not important					Very important
1	2	3	4	5	

Concern regarding diversifying beyond livestock:

1 2 3 4 5

Uncertainty about future rules and regulations for new payments for ecosystem services:

1 2 3 4 5

Possible high cost of adopting new management practices:

1 2 3 4 5

Concern that participation would take too much time:

1 2 3 4 5

Uncertainty about ranch's future:

1 2 3 4 5

Other
PLEASE LIST: _____
1 2 3 4 5
PLEASE LIST: _____
1 2 3 4 5

APPENDIX II: INTERVIEW SCRIPT AND SURVEY INSTRUMENT (PRACTITIONERS)

Semi-Structured Interview Questions: Practitioner

Ranchers have always been an important part of communities, especially in the West. Not only do ranchers provide food and other products through livestock sales, but they also steward land, water, air, and wildlife resources. The resources they steward provide *ecosystem services*, which are benefits provided to the public as a result of good land and animal stewardship, such as food production, wildlife habitat, protection of open space, water purification, recreational activities, and much more. While markets for livestock products are well-established, markets for these other resources that ranchers manage (namely public environmental benefits related to land, water, air, and wildlife) have historically not existed. In other words, livestock grazing can generate income but they are generally not paid for improvements made to natural resources. This is starting to change through government payment programs such as conservation title programs through the US Farm Bill, conservation easements, and a new approach for compensating ranchers for resource stewardship called payments for ecosystem services (our focus for today).

Our goal is to help develop and encourage more opportunities for ranchers to combine income from livestock production with income from new and developing ecosystem services markets. We hope that in so doing, there will be more diverse future income streams to improve the economics of ranching. We hope that if ranching can be made more financially secure and be supported by positive market incentives for good land management and animal husbandry practices, this would combine to revitalize rural ranching economies, offer improved opportunities for future generations in ranching, and lead to better stewardship of public environmental resources.

I would like to ask your permission to record this interview. Digital recording will allow me to accurately remember your answers and will also take less time as I will not have to take as many notes. If you are not comfortable with being recorded, I will only take notes by hand. Is it ok if I record this interview? Is it ok for me to take notes as well as I may think of something I would like to follow up on?

Section 1: Opening questions and setting the context

First I'd like to start with some general questions regarding ranching in the region where you work:

1. Can you tell me about your current position?
 - a. What are your main responsibilities?
 - b. How long have you been in this position and with this organization?
 - c. What kind of interactions do you have with ranchers in the Laramie Foothills region?
2. What do you perceive to be the major challenges facing ranchers in your area? [As needed, I will prompt the interviewee to think about ecological, financial, personal/family, legal, and policy issues]
 - a. Are there any other financial issues of concern, such as cost of feed or market prices?
 - b. Are there any other personal factors that are challenging such as approaching retirement?
 - c. Are there any legal or policy issues of concern, such as regulations or federal agencies?
 - d. Are there any social issues of concern, such as other ranchers leaving the area or the concentration of production (ie fewer number of buyers?)
3. What types of business plans have you observed among ranchers?

- a. Which activities seem to earn money most often?
- b. How do these rank in terms of the most to least contribution to income among ranchers?
- c. Have you broached the topic of any new income sources or diversification strategies linked to conservation management practices for ranchers in your area? Please describe. If not, why not?

Section2: Current conservation practices and overall business model

Let's move on now to some questions regarding current conservation practices and overall business approaches to ranching.

4. What conservation management practices have you most often observed ranchers using?
 - a. Do these provide income? (examples if necessary: rotational grazing, habitat restoration, riparian buffers, water development).
 - b. Please describe the practice and the payment program (examples: EQIP, GRP, CRP).
5. If there are practices that ranchers could use to provide conservation benefits and earn income but currently do not, what are some key reasons why you think they have not implemented them?
 - a. Are there any other financial factors, such as cost or risk, which are important?
 - b. Are there any legal or policy issues that you believe concern ranchers? If so, what are they?
 - c. What about personal or family issues particular to individual ranching operations?
6. What do you think are key reasons for why ranchers HAVE adopted conservation management practices?

Section 3: Integration of PES into ranching operations

This is the second to last section, specifically about integrating payments for ecosystem services into ranching operations. A little background might be helpful from me before I ask the questions...

Thinking about challenges facing ranchers in your area as well as opportunities to overcome these challenges, I would like to discuss your thoughts about the potential strengths and drawbacks of diversifying ranch business plans beyond livestock. As mentioned before, ecosystem services are benefits provided to the public as a result of good land and animal stewardship, such as food production, wildlife habitat, protection of open space, and many others. Most of these ecosystem-service benefits have not had payments attached to them in the past, but there are increasingly opportunities for ranchers to generate income from conservation-oriented management practices.

An example exists in a program being piloted in Florida called the Florida Ranchlands Environmental Services Project. This is a payment program operated by collaboration between ranchers, government, and NGO's, to help improve water quality in the Florida Everglades. Ranchers are paid to adopt new grazing and land management practices that reduce the runoff of phosphorous into nearby lakes and

streams, reducing problems caused by too many nutrients polluting the water systems. Ranchers are able to generate a new source of income from this payment program by helping to protect the environmental health of the region, while continuing to stay in the livestock business.

(If other examples are needed: An example of carbon is being able to register land through the Chicago Climate Exchange for carbon stored in the soil and vegetation. An example of biodiversity is a species mitigation bank. If endangered species are found in an area, a landowner can conserve the habitat and be paid by a developer or other person who wishes to develop similar habitat elsewhere to protect the species. These are just examples, and many different management practices can contribute to many different environmental benefits.)

7. Could you envision integrating new income streams that pay ranchers for providing ecosystem services along with the traditional livestock operation?
8. Does a more diversified business operation align with goals expressed by ranchers in your area, or do you foresee problems with this? Please explain.
9. Do you think there would be financial benefits to more diverse income streams that include payments for ecosystem services?
10. Do you think there would be personal or family benefits?
11. Do you have any concerns regarding ranchers' lifestyles, goals, or family life related to changing management practices?
12. Are there any laws or policies that you think might encourage ranchers to participate in a payment for ecosystem services program?
13. Are there any laws or policies that you think might DISCOURAGE ranchers to participate in a payment for ecosystem services program?
14. Carbon markets are an opportunity that ranchers could take advantage of today, if they thought it was appropriate for their operation. For example, ranchers can sign up for a contract with the Chicago Climate Exchange to adopt grazing management practices that enhance the storage of carbon in rangeland soils, thereby contributing to efforts to reduce carbon dioxide emissions that are linked with global climate change. Power plants, car companies, and others are the ones who would purchase the carbon credits through the market established by the Chicago Climate Exchange – again, as one example of how a rancher could be paid for this conservation practice.
 - a. Have you looked into these carbon market opportunities? Are any of these opportunities a formal part of your job?
 - b. Do you know of ranchers in your area who currently have a contract to get paid for carbon credits, whether through the Chicago Climate Exchange or another source?
 - c. If so, can you share the general details of the contract?
 - d. If no, do you know why ranchers have not enrolled in a carbon payment program?
 - e. What would be required for them to participate?

15. If a payment program existed for conservation practices that ranchers COULD use, what further information do you think they would need in order to enroll?

16. Given the potential environmental income sources we talked about, what would be helpful to you as next steps in order to explore opportunities for ranchers in your region?

Section 4: Demographic Information

Next I have a few more personal questions to ask you regarding your own characteristics. This information will be kept confidential and is important to be able to describe my study population, or your community. If you are not comfortable answering any of these questions, please feel free to give a more general answer or to not answer at all.

17. What is your age range? 20-35, 36-45, 46-55, 56-65, 66-75, over 75

18. What is the highest level of education you have completed?

19. What is your undergraduate, and if applicable, graduate degree in?

20. How many years have you been with this organization? And in what roles?

21. How many years overall have you been working in natural resource-related jobs? And in what roles?

Survey Instrument (Practitioners)

- Thinking back to what we have discussed today, what do you see as being the one or two most promising aspects about integrating into ranch operations payments for ecosystem services with continued income from livestock production?

- What do you see as the one or two most important challenges for ranchers related to integrating payments for ecosystem services into their ranch operations?

- How important do you think the following possible advantages are to ranchers for pursuing new opportunities related to payments for ecosystem services? (PLEASE CIRCLE ONE NUMBER FOR EACH)

Not important					Very Important
1	2	3	4	5	

Increased income:

1 2 3 4 5

Diversify income beyond livestock:

1 2 3 4 5

Enhance conservation practices on ranch:

1 2 3 4 5

Aligns with personal goals for the ranch:

1 2 3 4 5

Aligns with current management practices:

1 2 3 4 5

<p>Other</p> <p>PLEASE LIST: _____</p> <p style="text-align: center;">1 2 3 4 5</p> <p>PLEASE LIST: _____</p> <p style="text-align: center;">1 2 3 4 5</p>
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- How important do you think the following possible disadvantages are to ranchers related to payments for ecosystem services? (PLEASE CIRCLE ONE NUMBER FOR EACH)

Not important					Very important
1	2	3	4	5	

Concern regarding diversifying beyond livestock:

1 2 3 4 5

Uncertainty about future rules and regulations for new payments for ecosystem services:

1 2 3 4 5

Possible high cost of adopting new management practices:

1 2 3 4 5

Concern that participation would take too much time:

1 2 3 4 5

Uncertainty about ranch's future:

1 2 3 4 5

Other

PLEASE LIST:	_____				
1	2	3	4	5	
PLEASE LIST:	_____				
1	2	3	4	5	

APPENDIX III:

DIVERSIFIED RANCH BUSINESS MODELS IN THE LARAMIE FOOTHILLS:

STAKEHOLDER REPORT

Executive Summary

Working ranches in the Laramie Foothills are important in providing food, water, open space, wildlife habitat, and many other valuable ecosystem services to society. While ranchers are paid for some of these benefits through existing markets (usually livestock products), most of these ecosystem services generate little, if any, income for ranchers. As financial pressures on ranchers increase due to factors such as rising operational costs and rising land values, ranchers are looking for new ways to make ends meet and reach their stewardship goals. These strategies could include ways to reduce costs, enhance current income sources, or pursue new income opportunities. One potential new income source could be payments for ecosystem services, which are being explored in Colorado, other U.S. states, and around the world. Payments for ecosystem services involve beneficiaries of an ecosystem service paying landowners for providing that service through their land stewardship and animal husbandry practices.

To support community efforts, we undertook a study to examine ways that ranchers could create more diversified ranch business models that deliver financial benefits to ranchers and conservation benefits to the public. To learn about what ranchers are currently doing and what they might do in the future, we conducted topic driven, semi-structured interviews from August 2010 to January 2011 with 16 ranchers in Larimer County, CO, as well as 7 natural resource practitioners who work closely with ranchers in this region. We asked practitioners to provide responses in terms of their observations of ranchers in the region to gain a broader perspective.

We asked interviewees about current ranch business models, current ranch challenges and future concerns, and their reactions to the possibility of creating a new payment for ecosystem services program in this region. In terms of current business models, ranchers generally depend upon a

combination of income from livestock, other on-ranch sources, and off-ranch sources. Interviewees identified a wide range of current challenges and future concerns including financial, ecological, legal or policy, personal, and social factors. Interviewees identified 85 opportunities that ranchers are currently using or could use in the future to contribute to more diversified ranch business models. All interviewees expressed interest in the possibility of developing a payment for ecosystem services program in this region. This interest, however, was met with caution and many questions about how such a program would work, and whether it would be beneficial to program participants. As explorations advance in this community related to payments for ecosystem services, factors related to access to information, payment structure, program transparency, and other issues will need to be carefully considered by stakeholders.

We thank all interviewees and the entire community for your support of this project. We hope this information helps to inform future discussions about ways to create more diversified and robust ranch business models that deliver financial and conservation benefits to the ranch and the broader public.

Introduction

Working ranches in the Laramie Foothills and across the American West provide a diverse array of vital benefits that help fulfill human life – food and fiber, clean drinking water, climate regulation, recreational experiences, wildlife habitat and others. With the notable exceptions of food, fiber, and other livestock products, most of these benefits from working lands remain largely outside existing economic markets. For ranchers, income is primarily generated through their livestock operation and less so from stewardship of the broader set of environmental benefits. While personal and family values drive many ranchers to be committed stewards of

land, water, air, and wildlife resources, the financial burden of doing so can make such activities difficult given the financial pressures facing working ranches.

Recognizing these challenges facing ranchers, and what is at stake for society more broadly, leaders from across the public, private, nonprofit, and academic communities are coming together to pursue new solutions. A key target is to work with ranchers to develop new revenue streams, called payments for ecosystem services, to compensate ranchers for the benefits they provide to the public related to stewardship of land, air, water, and wildlife resources, and through these payments, to help develop more diversified and robust ranch business models.

In this context, the objective of our study was to investigate the barriers and opportunities for developing more diversified business models for working ranches that integrate traditional livestock income sources with additional conservation-oriented sources. To address this objective, we interviewed 16 ranchers and 7 natural resource practitioners (from public agencies and nonprofits) working with ranchers in Larimer County, CO, focusing particularly on the Laramie Foothills region. Here, we report on the major findings from our interviews related to four topics: (1) current ranch business models and incorporated conservation practices, (2) current challenges and future concerns facing working ranches, (3) business strategies being employed to address these issues, and (4) reactions to developing a payment for ecosystem services program in this region. We conclude by discussing implications and recommendations that arise from our study.

We express our sincere gratitude to each interviewee for taking time to participate in this study, as well as to the Laramie Foothills Advisory Committee (LFAC) collaborative group for supporting this project by connecting us with interviewees. We hope that the information

described below is useful to informing discussions and decisions by this community in the future.

Results and Discussion

Current ranch business models

We identified three general current business models used by ranchers in this region: (1) The livestock operation loses money and is funded through outside income (4 ranches). (2) The ranch makes a little profit through livestock sales and is supplemented with outside income (8 ranches). (3) The ranching operation is the main source of income for the rancher, with little to no off-ranch income (4 ranches).

The majority of ranchers stated that they earned most of their income from off-ranch sources, and all had at least some income provided by activities unrelated to cattle (see Table 1 for complete list). Of the 32 income sources mentioned, other jobs (cited by 11 ranchers and 4 practitioners), land sales (5 ranchers, 2 practitioners), investments (3 ranchers, 1 practitioners), and hospitality (1 rancher, 1 practitioner), were the only non-cattle sources reported by ranchers as providing a substantial amount of revenue to the ranch operation. Selling hay (6 ranchers, 4 practitioners) and participation in federal government programs (6 ranchers, 5 practitioners) were mentioned by several ranchers, but these sources did not provide much income.

Current conservation practices

Interviewees mentioned 28 different management practices related to land or water stewardship (Table 2). Of these, the most frequently mentioned practices were rotational grazing (14 ranchers, 5 practitioners), weed management (12 ranchers, 3 practitioners), and water

development (9 ranchers, 5 practitioners). As noted by one participant, these practices are relatively "standard" practices used by ranchers in the study region.

Current challenges and future concerns facing working ranches

Participants discussed a total of 58 current challenges (Table 3). Of these, input costs (15 ranchers, 5 practitioners) were mentioned most often. This included costs such as feed, fuel, labor, and transportation, among others. As one rancher noted: "Labor and feed's our big expenses. And we're not, we're not high on the salary side, I mean (laughs), you don't come here to get rich! Labor and feed are big costs, actually." A closely related challenge was unprofitability (13 ranchers, 6 practitioners), which referred to general discussion about a ranch earning little to no profit. Time and energy (11 ranchers, 3 practitioners), water scarcity (12 ranchers, 1 practitioner), and development pressure (10 ranchers, 6 practitioners), also emerged as major current challenges.

Interviewees also discussed 70 concerns about factors in the future that may affect ranches (Table 4). Most mentioned were regulations (9 ranchers, 3 practitioners), which were characterized as a law or policy affecting a rancher's ability to run a profitable operation by creating restrictions on their management practices. Invasion of privacy (8 ranchers, 5 practitioners) was mentioned often, and was defined as concern regarding the potential interference by outsiders in ranch operations. Taxes (8 ranchers, 1 practitioner) and the financial profitability of payment for ecosystem services (7 ranchers, 0 practitioners) were also discussed as important concerns. Ranchers were worried about the financial profitability of potential payment for ecosystem services programs: "It seems like the payment, you know, if you're talking a few bucks an acre or whatever, it isn't worth the interference, so to speak."

Business strategies to address current challenges and future concerns

Interviewees discussed both current and future business and management strategies that could help address challenges and develop more diversified and robust ranch business models. Three current cost reduction strategies (windrow grazing, changing calving season, and direct marketing) were mentioned. Additionally, participants brought up 85 different future opportunities (Table 5). These opportunities could be grouped into three major categories: (1) reducing costs, (2) enhancing revenue through existing and new funding sources, and (3) building regional capacity. Additionally, five personal opportunities (such as retirement) were mentioned, which represent byproducts of more sustainable business models. Although no opportunities stood out as being mentioned by a majority of participants, the range of possibilities is important in this exploratory research.

Some examples of strategies to reduce costs in the future are fencing (3 ranchers, 1 practitioner), taxes (3 ranchers, 0 practitioners), and water development (3 ranchers, 0 practitioners). Fencing and water development centered around discussion regarding payments for ranch improvements such as fencing out riparian areas, creating more pastures, or drilling wells for more water sources. Participants also mentioned that reducing taxes would be a good way to reduce costs. One rancher said: “If there was a way of logically lowering the property taxes... [that] would be a big benefit. I’m sure every rancher has that problem.”

Strategies to enhance revenue included both enhancement of current revenue and new revenue sources. These included carbon credits (6 ranchers, 3 practitioners), water quality enhancement (4 ranchers, 4 practitioners), and wind energy (4 ranchers, 3 practitioners). Carbon credits would involve payments for management practices that increased carbon uptake in plants and soils.

Water quality enhancement would involve payments for practices that improved water quality for downstream users. Sixteen potential funding sources were discussed, which included local and national governments and organizations, as well as current government programs (such as the Wetland Reserve Program). Of those mentioned, Farm Bill Programs (3 ranchers, 3 practitioners), and Larimer County (1 rancher, 2 practitioners) were discussed the most often. These funding sources are hypothetical possibilities and would require further research and discussion to determine the feasibility of any new programs.

While participants discussed some regional changes as challenges (such as development pressure), they also referred to other regional factors as opportunities. Most often mentioned were changing ranch culture (3 ranchers, 4 practitioners), collaboration in the Laramie Foothills (1 rancher, 4 practitioners), and local markets (1 rancher, 4 practitioners). The changing ranch culture, according to interviewees, is represented by ranchers being more open and willing to try new business models and management practices, rather than sticking solely to a conventional cow-calf model. Collaboration in the Laramie Foothills was recognized by participants as a partnership between landowners and other organizations and agencies, which may provide more opportunities for new programs. Three practitioners discussed the need to develop a larger local marketplace in Larimer County for grassfed or value-added beef.

One practitioner said regarding collaboration: “I don’t think there’s many places in the country that you can... find the interaction and the cooperation between varied entities. From a rancher to a conservation organization to local governments... there’s been a lot of buy in and I think it’s been great because people have maybe opened their eyes to where an organization or government might have been threatening or scary ... turns out to be a partner.”

Potential for payments for ecosystem services (PES)

All interviewees expressed potential interest in developing a payment for ecosystem services program in this region, and this interest was also matched with many questions and concerns about how such a program would be designed and administered. The two most promising aspects of a new PES program according to respondents (Table 6) were enhancing conservation (7 ranchers, 5 practitioners) and increasing income (7 ranchers, 1 practitioners). The two challenges mentioned most often were lack of knowledge or information (4 ranchers, 1 practitioner) and transparency or trust (4 ranchers, 1 practitioner). Possible restrictions (3 ranchers, 1 practitioner) and unknown risk or cost (2 ranchers, 2 practitioners) also emerged as potential barriers to a new PES program.

Needs

Given the vast array of concerns expressed by participants regarding a potential new payment program, 13 different types of informational needs arose in the discussion (Table 7). Mentioned most often was the need for general information (12 ranchers, 5 practitioners) when deciding whether or not to participate in a new payment program. Some of the types of information that participants wanted were information on how a program would be implemented, whether a program would be profitable for the rancher, ecosystem services that would be targeted, and clear and concise information regarding qualifications, risks, and benefits.

Implications and Recommendations

All participants in this research were interested in learning about a new payment for ecosystem services program in the Laramie Foothills, even when they expressed skepticism regarding the

profitability of PES. Collaboration and innovation have already been clearly demonstrated by ranchers in this region, which may increase the chances for a new payment program to succeed. According to the concerns and needs discussed by interviewees, a new program will need to be simple to implement, flexible, have transparent rules, provide an economic benefit, and provide easy access information to participants.

Simple Implementation

Many interviewees viewed regulations and paperwork as challenges to operating a working ranch. Any new programs that are developed will have to be as simple and straightforward as possible. Although ranchers expressed willingness to try new diversification opportunities, they also discussed the copious amounts of time and energy that a traditional ranching operation requires, and it would be difficult to devote more to new practices.

Flexibility

Some interviewees expressed concern about strict regulations that may accompany a new program. These concerns included drastic changes in management practices, being locked into a program for a long period of time, or being forced to enter all of their acreage into a program to qualify. A pilot PES project in this region may be more feasible for ranchers if it requires minimal changes in practices, a short time period for initial contracts, and the ability for ranchers to start with a small amount of acreage, rather than their entire ranch.

Transparency

Several interviewees discussed being suspicious of the government, NGOs, or PES programs like the carbon market. In order to encourage participation, a new PES program will need clearly

defined rules, qualifications for participation, and a rigorous financial analysis. Additionally, a relationship will need to be built between ranchers (sellers) and buyers of ecosystem services. The buyers must appear legitimate to ranchers, and the ranchers must be able to demonstrate actual delivery of services.

Economic Benefit

Many ranchers were skeptical that a PES program could provide a worthwhile economic benefit. In order to undertake the paperwork and management practices required with a new program, the financial incentive will have to be sufficient to compensate ranchers for their time and energy. Even those ranchers who were interested were not convinced that their property provided enough of a service for the public to pay for it. A new PES program would require careful financial analysis to determine that the costs and benefits are fair for buyers and sellers.

Easy Access to Information

Most interviewees wanted more specific information about what a new PES program would look like. Transparent information would need to be provided to ranchers in diverse ways in order to target diverse participants. Some would prefer a workshop format, while others would rather access information online at their own convenience or receive hardcopy information in the mail. Additionally, the public would need to be informed about a new program, especially if they would be asked to provide funding.

If a PES program can be successfully implemented in the Laramie Foothills, this will provide another example to other regions and collaborative groups who are considering PES as a new

revenue stream to enhance the financial sustainability of ranching operations, while providing ecological benefits to the public.

Appendix: Tables

Table 2: Income sources mentioned by interviewees other than traditional cattle; listed in order from most to least mentioned by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

Other Income Source	Ranchers (N = 16)		Natural Resource Practitioners (N = 7)	
	Count	Percentage	Count	Percentage
Traditional cow-calf	12	75%	7	100%
Other jobs	11	69%	4	57%
Conservation Easements	7	44%	6	86%
Any Government Grant	6	38%	5	71%
Hay	6	38%	4	57%
EQIP Grant	5	31%	4	57%
Land sales	5	31%	2	29%
Hunting Licenses	3	19%	5	71%
Investments	3	19%	1	14%
Rental houses	3	19%	0	0%
Cell tower	2	13%	1	14%
Grazing lease	2	13%	0	0%
Government Grant (general)	2	13%	0	0%
Habitat Partnership Program	1	7%	2	29%
Crops	1	6%	1	14%
Hospitality	1	6%	1	14%
Conservation Stewardship Program	1	7%	1	14%
Chickens	1	6%	0	0%
Lack of debt	1	6%	0	0%
Loan backs	1	6%	0	0%
Natural Beef	1	6%	0	0%
Pigs	1	6%	0	0%
Ranch Preservation Community	1	6%	0	0%
Refinance	1	6%	0	0%
State Rebate	1	6%	0	0%
Subsidized crop insurance	1	6%	0	0%
Team roping	1	6%	0	0%
Goats	1	6%	0	0%
Lease land to gun club	1	6%	0	0%
Moss rock	1	6%	0	0%

Oil	1	6%	0	0%
Vertical Integration	1	6%	0	0%
Conservation Reserve Program	1	7%	0	0%
Increased Carrying Capacity	0	0%	3	43%
Diversifying livestock, bison	0	0%	1	14%
Sheep	0	0%	1	14%
Weed Coop Seed Sharing	0	0%	1	14%
DOW Access Lease	0	0%	1	14%

Table 2: Current conservation practices used by ranchers in the study region listed in order from most to least mentioned by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

	Ranchers (N = 16)		Natural Resource Practitioners (N = 7)	
Rotational grazing	14	88%	5	71%
Weed Management	12	75%	3	43%
Water development	9	56%	5	71%
Conservation Easements	7	44%	6	86%
Grazing management plan	5	31%	4	57%
Fencing riparian areas	4	25%	3	43%
Erosion Control	4	25%	1	14%
Wildlife friendly fencing	3	19%	1	14%
Efficient Irrigation	3	19%	0	0%
Planting trees or grass	3	19%	0	0%
Solar pump	3	19%	0	0%
Change calving season	2	13%	1	14%
Grassfed beef	2	13%	1	14%
No antibiotics	2	13%	0	0%
Using horses for transportation	2	13%	0	0%
Lease pasture to other ranchers	2	13%	2	29%
Developing Wildlife Habitat	1	6%	2	29%
Cattle to control weeds	1	6%	1	14%
Organic crops or fertilizer	1	6%	1	14%
Windrow grazing	1	6%	1	14%
Composting	1	6%	0	0%
Goats for weed control	1	6%	0	0%
Integrated crops and livestock	1	6%	0	0%
Manure Management	1	6%	0	0%
Night friendly lighting	1	6%	0	0%
Pine beetle control	1	6%	0	0%
Sheep to control larkspur	1	6%	0	0%
Prescribed Fire	0	0%	2	29%
Wind energy	0	0%	1	14%

Table 3: Current challenges facing ranching operations discussed by interviewees organized into the five general categories of ecological, financial, legal and policy, personal and social challenges. Within each category, challenges are organized from most to least cited by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

	Ranchers (N = 16)		Natural Resource Practitioners (N = 7)	
Ecological				
Water scarcity	12	75%	1	14%
Weeds	6	38%	0	0%
Wildlife conflict	4	25%	0	0%
Disease	3	19%	0	0%
Pine beetle	3	19%	0	0%
Rocky ground	3	19%	0	0%
Climate change	2	13%	1	14%
Floods	2	13%	0	0%
Larkspur	2	13%	0	0%
Fire	1	6%	1	14%
Ecosystem connectivity	1	6%	0	0%
High elevation weather	1	6%	0	0%
When to move cattle	1	6%	0	0%
Petroleum inputs required for agriculture	0	0%	1	14%
Financial				
Cost of inputs	15	94%	5	71%
Unprofitable	13	81%	6	86%
Scale	8	50%	3	43%
Taxes	7	44%	1	14%
Enough land	6	38%	3	43%
Insurance	6	38%	0	0%
Market prices	4	25%	1	14%
Marketing	4	25%	1	14%
Purchasing reliable livestock	1	6%	0	0%
Legal or Policy				
Regulations	8	50%	2	29%
Red tape (Bureaucracy)	5	31%	3	43%
Endangered Species Act	3	19%	1	14%
DOW kill deer due to CWD	2	13%	0	0%
Liability	1	6%	1	14%
Fees	1	6%	0	0%
Laws about hunting on own property	1	6%	0	0%
Mineral rights	1	6%	0	0%
No sheep grazing	1	6%	0	0%

Refinancing policies	1	6%	0	0%
Government owned land	1	6%	0	0%
Water rights	1	6%	0	0%
Focus on short term	0	0%	1	14%
Processing	0	0%	1	14%
Personal				
Time and energy	11	69%	3	43%
No heirs	4	25%	4	57%
Invasion of privacy or trespassing	3	19%	0	0%
Uncertainty	2	13%	0	0%
Finding information	1	6%	1	14%
Suspicious of recreational ranchers	1	6%	0	0%
Social				
Development pressure	10	63%	6	86%
Problems with neighbors	8	50%	3	43%
Regional changes	8	50%	2	29%
Public perception	5	31%	1	14%
Ranching vs recreation and wildlife	3	19%	2	29%
Few processors	3	19%	1	14%
Multiple landowners	3	19%	0	0%
Responsibilities, landowners and lessees	3	19%	0	0%
Keeping cattle where they belong	2	13%	2	29%
Fewer services	2	13%	1	14%
Grassfed beef characteristics	2	13%	0	0%
Theft	2	13%	0	0%
Access to property	1	6%	0	0%
Gender bias	1	6%	0	0%
Water competition ag vs municipal	1	6%	0	0%

Table 4: Future concerns expressed by interviewees organized into the five general categories of ecological, financial, legal and policy, personal and social challenges. Within each category, challenges are organized from most to least cited by ranchers. Practitioner responses are based on their knowledge of ranchers in the study region, not their personal or organizational perspectives.

	Ranchers (N = 16)		Natural Resource Practitioners (N = 7)	
Ecological				
Additionality	4	25%	1	14%
Nothing to offer for carbon market	3	19%	0	0%
Overgrazing	2	13%	1	14%
Antibiotic resistant bacteria	2	13%	0	0%
No services to offer public	2	13%	0	0%
No water for water PES	2	13%	0	0%
Not enough grazing	2	13%	0	0%
Tradeoffs in new practices	2	13%	0	0%
Fragmentation	1	6%	1	14%
Petroleum inputs required for agriculture	1	6%	1	14%
4-wheelers	1	6%	0	0%
Effects of oil drilling	1	6%	0	0%
Pollution by trespassers	1	6%	0	0%
Trees in Colorado	1	6%	0	0%
Water quality for irrigation	1	6%	0	0%
Wolf reintroduction	1	6%	0	0%
Water Scarcity	1	6%	0	0%
Grassland carbon storage	0	0%	2	29%
Wind power vs wildlife	0	0%	2	29%
Feedlot nitrification	0	0%	1	14%
Financial				
Taxes	8	50%	1	14%
Financial profitability of PES	7	44%	0	0%
Broader economy	5	31%	1	14%
Economic sustainability	3	19%	5	71%
Price of carbon	3	19%	2	29%
Ranch as retirement fund	2	13%	0	0%
Infrastructure cost	1	6%	1	14%
Continuous production	0	0%	1	14%
Marketing	0	0%	1	14%
Quantifying ecosystem services	0	0%	1	14%
Legal and Policy				
Regulations	9	56%	3	43%
Red tape (Bureaucracy)	6	38%	1	14%
Ethical implementation of conservation	3	19%	0	0%

easements				
Lack of tax dollars	2	13%	1	14%
Liability	2	13%	1	14%
Monitoring and Verification	2	13%	1	14%
New practices required with programs	2	13%	1	14%
Reservoir projects	2	13%	1	14%
35 acre ranchettes	1	6%	0	0%
Conservation easement restrictions	1	6%	0	0%
Municipal control of water	1	6%	0	0%
Flexibility in projects	0	0%	1	14%
Implementation	0	0%	1	14%
Receiving a PES on a lease	0	0%	1	14%
Personal				
Invasion of privacy	8	50%	5	71%
Suspicious of government	7	44%	2	29%
Suspicious of carbon market	7	44%	0	0%
Uncertainty	6	38%	4	57%
Traditional thinking or fear of change	5	31%	7	100%
Time and energy	4	25%	4	57%
Changing ranch operation	4	25%	2	29%
Dubious heir	3	19%	1	14%
Grassfed characteristics	3	19%	0	0%
Suspicious of some NGOs	2	13%	1	14%
Multiple landowners	2	13%	0	0%
Lack of knowledge	1	6%	4	57%
Legitimacy of funding source	1	6%	0	0%
Suspicious of neighbors	1	6%	0	0%
Suspicious of oil companies	1	6%	0	0%
Suspicious of research	1	6%	0	0%
Lack of capacity	0	0%	2	29%
Social				
Ranches being subdivided	5	31%	4	57%
Public perception	4	25%	4	57%
Visual impact	3	19%	1	14%
Losing grazing lease	2	13%	1	14%
Moral hazard	2	13%	1	14%
Safe and healthy food supply	2	13%	0	0%
Growing population	2	13%	0	0%
Stuck at gathering information	1	6%	1	14%
Concentration of agriculture	1	6%	0	0%

Table 5: Opportunities discussed by participants for creating more diversified ranch business models that achieve conservation and financial objectives. Opportunities are categorized as reducing costs, enhancing revenue, building regional capacity, possible funding sources, and personal opportunities. Each category is organized in terms of most to least cited by ranchers.

	Ranchers (N = 16)		Natural Resource Practitioners (N = 7)	
Reducing costs				
Fencing	3	19%	1	14%
Taxes	3	19%	0	0%
Water development	3	19%	0	0%
Conservation easements	2	13%	2	29%
Grassland restoration	2	13%	1	14%
Weed control	2	13%	1	14%
No debt	2	13%	0	0%
Vertical integration	1	6%	0	0%
Inheritance	1	6%	0	0%
Cost reduction for environmental stewardship	0	0%	1	14%
Enhancing revenue				
Carbon credits	6	38%	3	43%
Water	5	31%	4	57%
Wind energy	4	25%	3	43%
Hunting leases	4	25%	1	14%
Diversification general	3	19%	3	43%
Expand herd	3	19%	1	14%
Oil, natural gas, and minerals	3	19%	1	14%
Hospitality	3	19%	0	0%
Houses	3	19%	0	0%
Recreation general	3	19%	0	0%
Wildlife management	2	13%	1	14%
Cell or radio tower	2	13%	0	0%
Cultural or historical services	2	13%	0	0%
Moss rock	2	13%	0	0%
Grassfed beef	1	6%	2	29%
Conservation beef	1	6%	1	14%
Horseback riding fees	1	6%	1	14%
Timber	1	6%	1	14%
Backcountry guiding	1	6%	0	0%
Goats	1	6%	0	0%
Hay	1	6%	0	0%
Healing packages	1	6%	0	0%
Lease out goats	1	6%	0	0%
Livestock hauling	1	6%	0	0%

Maintaining enhancements	1	6%	0	0%
Manure management	1	6%	0	0%
Non tributary water	1	6%	0	0%
Organic crops	1	6%	0	0%
Organic price premium	1	6%	0	0%
Pine beetle wood	1	6%	0	0%
Poultry	1	6%	0	0%
Sheep	1	6%	0	0%
Storing campers	1	6%	0	0%
Water quality related to development	1	6%	0	0%
Riparian mitigation	0	0%	2	29%
Wetland mitigation	0	0%	2	29%
Bee hives	0	0%	1	14%
Birding	0	0%	1	14%
Bison	0	0%	1	14%
Cluster development	0	0%	1	14%
Grassbank	0	0%	1	14%
Habitat mitigation	0	0%	1	14%
Photography	0	0%	1	14%
Pollinator habitat	0	0%	1	14%
Specialty crops	0	0%	1	14%
Sustainable income	0	0%	1	14%
Possible Funding Sources				
Farm Bill programs general	3	19%	3	43%
Lottery money	2	13%	0	0%
Larimer County	1	6%	2	29%
NF Weed Coop cost share resources	1	6%	1	14%
Extension service	1	6%	0	0%
NGO's as funders for PES	1	6%	0	0%
City of Fort Collins	0	0%	4	57%
Government grants	0	0%	2	29%
CCA as funder	0	0%	1	14%
Conservation Stewardship Program	0	0%	1	14%
Denver water	0	0%	1	14%
Developer mitigation	0	0%	1	14%
Grassland Reserve Program	0	0%	1	14%
Other water municipalities	0	0%	1	14%
Wetland Reserve Program	0	0%	1	14%
Wildfire mitigation grant	0	0%	1	14%
Regional capacity				
Changing ranch culture	3	19%	4	57%
Collaboration in Laramie Foothills	1	6%	4	57%
Local markets	1	6%	4	57%

Increasing land value due to amenity demand	1	6%	0	0%
Present info at board meetings	1	6%	0	0%
Mobile slaughter	0	0%	1	14%
Conservation community marginal returns	0	0%	1	14%
Efficient use of funds	0	0%	1	14%
Personal				
Keep ranchers on land	2	13%	3	43%
Afford a ranch manager	1	6%	0	0%
Keep kids on land	1	6%	0	0%
Quit outside job	1	6%	0	0%
Retirement	1	6%	0	0%

Table 6: Survey Results. Participants were asked to list their top one or two most promising aspects of a new PES program, as well as their top one or two perceived challenges. These answers were categorized and aggregated in the following table. *One rancher did not take the survey. Of the two two-person interviews, in one group only one person took the survey and in the other both did. This resulted in 16 total rancher surveys completed, but representing only 15 ranch units (whereas 16 ranch units are represented in all results provided above).

Promising Aspects	Ranchers (N = 15)		NR Professionals (N = 7)	
Enhance conservation	7	47%	5	71%
Increase income	7	47%	1	14%
Preservation of ranching	2	13%	3	43%
Getting credit for ES	2	13%	0	0%
Income related to stewardship	2	13%	0	0%
Improve grazing conditions	2	13%	0	0%
Knowledge of ES/PES	1	7%	0	0%
Diversification	0	0%	3	43%
Efficient use of conservation dollars	0	0%	2	29%
Encourage local market	0	0%	1	14%
Guarantee services rendered	0	0%	1	14%
Challenges	Ranchers (N = 15)		NR Professionals (N = 7)	
Lack of knowledge or information	4	27%	1	14%
Transparency or trust	4	27%	1	14%
Restrictions	3	20%	1	14%
Red tape	3	20%	0	0%
Unknown risk or cost	2	13%	2	29%
Multiple owners or decision makers	2	13%	0	0%
Additionality	2	13%	0	0%
Changes operation	1	6%	1	14%
Time and energy	1	6%	1	14%
Tax increase	1	6%	0	0%
Should concentrate on global issues	1	6%	0	0%
Public perception	0	0%	2	29%
Not profitable	0	0%	2	29%

Table 7: Interviewee-identified needs regarding participating in a new payment for ecosystem services program. Needs are stratified by type of information, where to find information, ecological, financial, legal and policy, personal, and social. Each category is organized by most to least cited by ranchers and practitioners combined.

	Ranchers (N = 16)		NR Professionals (N = 7)	
Type of Information				
General information	12	75%	5	71%
Info on implementation	2	13%	4	57%
Targeted information	2	13%	1	14%
Info on cost benefit analysis	1	6%	4	57%
Info on capital cost	1	6%	2	29%
Info on local ES	1	6%	2	29%
Info on how to sign up	1	6%	1	14%
Concise information	1	6%	0	0%
Info on qualifications to participate	1	6%	0	0%
Training on internet usage	1	6%	0	0%
Info on clearly defined roles	0	0%	1	14%
Info on reporting	0	0%	1	14%
Info on social risk	0	0%	1	14%
Where to get information				
Workshop information	6	38%	1	14%
Online information	4	25%	2	29%
Hard copy information	2	13%	2	29%
Word of mouth information	2	13%	0	0%
Easy access information	1	6%	2	29%
County fair information	1	6%	0	0%
Ecological Needs				
Monitoring and Verification	3	19%	0	0%
Non destructive program	1	6%	0	0%
Seed driller for disturbance areas	1	6%	0	0%
Defined geographical area	0	0%	1	14%
Easily definable ecosystem services	0	0%	1	14%
Ecological sustainability	0	0%	1	14%
Water storage	0	0%	1	14%
Financial Needs				
Sustainable income	3	19%	4	57%
Minimize cost	2	13%	1	14%
Actual Markets	1	6%	1	14%
Legal and Policy Needs				
Program time limit	2	13%	2	29%
Minimize red tape	2	13%	0	0%
Lobbyist	1	6%	0	0%
Strict contracts	1	6%	0	0%

Weed control cost share	1	6%	0	0%
Targeted projects	0	0%	1	14%
Personal Needs				
Simple changes	4	25%	3	43%
Low risk	2	13%	4	57%
Motivation to participate	2	13%	2	29%
Landowner interests and knowledge	1	6%	3	43%
Minimize invasion of privacy	1	6%	0	0%
Culturally sensitive	0	0%	2	29%
Social Needs				
Successful examples	4	25%	3	43%
Guinea pig	2	13%	3	43%
Public education	2	13%	1	14%
Build trust	1	6%	2	29%
Leader for local market	1	6%	2	29%
Infrastructure to process and store	0	0%	1	14%
Communication about other programs	0	0%	1	14%
Enough interest	0	0%	1	14%