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Grassbanks: An evaluation of a conservation tool

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GRASSBANKS: AN EVALUATION OF A
CONSERVATION TOOL

by

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Grassbanks: An Evaluation of a Conservation Tool

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Grassbanking, the exchange of forage for conservation benefit, is an innovative new tool that has emerged in recent years. Because of the perceived potential of this tool to overcome numerous ecological problems in the western United States, millions of dollars have been invested by several organizations and individuals to develop five grassbanks. However, little peer-reviewed literature exists on grassbanks and the assertion that grassbanks result in cost-effective conservation benefits remains an untested assumption. The overall objective of my dissertation research was to provide the first comprehensive evaluation of grassbanking while providing usable information to grassbank operators that would result in better informed decisions.

I found that grassbanks face several substantial policy challenges, ranging from unintended negative consequences of trademarking the concept, to IRS conservation benefit valuation concerns, to the lack of support from national environmental and cattle lobby groups, to mixed support from the public land agencies. These obstacles may be too substantial for grassbanking, in its current form, to overcome.

I qualitatively assessed the cost and benefits associated with grassbanks and found that grassbanks can improve their overall effectiveness by reducing purchased land costs and instead using donated private land, leased land, or public land for the grassbank. Conservation benefit can be increased by pursuing treatments that target rare or declining conservation targets over a greater spatial scale.

Finally, I investigated the influence of property ownership arrangements on grassbank outcomes and found that the nonprofit and public grassbanks working on public land achieved relatively higher conservation benefits than the private grassbank/private management area model. The greater conservation benefit associated with these models was due to higher levels of organizational support, which resulted in support of larger restoration treatments. However, increased organizational support resulted in much higher costs, rendering these models unsustainable over the long term. As long as current property laws and policies remain, grassbanks, along with other approaches designed to achieve ecosystem management goals, will require additional incentives for private and nonprofit landowners. Alternatively, all levels of government need to create mechanisms to pay for the management of common pool resources that characterize ecosystems.

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My 1992 graduation photo stated that Stephanie Gripne would become a wildlife biologist. During that same time period Dr. Jack Ward Thomas, arguably the most famous wildlife biologist in the U.S., had recently been named Chief of the USDA Forest Service. During the summer of 1994 I worked on the Engine 352 for the Sawtooth National Forest Ketchum Ranger District and fought 14 fires throughout the western U.S. including in the Book Cliffs, Utah, not far from Storm King Mountain. I interned for the Forest Service and studied mountain goats that fall. Chief Thomas was my professional hero and only in my dreams did I ever think I would have the opportunity to work with him. Working with Dr. Thomas has been a dream come true for me. Both Jack and Kathy Thomas have provided everything one could ever ask from professional mentors and personal friends. I consider them family and am more grateful to them for their love, support, and high expectations than they will ever know.

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Steph

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CHAPTER: INTRODUCTION

1.1 Background

The Challenge of Cross Boundary Ecosystem Management. Ecosystem management, with its emphasis on creating partnerships of diverse interests working together to manage large natural systems, emerged during the past 20 years as a viable alternative to historical natural resource management that was top-down, government mandated, and expert-driven in nature (Meffe et al. 2002). One of the key factors for the effective application of ecosystem management is that ecological systems are managed according to ecological characteristics (e.g., watersheds) instead of political boundaries such as property ownership (Grumbine 1994; Christensen et al. 1996).

As more agencies shift toward a holistic and, therefore, cross-boundary ecosystem management approach, partnerships have emerged among federal agencies, state and local governments, as well as private landowners and citizens (Knight 1997). However, while the ecological premise of ecosystem management is conceptually sound, a tension exists between existing property rights and the practical implementation of ecosystem management. Currently, private land ownership is incompatible with the "public goods or common pool resources" nature of ecosystem services originating on private land because the private land owner bears the cost of providing ecosystem services without receiving compensation for producing them (Haddad 2003).

The notion that land ownership confers exclusive dominion to its owner can be traced to property philosophies first generated over 300 years ago, and has formed the basis for much of the property arrangement law and policy followed by industrialized nations today (Rose 1998; West 2003). This individualized concept of property discounts the notion of "ecosystem services", that there are landscape-level attributes (e.g., watershed health) that exist independently of property ownership, and that these collective attributes have tangible value to the public (Costanza et al. 1997).

The challenges associated with managing landscapes characterized by a mixture of public and private lands are widely acknowledged (Shogren 1999; Hurley et al. 2002; Jackson-Smith et al. 2005). The Ecological Society of America's Committee on the Scientific Basis for Ecosystem Management recognized this tension with the statement that "management strategies must deal constructively with such growing concerns as the rights of private property owners and local loss of jobs" (Christensen et al. 1996). Some scholars and practitioners have pushed to restructure political boundaries so that they are compatible with ecological systems (Sax 1993; Duncan 1996; Goldstein 1998), an option that currently lacks broad public support. In the absence of the wholesale restructuring of our land tenure system, government regulation or voluntary incentives are commonly offered as solutions to the challenge of managing in mixed-ownership landscapes (Rasker 1992; Sample 1994; Breckenridge 1995; Dwyer 1995). Many of these incentives, such as conservation easements, have been brokered through non-governmental organizations, hereafter referred to as nonprofits.

The Role of Nonprofits in Ecosystem Management. While nonprofits share characteristics with both government and private sector businesses, they are unique in that they are independent of any government, and have a humanitarian or cooperative mission rather than a commercial purpose, and therefore, are tax-exempt. For example, like a private individual or business, nonprofits can own land, but unlike a private owner, they are not required to pay property taxes. Nonprofit land may be thought of as representing the middle ground between private land often managed with the intent of making a profit, and public land, which is managed by the government for public benefit. Nonprofits have the same landowner rights as private landowners, but they have the additional duty of fulfilling their nonprofit mission of promoting the public good.

During the past 20 years, nonprofits, and land trusts specifically, have played a significant role in providing incentives for promoting conservation on private lands. The primary tools of land trusts include the direct purchase of land, or much more commonly, the use of conservation easements, or voluntary conservation agreements, which limit land development. In the case of conservation easements, landowners are generally either paid directly for the value of their development rights, or are allowed a tax deduction equal to the value of their development rights. Conservation easements are a popular conservation tool. By 2003, there were more than 1,500 land trusts that together, had placed over nine million acres of land under voluntary conservation agreements in the U.S. (Land Trust Alliance 2004).

Grassbanks: A New Conservation Tool for Ecosystem Management. While conservation easements have been by far the most successful "incentive-based" tool, there has been a persistent search by nonprofits for additional conservation tools that could be used to achieve their various conservation-based missions. Grassbanking is a relatively new conservation tool that provides management flexibility by exchanging forage for conservation benefits. The term grassbank is used to describe the practice where a private individual, nonprofit, or government entity, provides forage at a discounted rate to a rancher in need of alternative forage because the organization's and rancher's desire to conduct conservation work requires cattle to be removed from their usual foraging areas for an extended period of time. Forage can be traded for a variety of treatments, such as prescribed fire, mechanical thinning, and invasive weed control, which lead to conservation benefits.

Because they can be generally categorized according to property ownership arrangements, grassbanks provide a unique opportunity to explore some of the challenges associated with attempting to implement the cross-boundary management principles associated with ecosystem management. Grassbanks involve at least two different properties: the ownership of the grassbank property, that provides the alternative forage and the ownership of the management area, where the conservation benefits occur. As a result, there are a set of six different property ownership arrangements associated with grassbanks that include: (1) private grassbank/private management area; (2) private grassbank/public management area; (3) nonprofit grassbank/private management area; (4) nonprofit grassbank/public management area; (5) public grassbank/private management area; and (6) public grassbank/public management area.

I acknowledge that property ownership is more complex than the dichotomous division of private and public property (Geisler and Salamon 1993; Fortmann 1996; Geisler 2000). However, for the purpose analyzing grassbanks as a conservation tool, legal property ownership is highly relevant because property ownership arrangements dictate what organizational and legal authorities, as well as economic- and politically-based incentives influence grassbank operations. Even though the property ownership arrangement varies, the purpose of each of these grassbanks remains the same, the exchange of forage for conservation benefit. This characteristic distinguishes grassbanking other more broad conservation efforts, which often sound like the same tool (e.g., watershed councils), but in reality typically have multiple purposes that are quite varied. In this dissertation, I take advantage of the singular purpose of grassbanks and make comparisons among them to determine the influence of the property ownership arrangement on the ability of grassbanks to achieve their conservation goals in a cost-effective manner.

Resource Allocation Decisions. To date, nearly all existing grassbanks are owned, operated, and/or supported by nonprofits, and these organizations generally derive most of their funds from private sources. Increasingly, nonprofits, including those operating grassbanks, are being asked by donors to demonstrate a strong "return on investment" for donated funds (O'Connor et al. 2003). However, while the relative level of sophistication associated with tools used for conservation planning and identification of priority areas to focus conservation work is impressive and well grounded in conservation biology (e.g., Margules and Pressey 2000; Groves 2003), the academic development of decision support tools to help make the most basic resource allocation decisions is lacking (Salafsky et al. 2002). Currently, nonprofits use little more than their past experience and intuition to answer questions like: What grassbank property ownership arrangement is more effective? When should I use a conservation easement instead of a grassbank? Because many nonprofits have the ability to invest millions of dollars in conservation efforts, more systematic tools are needed to aid in making resource allocation decisions.

1.2 Research Objective

Because of the perceived potential of grassbanks to help address numerous ecological problems in the western U.S., significant amounts of time and money have been invested by organizations and individuals to develop grassbanks. Over 20 grassbanks have been documented as of 2001 (Harper 2001) and additional grassbanks have emerged in Montana, Oregon, Iowa, and New Mexico.

Grassbanking has been appealing to nonprofits because of their initial characterization as a win-win-win tool for ranchers, conservationists, and local communities. In theory, conservationists "win" because treatments, such as prescribed fire, that should improve overall health of an ecosystem, are implemented. Ranchers "win" because the grassbank provides forage to them, often at a discounted rate, so they don't suffer any economic harm as a result of the treatments which can require them to vacate their regular grazing pastures. Finally, local communities whom value "working landscapes" "win" because it is assumed that ranchers can remain in business while restoration treatments occur, thereby helping sustain the local economy and reduce the risk of subdivision. It is true that grassbanking is a versatile tool, and provides management flexibility for both ranchers and land managers to engage in a number of conservation projects. However, despite the large degree of optimism surrounding grassbanking, as well as significant investment thus far by both the federal government and nonprofits, its effectiveness as a conservation tool has not been evaluated.

The overall objective of my dissertation research is to provide the first comprehensive evaluation of grassbanking as a conservation tool. My primary purpose is to provide usable information to grassbank operators that would expand the ability to provide more informed decisions about grassbank management. While I did not test hypotheses, I developed questions and collected data with the intent of gaining insight and understanding about grassbank operations. The central questions of this research are:

- What is grassbanking and how is it being used to promote the principles of ecosystem management?
- Which grassbank model (i.e., property arrangement) was the most successful at achieving its conservation objectives under the constraints of current property arrangement law and policy?
- What are the current policy challenges associated with grassbanks, and what are the implications for the future of this conservation tool?
- Can a simple heuristic tool be developed that nonprofits and others can use to help clarify costs as well as proposed conservation benefits associated with conservation tools, thus providing a decision support tool to make resource allocation decisions?
- Are grassbanks achieving cost-effective conservation benefits and should they be replicated?

1.3 Research Approach

Development of Research Project. The primary purpose of this section is to reflect on the research process and how, I attempted to expand my training and experience into an interdisciplinary arena by exploring and evaluating the use of grassbanks to achieve conservation goals.

In an era of cross-boundary ecosystem management, research that takes an interdisciplinary approach and uses qualitative and quantitative methods with an emphasis on participation is often cited as a preferred technique for achieving meaningful results. Accordingly, many requests for proposals often rank interdisciplinary, multiple partners, and multiple methods projects higher (Mascia et al. 2003; Rhoten 2004). As a classically trained positivist looking to expand into different epistemologies and fields of social science, economics, and communication, I found myself asking the question of whether or not it was possible for a Ph. D. student to successfully undertake an interdisciplinary project.

A combination of experiences enabled me to begin to pursue an interdisciplinary project, these included: basic coursework outside my discipline, a small social network analysis communication research project completely outside my field of expertise, a supportive advisor and professors, a Ford Foundation Community Research Fellowship, and a willingness on my part to push myself outside of my comfort zone. Next, I needed to commit to a research project. I first became aware of grassbanking when I completed some pro-bono consulting work for a colleague. The pro-bono work eventually enabled me to have the opportunity to become a member of the Heart Mountain Grassbank advisory group in Cody, Wyoming. I quickly learned that there were a few other grassbank projects emerging throughout the western U.S., and that many of them were struggling with similar issues.

I wanted to pursue a participatory research project and I was part of a local place-based collaborative. However, I was also a Ph. D. student with academic theoretical requirements, deadlines, and funding needs. Hence, with the input of many grassbank participants, I worked with my two advisors and a representative of the Nature Conservancy (TNC) to develop a proposal to complete comparative case-study of grassbanks throughout the western U.S. I would have been thrilled to focus all of my time and energy on a single grassbank, but I knew my likelihood of securing funding would improve as I increased the spatial scale and number of formal institutional partners. I therefore expanded the proposal to include multiple grassbank projects in the western U.S. and I was awarded the research funds.

Identifying Primary Research Questions. My overall goal was to develop an academically rigorous, but interdisciplinary study of grassbanks that would also meet my Ph.D. requirements. Within this larger objective, I wanted to develop a fair assessment of the conservation tool grassbanks that was as inclusive and participatory as possible, critical but constructive, adaptive but rigorous, and most importantly, resulted in practical tools and results that would lead to on-the ground improvements. Unlike my past research that strictly followed the hypo-deductive approach, I knew that my current work would have to be modeled after earlier ecological methods that relied on observational data from multiple sources to draw rigorous conclusions (Lieberson and Lynn 2002).

Participatory research is a methodological approach that has recently gained popularity in academic circles, and is based on the premise that people need to be involved in addressing issues that affect the quality of their lives, knowledge is power, and action directed at improving people's lives is the desired outcome (Gaventa and Cornwell 2001). Even though I attempted to make my project as "participatory" as possible, I would not classify it as a collective participatory research effort because I personally made final decisions about the research project, rather than relying on consensus, and did so based on timelines dictated by my funding and University requirement deadlines.

An evaluation of grassbanks was requested by different grassbank initiatives and dozens of grassbank stakeholders played a very active role, reviewing proposals, data analysis, results, completing their own independent case studies, and publishing articles. I had originally intended to have a large interpretive component to my research and devoted much of my data collection to semi-structured interviews. But the grassbank community urged me to address questions of tradeoffs, costs, conservation benefits, and policy questions first. It's not that this community did not care if grassbanks increased social capital or generated good will, but social capital, by itself, was not a deciding factor for funding grassbanks because presently, the nonprofits supporting grassbanks have missions of conserving biodiversity, and not necessarily social capital. For example, a grassbank that generated a high level of social capital, but was costly and did not generate significant conservation benefits, would not be funded by these organizations. Therefore, I adjusted my research approach, questions, and methods to meet the needs of the community impacted by this research.

The grassbank community made it clear that they wanted a nonmarket valuation study that would assign monetary values to the grassbank-produced conservation benefits that would meet the IRS requirements of nonprofits for private benefit (please see Chapter 3 for a detailed discussion of private benefit issues associated with nonprofits).

When I failed to obtain funding for a nonmarket contingent valuation study that would be able to assign conservation values, I settled for a less costly applied cost-effectiveness analysis. Knowing that I needed an estimate of conservation benefit for the cost-effectiveness analysis, and that I could not directly measure conservation benefit, I created a Conservation Benefit Index (CBI). The purpose of the CBI was to approximate conservation benefits associated with grassbank treatments. The value of the CBI was twofold: (1) it permitted me to make relative comparisons of conservation benefit associated with various grassbank treatments; and (2) the CBI was general enough that, in theory, it could be applied more broadly to compare multiple conservation tools.

I needed to estimate conservation benefit associated with grassbank treatments, but did not have the financial resources to complete a contingent valuation study, an accepted methodology generally used to estimate conservation benefit (Arrow et al. 1993). Conservation practitioners face a similar challenge of not having the financial resources to conduct comprehensive biological analyses, and consequently, must make decisions based on imperfect or incomplete data.

During the past ten years it has become increasingly common for relatively straightforward qualitative tools to be developed which are used to help make decisions related to conservation. For example, a growing number of organizations are using an "ecological scorecard" approach to help measure success associated with conservation tools (Parrish et al. 2003). Generally speaking, this type of approach uses a combination of qualitative and quantitative information to track ecological characteristics and then categorically rates them. For example, if the characteristic of interest is acres of suitable habitat, then a coarse estimate of available acres would yield a current "indicator" rating ranging from poor if little to no habitat is available, to very good if an adequate amount of habitat is available, with the ranges of each rating based on best available current knowledge.

I employed a similar approach when I created the CBI. I chose four attributes (i.e., duration, size, irreplaceability, and vulnerability) to describe the conservation benefit of each grassbank treatment. Duration and size describe treatment scale, while irreplaceability and vulnerability describe biodiversity value associated with the treatment. I selected these attributes based on fundamental concepts of conservation biology and used objective data whenever possible as the basis for my qualitative ratings. I assigned a qualitative rank of low, medium, high, or very high, to each of the four attributes. I then converted the qualitative ratings to a quantitative number for the purpose of creating three different indices for each grassbank treatment. It is important to note that the quantitative number associated with the CBI does not have value in and of itself, but was generated to permit relative comparisons among treatments, as well as permit grassbank cost and conservation benefit to be graphed.

The first index I calculated was scale, and was the product of the rankings associated with duration and treatment size; the treatment with longer benefit duration and affecting a larger percentage of the spatial extent of the conservation target received the highest index score. The second index was biodiversity, and was the product of rankings associated with irreplaceability and vulnerability; the treatment that affects the rarest and most threatened conservation targets received the highest index score. Finally, the combined index was the sum of the scale and biodiversity indices. I calculated all three indices to make it more clear how the two scale attributes versus the two biodiversity attributes contributed to the estimated conservation benefit ratings. Detailed information about the CBI is provided in Chapter 4.

1.4 Methodological Overview

Study Site Description. My primary study sites included grassbanks that had been operating for at least two years by 2001: Valle Grande Grassbank – New Mexico, Rocky Mountain Grassbank – Montana, and Heart Mountain Grassbank – Wyoming. When my research began arguably the most famous grassbank, The Malpai Borderlands – Gray Ranch Grassbank had ceased operating. In addition, the Lassen Foothills Grassbank, operated by California TNC, was winding down operations while another TNC grassbank, The Matador Ranch Grassbank, had not yet begun operating. A description of Lassen Foothills Grassbank is included in Chapter 4, but this grassbank was not included in the cost-effectiveness analysis because financial information was not publicly available. I interviewed people associated with these earlier grassbanks, as well as the Matador Grassbank and that interview and survey data is included in my analyses. Please see Chapter 2 for a description of the Malpai Borderlands - Gray Ranch, Lassen Foothills, and Matador Grassbanks, along with the other three grassbanks used in my research.

Valle Grande Grassbank[1]—Conservation Fund. In 1998, the Valle Grande Grassbank in New Mexico was formed when the Conservation Fund purchased 240 acres of base property associated with a 36,000-acre USDA Forest Service (Forest Service) grazing allotment. The purpose of the grassbank has been the exchange of forage for restoration commitments (e.g., riparian restoration, fire restoration, and removal of small diameter timber) by the Forest Service on grazing allotments (deBuys 1999). This grassbank is primarily on a public land grazing allotment that supports restoration work that occurs on other Forest Service grazing allotments.

Rocky Mountain Front Grassbank—TNC. The Rocky Mountain Front Grassbank in Montana is a 320-acre parcel of private land. The local advisory group was enthusiastic about the Malpai Borderlands–Gray Ranch Grassbank model, but obtaining a large-acreage private ranch for the purpose of a grassbank was not monetarily feasible. Hence, the Rocky Mountain Front Grassbank started a small pilot grassbank on private land and intends to create a network of private grassbanks from ranches whose owners are willing to donate or lease forage, thereby forming a collective grassbank for use by local ranchers (Bay 2001). In this case, both the grassbank and most of the conservation work have taken place on private land.

Heart Mountain Grassbank—TNC. The Heart Mountain Grassbank, located near Cody, Wyoming, is owned by the Wyoming Chapter of TNC. This 15,000-acre property includes 600 acres of low-elevation irrigated pasture that is utilized for the grassbank. Ranchers have used the grassbank when their federal grazing allotments are unavailable

[1] In November 2004, the Valle Grande Grassbank changed names to the Rowe Mesa Grassbank and is now associated with the Quivira Coalition.

to them because of local Forest Service and BLM restoration activities (e.g., rest from grazing, prescribed burning) (Bell 2001). Heart Mountain Grassbank is the only grassbank that is utilizing irrigated pasture and it currently supports conservation work primarily on public land.

Data Collection. Using multiple approaches to assess the effectiveness of particular phenomena is widely supported in the field of evaluative research (Guba and Lincoln 1989; Patton 1990). Since most research projects have multiple objectives for multiple audiences, multiple mixed methods are often justified. Multiple approaches allow researchers to overcome limitations encountered with using any one method and increase the overall validity of the evaluation (Patton 1990). I used both quantitative and qualitative approaches, primarily in the form of developing a cost-effectiveness analysis, in depth interviews, and a comparative case study, to evaluate grassbanks.

Initial conversations with public agency personnel, ranchers, and other community members during the Fall of 2001 helped me identify the salient grassbank issues facing ranchers, agencies, and nonprofits. Data included in this dissertation were collected beginning in May of 2002 until May of 2005. Additional grassbank data is still being collected through the web survey and outreach efforts associated with the National Grassbank Network.

Because no peer-reviewed grassbank literature existed at the beginning of this study, my first objective was to develop a publication defining grassbanks, documenting their history, and highlighting specific research needs. Additionally, I explored literature that addresses techniques that can be used to evaluate the economic effectiveness of conservation tools like grassbanks. I obtained and reviewed all grassbank literature, of which no peer-reviewed literature existed, and I made contact with representatives of each of the grassbanks. The result of this first step was the first peer-reviewed publication (Chapter 2) to introduce the concept of grassbanking as a conservation tool. This manuscript discusses the benefits and challenges of this tool, as well as research needs (Gripne 2005).

Once I had a basic understanding of grassbanks and challenges associated with them, I spent the remainder of my time developing a comparative case study for three existing grassbanks using multiple sources of evidence, in-depth interviews, documentation, archival records, and participant observation (Feagin 1991; Huberman and Miles 1994; Yin 1994). Data analyses included examination, tabulation, and categorization of the evidence (Yin 1994).

I used both quantitative and qualitative data collection methods that included semi-structured in-person interviews, semi-structured phone interviews, phone surveys, and a web survey. I developed a metric for conservation benefit, called a Conservation Benefit Index (CBI), which estimated conservation benefit associated with grassbank treatments. For each grassbank, I documented the expenditures and the corresponding conservation benefits achieved, as estimated by the Conservation Benefit Index, and developed cost-effectiveness ratios to make comparisons among them. Cost-effectiveness analysis is an alternative to cost-benefit analysis that is often used when the benefits are not easily quantified into monetary units, but decisions about tradeoffs still need to be made (Boardman et al. 1996).

Sample Size. One of the biggest challenges I encountered with my research was determining my sample population. Most people are not aware of the concept of grassbanks, even in communities where a grassbank exists, and so a random sample of a community where a grassbank exists would not yield useful information. Because of the relatively small population (< 500), I attempted to complete a census of the grassbank "population" by administering some sort of interview or survey to each individual.

I borrowed from the species-area curve concept of island biogeography theory to help determine how many surveys I needed to census the population. The premise of island biogeography theory is that larger islands will have more species, but eventually only a few new species will be added as area increases (i.e., law of diminishing returns). As I conducted my surveys and interacted with the grassbank community, I kept a list of potential people to survey that were familiar with grassbanking and added to the list when I received additional names from surveys and interviews. I plotted the number of individuals on my survey list against time (Figure 1-1). Indeed, there were a diminishing number of people added to my list over time, suggesting that approximately 250 people belonged to the grassbank population.

However, I did not account for the fact that membership of the grassbank population was not static, but rather was increasing over time, which was due in part to the outreach efforts of my project that included: (1) a grassbank research website (www.compatibleventures.com); (2) a quarterly research newsletter; (3) two Society of Range Management Grassbank Symposiums is 2004 and 2005; (4) the emergence of the National Grassbank Network in 2004 (www.grassbank.net); and (5) multiple presentations for agencies, collaboratives and professional meetings. A year into my research I discontinued the use of my graph shown in Figure 1-1 because I realized the grassbank population was going to continue to increase. Therefore, I shifted my sampling goal from a census to capturing a 'representative sample' of the grassbank population.

To achieve my goal of sampling a representative cross-section of the grassbank population, I interviewed individuals who identified themselves at the conclusion of the interview or survey in the following manner: cattle association representative (1); donor (2); federal employee (46); environmentalist (1); Indian Tribe (1); local government employee (2); nonprofit employee (47); private citizen (14); rancher (21); researcher (6); and state employee (18). Fifteen of the survey respondents did not affiliate themselves with a descriptive category. By the conclusion of my research I had conducted a total of 179 interviews and surveys. Nineteen of the 179 respondents did not know what a grassbank was and I gathered information from the remaining 160 through an in-depth interview conducted in person (40) or over the phone (11), a phone survey (112), or a web survey (16). Methodology associated with each of these data collection techniques is provided below. I terminated my interviews once I thought that I had sampled enough individuals to capture a cross-section of the grassbank populations while keeping the amount of data collected manageable so that I had adequate time to complete content analyses for each interview or survey.

Descriptions of Survey Techniques

Semi-structured Interviews. I gained insights about stakeholder understandings of grassbank success, challenges, and opportunities associated with their experiences with grassbanks using in depth semi-structured interviews (Ragin 1994; Strauss and Corbin 1998; Stringer 1999). The interviews provided me a medium to explore questions in a way that a web survey or phone survey would not allow.

A directed snowball sampling technique was used to select participants for semi-structured interviews (Babbie 1998). Selected participants that were interviewed were involved in administration, monitoring, participation, and funding of grassbanks. In addition to the participants I identified through professional contacts, other researchers, grassbank operators, and the grassbank conference, each person interviewed was asked for the names of others who were aware of grassbanks. I conducted 40 in-person interviews and 11 phone interviews of grassbank participants and persons not directly involved with the grassbanks at three sites (e.g., Rocky Mountain Front Grassbank, Heart Mountain Grassbank, and Valle Grande Grassbank) and the National Grassbank Network. Interviews were semi-structured, followed the methodology of Kvale (1996). All 51 respondents agreed to be interviewed; I terminated the interview in two cases when the respondent did not know what a grassbank was.

The interviews included questions prepared in advance, but with flexibility to take on other directions once the interview began. I developed an interview guide that included four different tiers, depending on the level knowledge of the grassbank participant (Appendix 1). For example, if the participant did not know what a grassbank was, the interview was terminated. The interviews were digitally tape recorded and transcribed (Maxwell 1996; Neuendorf 2002). When possible, notes were taken during each interview and were completed immediately following the interview. Content analysis was conducted on specific questions and themes and paired with phone survey and web survey data.

Content analysis consisted of categorizing responses given to open-ended survey questions. In order to do this, I developed categories for responses to questions asked in all surveys (i.e., in-person, phone, web). An assistant and I then assigned responses to the *a priori* categories. Once we both categorized the responses, we compared our results. There was 97% to 99% agreement in the initial categorizations for the four questions included in this analysis. For those questions we did not have initial agreement, we agreed upon final categorization.

<u>Telephone Survey</u>. To incorporate stakeholder interpretation and investigate whether the conservation objectives set out by the stakeholders have been met, I conducted 112 telephone interviews of grassbank participants and persons not directly involved with the grassbanks. All of the phone survey respondents agreed to be surveyed; the phone survey was terminated in 17 cases when the respondent did not know what a grassbank was. All of the phone interviews were conducted by a single professional phone interviewer or myself.

The phone survey was based upon the general questions asked during the semi-structured interviews. They survey was designed to include primarily open-ended questions and was initially reviewed by 10 researchers. Questions included after the open-ended survey were for conducting initial content analysis and to help the interviewer probe. A pilot sample of five individuals was conducted and the survey was further modified. The telephone survey was administered to every person in the grassbank population that was not selected for an in-person interview (Babbie 1998).

Initially, I designed a guide that was used for the both phone surveys and semi-structured interviews to include categories that would be marked immediately after the respondent gave an answer. Any confusion about an answer would illicit an immediate clarification question. However, although the professional phone surveyor had significant phone survey experience, the surveyor did not have a ranching or natural resources background, and so efforts to conduct content analysis "on the fly" did not work for a most of the phone surveys. Hence, the content analysis was conducted after the semi-structured interviews and surveys had been collected.

Web Survey. One of the most important aspects of this project has been the ability to adapt to different challenges and circumstances. For example, I wanted to interview a member of an anti-grazing environmental group, but this person could not be reliably reached by phone and lived a far distance from myself. At this point, I created a web page survey that matched the content of the phone survey and interview guide. I also attached a link to the web survey on my grassbank research webpage to capture people visiting the grassbank webpage. As of May 2005, I have had 3,467 repeat visits and 1,153 unique visits to my grassbank research website and 16 web survey respondents.

1.5 Key Findings

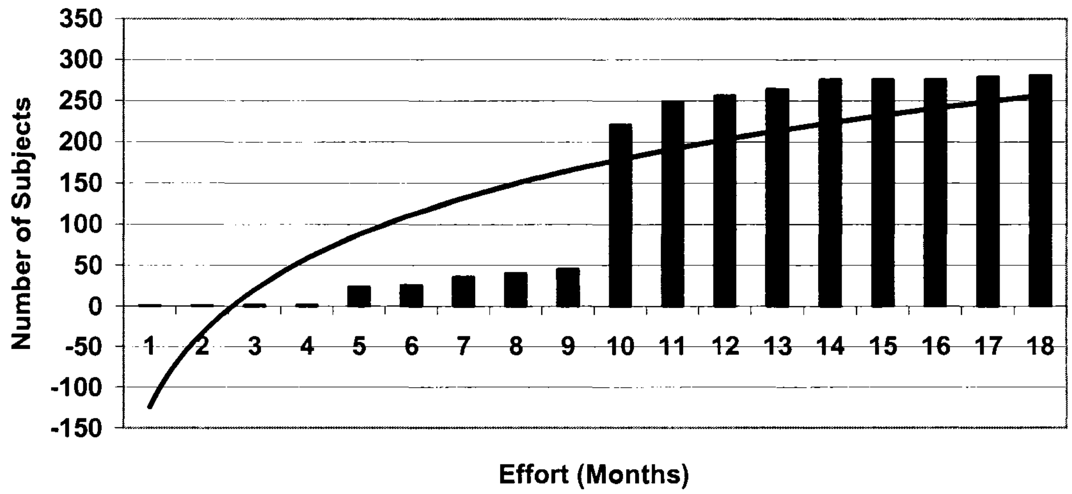
Although the enthusiasm and investment for different grassbank initiatives has been high, grassbanks have not proven to be a cost-effective conservation tool under any of the different property ownership arrangements. Transaction costs of working across property ownership boundaries were too high relative to the levels of conservation benefit achieved by the various grassbanks. Specific results include:

- The public grassbank/public management area ownership arrangement had the highest cost, while the private grassbank/private management area ownership arrangement had the lowest cost.
- The nonprofit grassbank/public management area ownership arrangement had the highest level of conservation benefit, whereas the private grassbank/private management area ownership property arrangement had the lowest level of conservation benefit.
- The private grassbank model had few legal or regulatory requirements; however, this model was also associated with low levels of organizational and financial support.
- The public property grassbanks had legal and regulatory requirements which led to increased costs, but this model is also associated with a high level of organizational support and financial resources.

These results suggest the following dilemma for conducting restoration treatments on private and public management areas: transaction costs (e.g., minimal staff, overhead, NEPA) of working on private land are relatively low, but resources are limited to support restoration treatments that lead to increased levels of conservation benefits, whereas transaction costs are high when working on public management areas, but organizational support is high as well, which should lead to higher conservation benefits. However, currently there are no long-term funding sources in place to support conservation and management of common pool resources.

As long as current property laws and policies remain, grassbanks, along with other approaches designed to achieve ecosystem management goals, will require additional incentives for private and nonprofit landowners. Alternatively, all levels of government need to create mechanisms to pay for the management of common pool resources that characterize ecosystems. Unless incentives and other payment mechanisms are increased, inventive approaches to ecosystem management, such as grassbanks, will be admired for their creativity, but will ultimately fail to generate significant conservation benefits and/or be sustainable over the long term.

Figure 1-1. Number of individuals in the grassbank "population" identified during the first 18 months of the grassbank research.



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2 CHAPTER: GRASSBANKS: BARTERING FOR CONSERVATION

2.1 Abstract

Grassbanking is an innovative conservation tool that trades forage for conservation benefits. At least six grassbanks have been established and more are planned throughout the western United States. This paper defines grassbanks, provides a history of the concept and its application, describes existing grassbanks, and details some of the economic, ecological, social, and policy challenges that grassbank users face. Innovative tools come with new challenges and opportunities; this paper explores those that are associated with grassbanks.

2.2 Introduction

Over the next 10 years, the Shoshone National Forest in Wyoming will implement fuel-reduction burns on approximately 10 cattle grazing allotments, temporarily displacing up to 13 ranchers from 1 to 3 years. As is the case for many other national forests, a significant obstacle facing federal land managers implementing restoration treatments is the lack of alternative forage for permittees who must remove their live-stock from allotments for extended time periods while restoration work occurs. If these temporarily displaced families sold their ranches, which are often large intact tracts of land adjacent to the national forest, there would likely be an increased rate of subdivision contributing to the loss of open space, wildlife habitat, and degradation of forest ecosystem processes such as fire (Thomas and Gripne 2002; Maestas et al. 2003). To help support restoration activities on public land and minimize the threat of habitat fragmentation on private land, the Wyoming Chapter of The Nature Conservancy (TNC) has used an irrigated pasture of its Heart Mountain Ranch near Cody as a grassbank to provide forage for permittees whose grazing allotments are temporarily unavailable because of the restoration activities on the Shoshone National Forest.

Grassbanking is a conservation tool that exchanges forage for conservation benefits. In the example of Heart Mountain Ranch, TNC trades forage for a suite of restoration activities. Fuel loads have been reduced (thus decreasing the potential for catastrophic fire), forage quality and quantity have been enhanced and increased for both cattle and wildlife, and the likelihood of habitat fragmentation has been temporarily reduced because ranches remain economically viable and intact.

2.3 History of Grassbanking

The term "grassbank" was coined and registered as a trademark by the Malpai Borderlands Group, a nonprofit located in Arizona devoted to restoring and maintaining "the natural processes that create and protect a healthy, unfragmented landscape to support a diverse, flourishing community of human, plant, and animal life in our Borderlands Region." The Malpai Borderlands Group, working on the 321,000-acre Gray Ranch, which is located in New Mexico and owned by the Animas Foundation, has developed several conservation tools, with grassbanking among their most innovative. The term "grassbank" was used to describe the practice where a rancher in need of alternative forage because of drought, or the desire to conduct restoration activities that require temporary cessation of grazing, moved the displaced cattle to the Gray Ranch. In exchange for forage, the rancher placed a permanent conservation easement on their property, which generally restricted development and, therefore, subdivision. The easement is held by the Malpai Borderlands Group, and its value is equal to the forage value the rancher used on Gray Ranch. As a result of this exchange of forage for conservation easements, over 25,000 acres have been restricted from subdivision. Many people associate grassbanking with conservation easements, but the Malpai Borderlands Group has been the only grassbank that has traded forage for conservation easements. All other grassbanks have traded forage for other types of conservation benefits, such as prescribed fire, rest, or wildlife habitat improvements.

While the term "grassbank" is relatively new, the practice of using a forage reserve, custom grazing, or other tools to incorporate rest rotation into a grazing management plan is centuries old, with examples found across the world, from Canada to Africa and New Zealand (Fernández-Giménez and Swift 2003). In the U.S., the historical precursors to grassbanks were "swing allotments," which were informally implemented by the Forest Service in the first half of the 20th century. More recently, the Bureau of Land Management (BLM) and Forest Service have informally supported similar tools, such as "reserve common allotments" and "forage reserves." Neither "swing allotments" nor "forage reserves" have been formally defined by the Forest Service but are understood to be vacant allotments that can be used by operators in situations when their home allotment is unavailable for grazing for reasons such as rest, natural disasters, or management activities. The BLM has formally defined "reserve common allotments" as areas that allow permittees to engage in rangeland restoration by temporarily shifting their livestock to forage reserve areas. However, in 2004, the BLM chose not to formally adopt this tool. Regardless of the name, all these tools are an attempt to provide land managers flexibility, supporting a type of "third-party rest rotation" for managing their grazing operations in a way that produces both agricultural products and ecosystem goods and services over the long term.

2.4 Existing Grassbanks

Because of the perceived potential of grassbanks to help address numerous ecological problems in the western U.S., significant amounts of time and money have been invested by organizations and individuals to develop grassbanks (Figure 2-1). The six longest-running and most publicized grassbanks include: (1) Malpai Borderlands–Gray Ranch Grassbank, Arizona; (2) Valle Grande Grassbank, New Mexico; (3) Lassen Foothills Grassbank, California; (4) Rocky Mountain Front Grassbank, Montana; (5) Heart Mountain Grassbank, Wyoming; and (6) Matador Ranch Grassbank, Montana. The Malpai Borderlands–Gray Ranch Grassbank was described previously; these 5 other most well-known grassbanks are described here. Over 17 additional potential grassbank initiatives have been documented as of 2001 (Harper 2001) and additional grassbanks are emerging in Oregon, Nevada, South Dakota, Arizona, and New Mexico.

Valle Grande Grassbank—Conservation Fund

In 1998, the Valle Grande Grassbank in New Mexico was formed when the Conservation Fund purchased 240 acres of base property associated with a 36,000-acre Forest Service grazing allotment. The purpose of the grassbank has been the exchange of forage for restoration commitments (e.g., riparian restoration, fire restoration, and removal of small diameter timber) by the Forest Service on grazing allotments (deBuys 1999). This grassbank is primarily a public land grazing allotment that supports restoration work that occurs on other Forest Service grazing allotments.

Lassen Foothills Grassbank—TNC

The Lassen Foothills Grassbank is owned and operated by a nonprofit that supports restoration work on private land. In 1997, the California Chapter of TNC converted its 4,600-acre Vina Plains Preserve into a grassbank to support some local landowners' interest in using prescribed burning to control invasive weeds on private land. The grassbank enabled local ranchers to undertake management practices that reduced the abundance of invasive species in exchange for reduced grazing fees at the preserve (McNutt 2001)[1].

Rocky Mountain Front Grassbank—TNC

The Rocky Mountain Front Grassbank in Montana is a 320-acre parcel of private land. The local advisory group was enthusiastic about the Malpai Borderlands–Gray Ranch Grassbank model, but obtaining a large-acreage private ranch for the purpose of a grassbank was not monetarily feasible. Hence, the Rocky Mountain Front Grassbank started a small pilot grassbank on private land and intends to create a network of private grassbanks from ranches whose owners are willing to donate or lease forage, thereby

[1] Vina Plains Grassbank ceased formal operations in 2004.

forming a collective grassbank for use by local ranchers (Bay 2001). In this case, both the grassbank and the restoration work take place on private land.

Heart Mountain Grassbank—TNC

The Heart Mountain Grassbank, located near Cody, Wyoming, is owned by the Wyoming Chapter of TNC. This 15,000-acre property includes 600 acres of low-elevation irrigated pasture that is utilized for the grassbank. Ranchers have used the grassbank when their federal grazing allotments are unavailable to them because of local Forest Service and BLM restoration activities (e.g., rest from grazing, prescribed burning) (Bell 2001). Heart Mountain Grassbank is the only grassbank that is utilizing irrigated pasture it currently supports management activities on public land.

Matador Ranch Grassbank—TNC

The Montana Chapter of TNC owns and operates the Matador Ranch in eastern Montana as a grassbank. They use the forage on the 60,000-acre ranch to leverage a variety of benefits, such as the conservation of prairie dogs, sage grouse, sod busting and weed prevention, and sustainable stewardship practices on both private and public land (Poole and Veseth 2003).

2.5 Grassbank Associated Research

A decade ago, the term "grassbank" was virtually unknown. In recent years, the grassbank concept has gained momentum and has received increasing attention through numerous popular articles and unpublished scientific literature (Page 1997; White 1999; Goldman 1999; Jensen 2001; Christensen 2002; Kappel 2002). However, no peer-reviewed literature exists describing or evaluating the effectiveness of grassbanks. The three primary descriptive sources of information about grassbanks are conference proceedings from a symposium held in New Mexico in 2001 titled "Grassbanks in the West: Challenges and Opportunities" and 2 Master's projects (White 1999; Goldman 1999). The conference held in New Mexico included a diverse group of panelists addressing issues associated with grassbanks. The symposium was sponsored by the Quivira Coalition, the Conservation Fund, the Malpai Borderlands Group, the Northern New Mexico Stockman's Association, the Forest Service, and New Mexico State University's Cooperative Extension Service. The conference provided clarification, assessment, and input about grassbanks and covered a variety of topics, including definitions, policy barriers, funding, and limitations of the concept.

While the conference provided the first public forum to clarify and assess grassbank initiatives, Claire Harper completed the first study of a grassbank, focusing on the Valle Grande Grassbank as a model for nonprofits working in the arena of grazing on federal lands (Harper 2002). She documented grassbank challenges, which included: (1) the Forest Service completing timely and high-quality environ-mental assessments similar to those of the National Environmental Policy Act; (2) the Forest Service's development of restoration treatments to ensure a stable flow of participants; (3) obtaining long-term funding; (4) completing restoration treatments in a timely manner; and (5) increasing the role of rancher responsibility.

Edwards (2002) reviewed innovations related to conservation and focused specifically on grassbanks. She cautioned against the widespread endorsement of untested conservation tools, including grassbanks, because such an endorsement could lead to the premature adoption of a conservation strategy that may not be sustainable. Edwards also noted that grassbanks will likely fail without support from public land management agencies and other pertinent institutions with authority to implement policies that enhance probabilities of grassbank success (Edwards 2002).

Additional research is under way by this author and a team of ecologists, economists, and social scientists representing the University of Montana, the University of Idaho, Colorado State University, The Nature Conservancy, and the National Grassbank Network to address the effectiveness of grassbanking as a conservation tool (Gripne, unpublished data). This research will address questions such as the following: (1) Which grassbank institutional arrangements or models are associated with the least cost and greatest conservation benefits? (2) How can individuals involved with grassbanks economically value conservation benefits in order to ensure an even trade of forage for conservation benefit while avoiding private inurnment issues? (3) What are the biggest practical and policy challenges associated with grassbanking? and (4) How do the different place-based grassbank initiatives (e.g., Heart Mountain Grassbank in Cody, Wyoming) interact with the larger communities of interest (e.g., citizens throughout the U.S. and the world with a vested interest in the Greater Yellowstone Ecosystem)? This research focuses on similarities and differences among currently operating grassbanks and opportunities to learn from those experiences.

2.6 Challenges

As with any conservation strategy, there are numerous ecological, economic, social, and policy challenges associated with grassbanks, chief among these being measuring and defining conservation benefits. Grassbanks are philosophically based on the concept of *quid pro quo* (i.e., an equal value of forage is traded for an equal value of conservation benefits). Hence, grassbank participants should provide a measure of conservation benefit associated with restoration activities such as rest from grazing, reintroduction of historic fire regimes, and other specific activities. Grassbank participants must also calculate economic costs associated with achieving benefits. Once costs and benefits associated with grassbanking are known, stakeholders can address the critical question of whether the conservation benefits could be achieved at lower costs using alternative conservation tools.

Valuing the conservation benefits associated with grassbanking in economic terms is essential to addressing the *quid pro quo* exchange requirement associated with grassbank operations. However, conservation valuation methods such as contingent valuation, hedonic, and substitution costs, and so on are often time intensive, costly, and controversial. While the notion of *quid pro quo* is philosophically tied to all grassbanks, this concept is a legal requirement of grassbanks operated by organizations with tax-exempt charitable status under U.S. tax laws (e.g., 501[c][3] organizations). In other words, such grassbanks must comply with operating rules established to ensure that tax-exempt organizations are operated for the charitable and public purposes for which they are established. Specifically, a nonprofit's assets cannot be used to benefit private individuals (i.e., private benefit).

Since a grassbank transaction is based on the concept of an exchange of forage for valuable and specific conservation benefits, the grassbank operator must ensure that the value of the conservation benefits are at least equal to the value of the for-age exchanged. For example, if the nonprofit grassbank organization leases forage at a discounted rate to a rancher, it must demonstrate that the economic value of the conservation benefit achieved by the rancher equals or exceeds the value of discounted forage. The nonprofit grassbank organization would need to perform a nonmarket valuation of conservation benefits (e.g., prescribed fire or reduced threat of habitat fragmentation from forfeited development rights) to demonstrate that the values of trade are equal. This task is further complicated when rights obtained from the landowner during the transaction also provide an economic benefit to the landowner (e.g., if, by resting the landowner's pasture from grazing or by implementing fire program, certain invasive or exotic species are removed and result in an overall increase in the quality of the landowner's forage), adjustments must be made to account for those benefits.

A policy dilemma that may arise in grassbank transactions relates to the inability of the landowner to claim a charitable contribution deduction for the value of the standing grass. Under current tax law, an individual can donate cut grass in the form of baled hay to a nonprofit and deduct the value of the hay as a charitable donation. However, until the tax law is changed, a donation cannot be claimed for the same grass if it is standing. In addition, there are other policy issues specific to grassbanks that operate on public land. For example, restoration projects on public land require appropriate environmental assessments of the consequences of management activities under the National

Environmental Policy Act, which has proven to be expensive and difficult to implement in a timely manner.

Finally, perhaps the greatest challenge associated with grassbanking is obtaining adequate funding and resources. Preliminary examination of existing grassbanks indicates that capital land investment ranges from $0 to $8,000,000 and that the annual operating costs associated with grassbanks range from $5,000 to $260,000. People who want to start a grassbank are logically seeking operational and financial resources that are currently unavailable to them in a central clearinghouse or network (Gripne, unpublished data). In response to this need, efforts are being made to establish initiatives such as a National Grassbank Network (www.grassbank.net) or Grassbank, Inc., to provide resources and representation for individual grassbanks.

2.7 Conclusion

Grassbanking is a tool that provides land managers with incentives and flexibility to pursue restoration activities that require temporary displacement of grazing activities that otherwise may not be feasible. Several grassbank initiatives have begun, and more are contemplated throughout the western U.S. While there is a high level of enthusiasm among some land managers and conservation organizations for grassbanks, there are challenges associated with successfully developing grassbanks that remain to be solved. My preliminary research suggests that, in general, grassbanks require substantial financial and administrative resources to be committed over the duration of the project; these costs have, in several cases, proven to be greater than the stake-holders originally anticipated. Measuring conservation benefits and demonstrating associated economic values of those conservation benefits has proven technically difficult. The long-term success of grassbanking depends on how well managers and researchers address the practical and policy issues articulated herein related to grassbanks.

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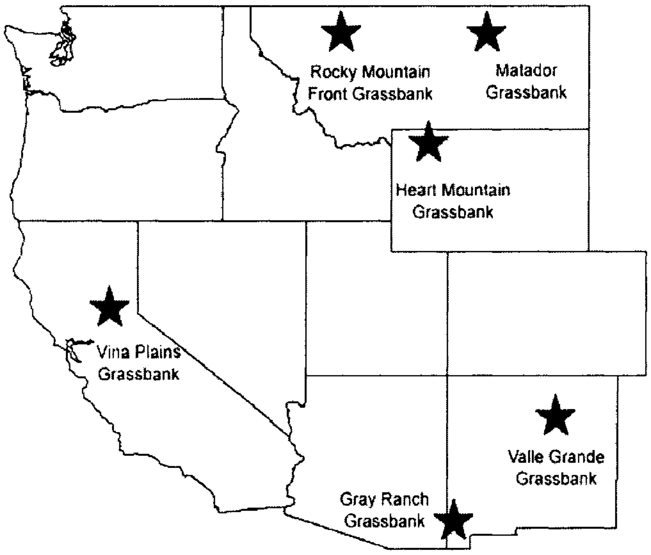
Figure 2-1. Locations of existing grassbanks in the western U.S.



3 CHAPTER: GRASSBANK POLICY

3.1 Abstract

An increasing number of conservation tools, such as easements, water banks, and most recently grassbanks, have emerged as strategies to conserve natural resources. Grassbanking provides incentives for ranchers, via alternative discounted forage, to implement various management activities that lead to conservation benefits such as invasive weed control, hazardous fuels reduction, open space protection, and wildlife habitat improvements. Grassbanks are generating tremendous interest and have been promoted as providing "win-win" solutions for ranchers and conservation groups that favor "cows versus condos', and local economies that prefer 'working' landscapes. As with any new tool, challenges accompany opportunities. This study finds that grassbanks, while intuitively appealing, face several substantial policy challenges. These challenges range from unintended negative consequences of trademarking the concept, to IRS conservation benefit valuation concerns, to the lack of support from national environmental and cattle lobby groups, to mixed support from the public land agencies. While there are several possible solutions for these challenges, such as terminating the trademark, these obstacles still may be too big for grassbanking, in its current form, to overcome.

3.2 Introduction

There are an increasing number of experimental conservation tools, such as easements, water banks, and most recently grassbanks, which have emerged as approaches to conserve natural resources in instances of perceived market failure. Natural resource-related market failures have often occurred because many natural resources (e.g., open space, wildlife, etc.) have poorly defined property rights or "formal and informal rules that govern access to and use of tangible assets..." (Anderson and McChesney 2003; p. 1). Users can "freeload" since they cannot be prevented from enjoying the amenity, and consumption by additional users diminishes its value. Because individuals cannot be excluded, there are no individual "private rights to the property benefits or private obligations to bear the costs" (Anderson and McChesney 2003; p. 1). The lack of clearly defined property rights has resulted in many goods being treated as if they were free. Hence, the marginal benefit is greater than the marginal price resulting in an overuse of resources in most cases.

Conservation tools such as grassbanks have been developed as approaches to conserve natural resources (Landell-Mills and Porras 2001; Merelender et al. 2004; Jenkins et al. 2004; Gripne 2005) by redistributing the costs that landowners incur for providing conservation benefits such as open space and wildlife habitat, more directly to society. While there is tremendous enthusiasm about the potential of grassbanks to solve numerous conservation problems, many challenges remain.

Despite the relative novelty of the tool, several key grassbank policy questions have already emerged. These questions include: (1) what are grassbanks and the associated policy challenges with this new conservation tool; (2) what opportunities are there to overcome some of these challenges; and (3) are these challenges significant enough to lead to the downfall of this conservation tool? Little research has examined grassbanks in general, much less the unique policy challenges associated with them.

I used both quantitative and qualitative methods, a cost-effectiveness analysis, in depth interviews, phone surveys, and web surveys to develop a comparative case study evaluating grassbanks to address the questions listed above. The data were collected from June 2003 to May 2005. I conducted 51 semi-structured in person interviews, 13 semi-structured phone interviews, 120 phone surveys, and 14 web surveys of respondents using a directed snowball sampling method. Interviews were transcribed and blind content analysis was conducted by two investigators [1].

3.3 Grassbanks - Background

Of the many threats to western U.S. ecosystems and surrounding human communities, two of the most pervasive are altered fire regimes of fire dependent ecosystems (Arno and Brown 1991; Mutch 1994; Czech et al. 2000) and the rapid subdivision of rural lands (Czech et al. 2000; Maestas et al. 2001; Theobald and Hobbs 2002). Because of their location, large ranches often play an important role in minimizing both threats. In addition to being located on highly productive land, many western ranches are adjacent to public lands such as national forests and rangelands that typically include federal grazing allotments. Their proximity and contribution to large tracts of connected landscapes make them important for maintaining ecosystem function

[1] Please see Gripne (2005) for a complete description of survey methodology.

(e.g., historic fire regime) and biodiversity (e.g., intact habitat) (Gripne and Thomas 2002; Thomas and Gripne 2002). However, many ranchers interested in restoration activities avoid participation because of the financial costs associated with herd displacement from the rangeland being restored. In some cases, this same obstacle exists for public land managers who want to ecologically restore federal grazing allotments, using tools such as prescribed burning, that ranchers may depend on for their livelihood (Bell 2001; Edwards 2002). Thus, both public land managers and private ranchers are left with this dilemma: if the costs of ecological restoration activities place the economic viability of private ranches at risk, an unforeseen result of these restoration activities may be an increased rate of subdivision and habitat fragmentation related to sale of large ranches (Maestas et al. 2001). Grassbanks have been proposed as a mechanism to address this problem and promote restoration activities on both private and public lands.

Grassbanks refer to the exchange of forage for conservation benefit (Mahler 2001; Gripne 2005). This definition of grassbanking is necessarily broad, because the types of conservation benefits that can be traded for forage are many. These benefits may include endangered species protection, invasive weed control, hazardous fuels reduction, and wildlife habitat improvements. The grassbank participant is given a forage discount to cover the cost of the conservation benefit. Grassbanks depend primarily on some combination of private donations, foundations, and/or public money cover the cost of the alternative forage discount given to a grassbank participant. Because of the perceived potential of grassbanks to overcome numerous ecological problems in the western U.S., millions of dollars have been invested by several organizations and individuals thus far to develop six grassbanks (Valle Grande Grassbank – New Mexico; Malpai Grassbank – Arizona; Lassen Foothills Grassbank – California; Rocky Mountain Grassbank – Montana; Heart Mountain Grassbank – Wyoming; Matador Ranch Grassbank – Montana). Over 17 additional potential grassbank efforts have been documented as of 2001 (Harper 2002).

While the term grassbank is relatively new, the practice of using alternative sources of forage (e.g., reserve common allotments, forage reserves, and/or custom grazing projects) that incorporate rest rotation into a grazing management plan is centuries old. In the U.S., the historical precursor to grassbanks was "swing allotments," which were informally implemented by the Forest Service in the first half of the twentieth century.

Many people consider grassbanking a promising tool; however, new challenges associated with the strategy have also arisen. Some of these challenges are general, such as the policy implications of the trademark and attempts of nonprofit 501(c)(3) organizations to control the meaning of the term, while other challenges are specific to grassbank ownership, such as the I.R.S. tax implications of private benefit to grassbanks owned by nonprofits. In this manuscript I explore the following policy-related issues associated with grassbanks: concerns over the meaning and consistency of the term grassbanking and implications of the term's trademark, tax incentives and requirements, interest group support and opposition, and public administration and policy issues. I conclude with a discussion of the implications of these issues and opportunities to overcome them.

3.4 Grassbank Meaning, Consistency, and Trademark Issues

The grassbank trademark is the most significant general grassbank policy issue. In practice "grassbank" has been used to describe a variety of grazing projects that may or may not have clearly defined conservation benefits associated with them (Gripne 2005). However, despite its wide and varied use, the term "GRASSBANK™" is a registered trademark with specific meaning. Legally, grassbanking is defined as "the exchange of forage for conservation benefit" (pers. comm. B. Runnels, October 29, 2003). The trademark is a direct result of the fact that the term grassbank emerged from nonregulatory nonprofit conservation collaborative, the Malpai Borderlands Group. The term grassbank originated with the Malpai Borderlands Group in conjunction with the Animas Foundation in 1996 (Hadley 1999; Gripne 2005). Unlike conservation tools such as stewardship contracting or conservation easements, which have been defined through government law, regulation, or policy, grassbanking did not emerge from a regulatory framework. Instead, in the absence of this framework, the Malpai Borderlands took the unprecedented step of trademarking the term.

A trademark is a distinctive sign which identifies certain goods or services as those produced or provided by a certain entity or person. The trademark serves to identify the source of products or services and to distinguish the trademark owner's goods and services from those of others (Barrett 1996; Samuels 1996) and is typically used to increase profits through product recognition. As long as a trademark fulfills these functions, it remains valid. Trademark ownership rights in the U.S. arise through continued use of a mark, which is necessary to maintain trademark rights, including the exclusive right to use the mark. Other rights include the ability to prevent the use by unauthorized third parties of a confusingly similar market (Barrett 1996; Samuels 1996).

The Malpai Borderlands Group's motivation for trademarking the term grassbank was not to discourage use of the term, but rather to ensure its integrity from egregious misuse and/or financially benefit from the use of the term should it prove profitable. An example of what The Malpai Borderlands Group considers egregious misuse includes a developer wanting to use the term as a subdivision name, or using the term to describe grazing projects that may have financially benefited a rancher, but had no conservation objective. In the case of the subdivision, the Malpai Borderlands Group sent a cease and desist order to a subdivision developer in Arizona. Although the Malpai Borderlands Group trademarked the term grassbank, they quickly realized that they did not have the capacity within their group to educate, promote, and enforce the trademark. Hence, representatives of the Malpai Borderlands Group, The Nature Conservancy, and the Animas Foundation (a representative of Quivira Coalition and the Conservation Fund were added in 2004) created Grassbank Incorporated as a separate nonprofit for these purposes.

Grassbank Incorporated has not been an effective nonprofit. Despite the best intentions of those involved with Grassbank Incorporated, their only accomplishment during the past three years has been officially creating a nonprofit 501(c) (3) corporation. They have not actively engaged in formal education, promotion, or enforcement of the trademark. Consequently, grassbank has evolved into a term with many meanings. Other conservation tools, such as conservation easements, can be used to achieve multiple goals (e.g., open space protection, conservation of wildlife habitat), but the various goals, by law, must all meet the standard of contributing to the public good. Alternatively, grassbanks are not regulated by the U.S. tax code or federal or state laws and regulations. The trademark is the only legal tool that influences the meaning of the term.

Given the lack of trademark enforcement and regulation of the term grassbank, it is relevant to ask those people familiar with the term what they think grassbank means. In addition, what do they consider the purpose and the primary conservation benefits of a grassbank? Of the interview respondents who self-identified themselves as being knowledgeable about grassbanks (n = 173), only 26% identified "conservation benefit" as the primary purpose of a grassbank. "Range improvements," which may or may not include conservation benefits, was listed by 25% of respondents to be the primary purpose. Almost half of the participants listed non conservation benefit-type purposes such as "assist ranchers," "drought relief," "economic relief", and "management flexibility" as the primary purpose of grassbanks (**Error! Reference source not found.**). Furthermore, when these participants were asked to explicitly define the conservation benefits results associated with grassbanks, only 43% listed ecological/restoration objectives as conservation benefits directly related to a grassbank, while 43% listed range improvement (Table 3-2).

Apparently, many people consider range improvements that may result in higher returns for ranchers, but may not necessarily improve the ecological condition of rangelands, to be a conservation benefit, which is precisely what some trademark proponents had hoped to avoid. For this reason, trademark advocates have argued that some quality control is needed because some grassbank initiatives have not emphasized conservation benefits directly linked to improved ecological conditions in their project design. Others involved with grassbanking feel differently and believe that trademarking the term grassbank has led to confusion, fear, and a greater level of bureaucracy that has reduced the overall flexibility the tool was intended to foster.

Despite the Malpai Borderland Group and Grassbank Incorporated's best efforts to ensure the integrity of the term grassbank, thus counteracting the perception that it is purely a subsidy for ranchers, my data suggests that trademark has failed and that the term means a variety of things to many people. The potential implication of no clear definition, or multiple definitions associated with grassbank is that the term itself can become meaningless, making it less attractive to potential private donors, foundations, and government agencies to support a project.

In addition to lack of organizational support for the trademark, there has been a similar lack of support for learning, developing, and assessing the effectiveness of grassbanks. With only limited formal support for developing a grassbank from agencies, nonprofits, or Grassbank Incorporated, individuals that have needed grassbank resources have used informal communication networks to learn about grassbanking. In 2004, a small informal group of individuals representing several place-based grassbank projects, multiple federal agencies, and universities emerged in the form of The National Grassbank Network (www.grassbank.net). In the summer of 2004, both the National Grassbank Network and Grassbank Incorporated met and discussed how they could collaboratively work together to address the growing needs of the grassbank movement. While the future of Grassbank Incorporated has remained unclear, the National Grassbank Network has remained active. The National Grassbank Network supported their second annual grassbank symposium at the 2005 Society of Range Management National Annual Meeting, where they unveiled their website (www.grassbank.net), agreed to continue supporting the National Grassbank Network listserv and quarterly grassbank newsletter. Even though the National Grassbank Network is clearly fulfilling the role of providing support for grassbanks and consequently, is well positioned to deal with trademark issues, at this time Grassbank Incorporated still holds the trademark.

3.5 Grassbanks – Tax Incentives and Requirements

Tax incentives for grassbanks on land owned by private individuals or nonprofits and the private benefit requirement for nonprofits are the two most important tax policy issues related to grassbanks. Grassbanks located on private land where landowners are willing to donate their standing grass are appealing for several reasons. These models have fewer political challenges (e.g., NEPA requirements, resistance from cattle industry and environmental groups, etc.) relative to the other grassbank models. However, while there is little, if any political resistance for this type of grassbank, there are also virtually no incentives for private landowners, which are often high income amenity ranch owners without an economic need to run cattle, to allow forage on their private land to be used for a grassbank. One idea has been to create a tax deduction for standing grass. Presently, an individual can donate cut grass in the form of baled hay to a nonprofit and deduct the value of the hay as a charitable donation. However, current tax law does not allow the landowner to claim a charitable contribution deduction for the value of the unbaled standing grass (pers. comm. Phil Tabas, October 11, 2003). Such a change in the tax law could greatly enhance the use of grassbanks as a management tool, and this fact is not lost on private individuals who are involved with grassbanking.

A second tax-related policy issue associated with grassbanking is the concern of meeting the IRS requirement of private benefit when a grassbank is owned by a nonprofit. The majority of grassbanks currently in existence occur on private land owned by nonprofit 501(c)(3) organizations such as The Nature Conservancy or Quivira Coalition, who recently purchased the Rowe Mesa Grassbank, formally the Valle Grande Grassbank operated by the Conservation Fund. A fundamental concept of grassbanking is *quid pro quo*, or, that an equal value of forage has been traded for an equal value of conservation benefit. For grassbank projects owned and operated by a nonprofit, this is also a legal requirement. In light of the recent crackdown on nonprofits for misuse of their charitable status, one of the biggest areas of potential concern for grassbanks is ensuring that the requirement of private benefit (i.e., *quid pro quo*) has been met. Accordingly, nonprofit grassbanks must ensure that the value of the conservation benefit meets or exceeds the value of the discounted forage in order not to violate the charitable status of a 501(c) (3) organization.

In part due to the novelty of the approach, grassbanks are at a distinct disadvantage compared to other more established conservation tools, such as conservation easements, that also require valuation of conservation benefit. In the case of conservation easements, an appraisal of the development value of the property is a well accepted methodology used to value the conservation benefit of an easement. One grassbank has experimented with conservation appraisals with limited success due to absence of a developed market for conservation benefits, as opposed to the market for development value which is easily assigned a monetary amount. Another grassbank has experimented with several conservation benefit valuation methods that include replacement costs, substitution costs, and willingness to accept. Grassbank stakeholders are concerned about valuing conservation benefits to demonstrate *quid pro quo*. In fact, 13% of survey respondents identified "valuation of conservation benefits" as the biggest challenge facing grassbanks (Table 3-3). However, at this time, there is no one widely accepted and cost-effective technique to economically value the conservation benefits from grassbanking (Gripne 2005).

3.6 Grassbanks - Interest Group Support and Opposition

With the exception of the Valle Grande Grassbank, all of the other grassbanks in existence occur on land owned by private individuals or nonprofits. There is little if any opposition by either environmental or national cattle industry groups for these types of grassbanks. This is not the case for grassbanks operating on public land, which face a variety of political challenges by anti-grazing environmental groups as well as several national cattle industry groups.

Many environmental groups do not support public lands grazing. Wuerthner and Matteson (2002) stated, "...no ranching in the West is environmentally benign, but even if there are a few exceptional operations, they don't invalidate the general rule: that livestock production in the arid West has contributed to major biological impoverishment." Despite this assertion, the question of whether or not domestic grazing causes ecological harm or benefit is unresolved. Both Conservation Biology and Ecological Applications have devoted two special issues to this topic and the debate is far from over. Most ecologists would agree that many ecosystems evolved with disturbance such as grazing, and that grazing is neither good nor bad, but it can be manipulated to achieve a variety of ecological goals, which are often based on historical range of variability and/or social construction of what a particular individual values.

Resistance to using public land for grassbanks is illustrated by the opposition to the BLM's recent attempt to include reserve common allotments in their proposed grazing rules. A reserve common allotment would allow voluntarily vacated BLM allotments to be used as a source of alternative forage for permittees in need in cases of drought, restoration, etc. However, this tool was met with opposition from both the national cattle industry lobby and the anti-grazing environmental groups and was dropped from the planning rule, although they have not ruled out reconsidering this tool as a future option.

Whether or not an individual or organization supports or opposes public lands grazing, there is strong support for allowing market forces to determine if public land grazing continues. In fact, over 217 local and regional organizations have supported a voluntary federal public lands grazing permit buyout program (National Public Lands Grazing Campaign 2002). Proponents of the National Public Lands Grazing Campaign have developed national legislation (Voluntary Grazing Permit Buyout Act [H.R. 3324]) that allows public land permittees and lessees to voluntarily waive their grazing permits and leases to the government and retire their grazing allotments for $175 per animal unit month. They have suggested that grassbanks "fleece taxpayers," "encourage and perpetuate poor grazing practices," "do not provide conservation benefits," and if done, should be funded by the ranchers that use the grassbanks and not the public.

Alternatively, the national livestock industry has a strong lobby, and does not support any effort that would lead to the Voluntary Grazing Permit Buyout Act. In addition, there are some livestock industry groups, such as the National Cattleman's Beef Association, that are opposed to grassbanks because they perceive them as a tool that results in a net reduction of animal unit months on public land. These groups are concerned that such animal unit month reductions could be perceived as the beginning of the end of public lands grazing, which has been the most dominant use of 360 million acres of federally managed land, located primarily in the western U.S. (CAST 1996).

3.7 Grassbanks - Public Administration and Policy Issues

In addition to the general trademark issues and multiple interest group opposition, grassbanks operating on public land face many additional bureaucratic challenges. For example, all restoration projects require some sort of NEPA such as an environmental impact statement, environmental analysis, or categorical exclusion. In the case of the Valle Grand Grassbank, the only example of a public land grassbank, there have been some instances where the Forest Service failed to complete NEPA by promised deadlines (Harper 2002). Part of this delay is attributed to the need to develop extensive analyses.

In many instances, agencies have overcompensated out of fear of litigation, thus spending extensive time in order to draft environmental assessments that are "bulletproof" (Harper 2002). In addition to NEPA concerns, narrow burn windows intended to minimize the risk of an escaped prescribed burn; fluctuating budget cycles that prevent long-term planning, high turnover rates, and crisis response are all additional factors that influence successful implementation of public land grassbanks (Harper 2002).

The Valle Grande Grassbank at Rowe Mesa in northern New Mexico is currently the only grassbank operating on public land, and this grassbank faced the substantial challenge of having federal grazing permits allocated to a conservation organization, rather than a private rancher, so that the allotments could be used as a grassbank. The Conservation Fund purchased a 360-acre base property associated with a 36,000-acre Forest Service allotment. Validation of a Forest Service allotment requires the owner of the base property to graze their own cattle on the allotment instead of subleasing (USDA Forest Service 1992). In this case, the Conservation Fund did not own cattle to validate their permit and wanted to place the permit into "non-use" and establish a grassbank that would use that allotment as alternative forage for permittees who wanted to do improvements on other Forest Service allotments. Forest Service officials took a risk in granting the permit since the Conservation Fund did not validate their Forest Service permit by running their own cattle on the allotment. Initially, this type of risk-taking appeared to be rewarded. An interim directive was approved by the Forest Service in 2001, which officially granted exception to the permit requirements as long as the allotment was used as a grassbank. Interim Directive Number 2230-2001-1 effective

February 16, 2001 "establishes an exception to the base property and livestock ownership requirements necessary to qualify for a term grazing permit when the applicant agrees to operate the allotment(s) as a grassbank."

However, while the Forest Service initially appeared to support this idea, the interim directive that classified "grassbanking as an acceptable non-use" expired August 16, 2002 and did not result in a permanent directive. There were several reasons the interim directive did not result in a permanent directive, including: (1) resistance by the national cattle industry, which is opposed to any net AUM reduction on public lands which they contend could eventually lead to the termination of public land grazing; (2) increasing pressure by environmental groups to make "retirement of the allotment an acceptable non-use" if grassbanking was allowed; and (3) general resistance on the part of the Forest Service and various cattle groups to make any changes to the current grazing regulations that might alter their current relationships and/or potentially result in unintended consequences.

While the BLM dropped the reserve common allotment from their proposed grazing regulations, current BLM policies do not presently offer the same types of obstacles as the Forest Service for creating a grassbank. The BLM allows permit holders to graze livestock on their permit that they do not own and sublease their land to other ranchers, and so a grassbank can be established within the arrangement a sublease. Permit holders do incur additional costs under this arrangement since the BLM does require charges and surcharges for subleases when the permittee does not own the livestock using their permit. The surcharge was developed to avoid allotment speculation where leasees would sublease the allotments for profit. The sublease is designed to provide flexibility in the use of the grazing permit while allowing the federal government to recover the landowner's share of any profit that occurred during the transaction.

3.8 Grassbank Policy Implications and Opportunities

In their current form, grassbanks suffer from quality control issues. In the absence of any top-down regulatory structure, the Malpai Borderlands Group took the unprecedented step trademarking the term. In theory, the trademark was one way to ensure a minimal level of quality control over the term. However, neither the Malpai Borderlands Group or Grassbank Incorporated personnel have not enforced the trademark, nor have they provided any organizational support. Hence, the unresolved issue of the trademark has lingered and has become an obvious obstacle for federal agencies pursuing projects that would use the term grassbank. A trademarked conservation term without explanation, encouragement, or organizational support has resulted in increased mistrust, confusion, and another layer of bureaucracy that already financially challenged projects must negotiate.

Dissolving the trademark and Grassbank Incorporated would be a first step towards ending confusion and opening up the door for federal agencies to use the term. While there may be other reasons the agencies do not want to be associated with the term grassbank, such as the close ties with The Nature Conservancy and Malpai Borderlands Group, which can make some of the more conservative cattle operators and land managers suspicious, at least the trademark would no long be offered as the reason that the federal land management agencies would not use the term and potential projects could proceed without the additional layer of bureaucracy.

From a policy perspective, the most feasible (e.g., lack of organization and/or agency opposition) grassbanks are those on private land or using leased private or state land. They are the most viable because neither model would reduce net AUMs on federally managed land, which the livestock lobby opposes, and neither model would contribute to additional grazing on public land, which many environmental groups oppose. Further, using leased land would allow the grassbank to become "mobile" and would reduce transportation costs that many grassbank participants pay.

There are policy challenges associated with the leased or private land grassbank models. The downside of the grassbank lease model is the loss of long-term ecological management by the nonprofit that owns the grassbank property, which is often hundreds or thousands of acres. In the case of grassbanks operated on private land, it is not clear what, if any, incentive could be provided to high income amenity ranch owners that would encourage them to offer their standing grass for the purposes of a grassbank. A tax deduction for standing grass might provide the needed incentive for these individuals. However, proponents of a tax deduction should first conduct a market analysis that would identify the number and location of willing participants who would donate standing grass before proceeding with this strategy. Notwithstanding these issues, the high political feasibility of grassbanks operated on leased or private land, coupled with low cost, makes them one of the most promising opportunities for continuing the grassbank movement.

Accordingly, grassbanks operated in this manner is an option that should be explored immediately.

Existing grassbanks on nonprofit land are finding it too costly to maintain or purchase land for the primary purpose of operating a grassbank. In addition, nonprofits supporting grassbanks are faced with the daunting challenge of economically valuing conservation benefits to avoid violating I.R.S regulations associated with private benefit. Experimental conservation appraisals have been attempted and the National Grassbank Network's research agenda includes supporting projects that would provide nonmarket economic values for the existing grassbanks.

Public land grassbanks have the greatest number of political challenges. Both the Forest Service and BLM do not have any regulatory authority to establish a grassbank project. Agency personnel have indicated that using the term grassbank is unlikely because the term is trademarked and the implications of the trademark are unclear. However, while both agencies have not actively promoted the term, at a local level there is some management flexibility that would allow for the establishment of a project that would have many similarities to a grassbank. For example, the Forest Service uses allotment management plans to comply with NEPA requirements to manage and disclose environmental effects of any action on the federal allotments. Within these allotment management plans, local managers can propose projects that reallocate forage, utilize swing allotments, and/or other conservation projects. Hence, the agencies can and do pursue grassbank-type projects, but are not likely to use the term grassbank because it is trademarked. In addition to the trademark, grassbanks on public land face multiple obstacles from industry and environmental groups as well as bureaucratic challenges such as NEPA. Neither the national cattle industry nor the anti-grazing environmental groups want to see grassbanks on public land. However, despite the national debate over this issue, at a local level land managers continue to experiment with different variations of grassbanks, forage reserves, and retirement of allotments as appropriate in a case by case basis. Innovation continues to emerge out of perceived gridlocked situations.

Many ranchers and conservationists are optimistic about the future of grassbanks because this tool is viewed as an approach to natural resource management challenges that promotes collaboration rather than conflict. In addition, grassbanks provide management flexibility for both ranchers and land managers to engage in a number of conservation projects. Despite the large degree of optimism surrounding grassbanking, significant challenges remain. Some of these challenges, such as cost, are beyond the scope of this paper. However, even if the issue of operating cost was resolved, the future viability of grassbanks, at least in their current forms, will depend in large part on the development of effective solutions to the policy issues presented in this paper.

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Table 3-1. Survey response[1-3] to the question, what is the purpose of grassbanks.

Grassbank Purpose	**Percentage**
Assist Ranchers	10
Conservation Benefits	26
Depends on Who is Running it	5
Drought Relief	8
Economic Relief	9
Management Flexibility	18
Range Improvements	25
Other	1

[1] n = 171
[2] Data based on 40 semi-structured in person interviews, 11 semi-structured phone interviews, 112 phone surveys, and 16 web surveys of respondents using a directed snowball sampling method.
[3] Respondent description: didn't identify (1%); donor (1%); federal employee (28%); environmentalist (1%); Indian tribe (1%); local government employee (1%); nonprofit employee (28%); other (3%); private citizen (9%); state employee (11%); rancher (13%); researcher (4%).

Table 3-2. Survey[1-3] response to the question, what are the primary conservation benefits associated with grassbanks.

Conservation Benefit	**Percentage**
Depends on Who is Running it	3
Prescribed Burning/Fuels Reduction	8
Range Improvement[4]	43
Restoration/ Biological Improvements[5]	43
Social/ Economic Benefit	3

[1]n = 170
[2]Data based on 40 semi-structured in person interviews, 11 semi-structured phone interviews, 112 phone surveys, and 16 web surveys of respondents using a directed snowball sampling method.
[3]Respondent description: didn't identify (1%); donor (1%); federal employee (28%); environmentalist (1%); Indian tribe (1%); local government employee (1%); nonprofit employee (28%); other (3%); private citizen (9%); state employee (11%); rancher (13%); researcher (4%).
[4]Includes prescribed burning to increase forage; rest; drought relief; reduce overgrazing.
[5]Includes treating invasive species; habitat improvements; reduce fragmentation; threatened and endangered species; soil conservation; watershed health.

Table 3-3. Survey[1-3] response to the question, what are the biggest challenges associated with grassbanks.

Biggest Challenge	**Percentage**
Agency Engagement	4
Funding	9
Grassbank Availability	24
Management Issues[4]	9
Monitoring	10
Organizational Support	11
Rancher Compliance	2
Trust and Community Support	18
Valuing Conservation Benefits	13

[1]n = 74
[2]Data based on 40 semi-structured in person interviews, 11 semi-structured phone interviews, 112 phone surveys, and 16 web surveys of respondents using a directed snowball sampling method.
[3]Respondent description: didn't identify (1%); donor (1%); federal employee (28%); environmentalist (1%); Indian tribe (1%); local government employee (1%); nonprofit employee (28%); other (3%); private citizen (9%); state employee (11%); rancher (13%); researcher (4%).
[4] Includes managing multiple animal herds; selecting participants; etc.

4 CHAPTER: A CONSERVATION RESOURCE ALLOCATION APPROACH APPLIED TO GRASSBANKING

4.1 Abstract

Resources available to conserve biodiversity and restore ecological communities are limited. Accordingly, conservation practitioners must make decisions about how to allocate resources among a variety of conservation projects with imperfect information. In most instances, choices are based on opportunity, intuition, and expert opinion because few tools are available to aid in the decision-making process. Those tools that are available generally are not applicable at the scale of most conservation projects, or are too complex, costly, and time-intensive to be of any practical use. I developed a simple heuristic tool that uses a combination of objective data and expert opinion to qualitatively assess the conservation benefit associated with a conservation strategy called grassbanking. A grassbank refers to the exchange of forage for conservation benefits. Grassbank-supported restoration treatments for three different grassbanks were assigned ranks based on four attributes: duration, size, irreplaceability, and vulnerability. The resulting Conservation Benefit Index scores were combined with grassbank costs to determine the cost-effectiveness among the grassbanks. All three grassbanks supported restoration treatments directly related to their conservation objectives in their landscapes, but all received very low Conservation Benefit Index scores. The Rocky Mountain Front Grassbank was the most cost-effective grassbank despite receiving the lowest Conservation Benefit Index scores. Grassbanks can improve their overall effectiveness

by reducing costs or increasing conservation benefits. Grassbank cost can be minimized by eliminating land investment costs and using donated private land, leased land, or public land. Conservation benefit can be increased by pursuing treatments that target rare or declining conservation targets over a greater spatial scale. Decision-makers can apply this tool to quantify costs and conservation benefits, and use the results along with other relevant information about political feasibility, opportunity, and potential to influence social capital to make more analytic and transparent decisions about allocating resources within and across different conservation strategies.

4.2 Introduction

Species extinctions are on the rise (Lawton and May 1995; Pimm and Raven 2000) and habitat loss is rapidly increasing (Ceballos and Ehrlich 2002; Brooks et al. 2002; Balmford et al. 2003), placing species, ecosystems and human communities at risk (Pimm et al. 1995; Luck et al. 2003). Today, the world is filled with organizations, both governmental and nonprofit, that are spending billions of dollars supporting a wide variety of conservation actions with the hope of slowing the loss of biodiversity by conserving species and protecting habitat. During the past twenty years there has been a plethora of scientific research aimed at identifying those species that are at greatest risk of extinction (Soule 1986; Belovsky 1987; Goodman 1987; Terborgh 1989; Flather et al. 1995; Taylor 1995; Johnson 1998; Purvis et al. 2000; Cardillo et al. 2004). Likewise, there has been enormous effort into the development of techniques (Noss 1983; Pressey 1994; Olson and Dinerstein 1998; Pressey et al. 1998; Margules and Pressey 2000; Scott et al. 2001; Margules et al. 2002; Malakoff 2002; Groves 2003; Lawler et al. 2003; Lourie and Vincent 2004) that identify the most important regions or "hotspots" (Game and Peterken 1984; Pressey et al. 1990; Myers et al. 2000; Mittermeier et al. 2003) for concentrating conservation priorities and strategies.

However, systematic regional planning often targets areas ranging from hundreds of thousands to millions of acres (e.g., Noss et al. 2002), instead of the scale at which most conservation projects occur, which is typically hundreds to thousands of acres. Consequently, conservation plans often provide only limited guidance for practitioners regarding specific areas to focus conservation work. Furthermore, while the relative level of sophistication associated with tools used for conservation planning and priority conservation area selection is often impressive, a critical step in achieving conservation results has largely been ignored, which is the formulation and comparative evaluation of strategies designed to achieve conservation goals articulated in conservation plans.

Effective conservation action requires that practitioners understand both the costs and benefits associated with conservation tools and strategies (Salafsky et al. 2002; Saterson et al. 2004). Conservation organizations could improve decision-making and evaluation by conducting cost-benefit analyses, but there are challenges associated with these types of analyses. For example, while costs are relatively straightforward, determining economic value of conservation benefits is not. Because there is not a market for most conservation benefits, nonmarket valuation methods must be used to estimate the economic value of the conservation benefit. The field of nonmarket valuation has grown substantially, and techniques such as revealed preference or stated preference approaches to estimate values (Mitchell and Carson 1989; Loomis 2000; Champ et al. 2003) can be used. However, these analyses are generally too complex, costly and time-intensive to be of any practical use for most conservation organizations that must make decisions rapidly as opportunities arise. Consequently, although these types of analyses are sorely needed by conservation organizations to make resource allocation decisions, they are rarely completed.

Recognizing the need for rapid evaluation of costs and benefits associated with various conservation tools, I developed a simple heuristic tool to qualitatively assess the conservation benefits associated with proposed restoration treatments (e.g., prescribed fire, weed control) supported by the conservation tool known as grassbanking. Grassbanking is a relatively new conservation tool that provides management flexibility by exchanging equal value of forage for equal value of conservation benefits. The term grassbank is used to describe the practice where a private landowner, conservation organization, government entity, or livestock grazing association provides forage at a discounted rate (e.g., the economic value of the conservation benefit must exceed the total value of the discounted forage) to a rancher in need of alternative forage because their desire to conduct conservation work requires cattle to be removed from their existing property for an extended period of time (Gripne 2005).

Grassbanking, as it is practiced today, depends on some combination of private donations, foundation grants, and/or public grants to cover the cost of the discounted forage to the rancher as an incentive to engage in conservation activities (Gripne 2005). Six grassbanks have been in existence for several years, while dozens more are emerging throughout the western U.S. Many individuals (e.g., ranchers, government employees, nonprofits) involved with conservation in the western U.S. are optimistic about the future of grassbanking because it is seen as a tool that can effectively promote ecological restoration and be a win-win-win for ranchers, conservationists, and rural local economies (Gripne 2005). Therefore, an analysis of the conservation benefits and associated costs of grassbanking is timely.

The assessment was conducted on three grassbanks that have been in existence for at least two seasons in the western U.S. I did not conduct a nonmarket valuation of conservation actions, nor did I directly measure the effectiveness of treatments supported by grassbanks. Instead, my objective was to illustrate how a conservation resource allocation approach can help conservation practitioners make informed decisions about how to use their limited funds in the most efficient and effective manner, or at the very least, be clear about the assumptions they are making regarding the potential benefits and costs of a proposed conservation action or strategy. My goal was to create a tool that had a high likelihood of being used by conservation practitioners because it was simple, inexpensive, and yielded an adequate estimate of potential conservation effects.

The tool I created is called a Conservation Benefit Index (CBI). In this paper I describe the application of CBI to three grassbanks to determine their cost-effectiveness. I discuss how conservation benefits associated with treatments supported by grassbanks could be increased, and offer suggestions regarding which grassbank models would have the greatest potential to achieve conservation benefits for the least cost. Finally, I conclude with a commentary about the generality of this approach and how it could be used by conservation practitioners to estimate the cost and benefit associated with various tools such as grassbanks or conservation easements, permitting comparisons among and within different tools so that limited resources are allocated more efficiently towards conservation goals.

4.3 Study Areas

Heart Mountain (HM) Grassbank. Heart Mountain Grassbank is located in northwest Wyoming and is owned and operated by the Wyoming Chapter of The Nature Conservancy. The grassbank consists of 600 acres of irrigated pasture that produces approximately 3,000 AUMs (animal unit months) of forage annually. The landscape of conservation interest for this grassbank is called the Eastern Absaroka Front, and encompasses over three million acres along the eastern flank of the Greater Yellowstone Ecosystem. Vegetation communities range from sage steppe at lower elevations, grading to mixed conifer forests dominated by Douglas fir and lodgepole pine, with small patches of aspen and meadows. The Wyoming Chapter of The Nature Conservancy has identified the following conservation goals for the area: (1) restore the historic fire regime; (2) protect migratory corridors for predators and ungulates; and (3) improve sagebrush steppe habitat that supports black-tailed prairie dogs and sage grouse (Bell 2001).

Rocky Mountain Front (RMF) Grassbank. The RMF grassbank is located in western Montana and was created by the RMF Grassbank advisory group in 2001. The grassbank currently consists of one privately owned, 380-acre parcel that supports 120 AUMs. The RMF Grassbank is a small pilot project created to explore the idea of forming a network of small private ranches whose owners are willing to donate their forage, forming a collective grassbank for use by local ranchers. The landscape of conservation interest is the Rocky Mountain Front, a two million-acre region of the east side of the northern Rockies where the mountains meet the plains. The landscape along the front of the mountains is characterized by prairie potholes, aspen glades, and mixed grass prairie. The conservation goals of the RMF Grassbank are to (1) promote wide-ranging carnivore (e.g., grizzly bear) habitat; (2) manage invasive weeds; and (3) encourage ecologically sensitive stewardship (Bay 2001)

Valle Grande (VG) Grassbank. The VG Grassbank is located in northern New Mexico and consists of a 36,000-acre Forest Service grazing allotment that supports approximately 3,900 AUMs. The landscape of conservation interest is the Santa Fe and Carson National Forests, encompassing approximately 3.1 million acres. The region is dominated by ponderosa pine forest. The VG Grassbank has focused on rehabilitating forests and grasslands in the Santa Fe and Carson National Forests of northern New Mexico. Specifically, restoration focuses on the re-establishment of grasslands in northern New Mexico by reducing encroaching woody species (e.g., juniper) through the use of prescribed fire and mechanical thinning. The general objectives of the VG Grassbank include (1) promoting ecological health; (2) promoting the economic and cultural landscape of northern New Mexico; and (3) demonstration of the value of partnerships (deBuys 1999). In November 2004, the VG Grassbank was sold to the Quivira Coalition who changed the name of the grassbank to Rowe Mesa Grassbank.

4.4 Methods

I had two goals for this research: (1) to create a simple conceptual framework and a heuristic resource allocation tool that conservation practitioners can use to select among several possible proposed conservation actions; and (2) to apply this framework and resource allocation tool to grassbanking in order to make comparisons about conservation benefits and cost-effectiveness among three different grassbanks. I limited the comparison of restoration treatments to those completed in 2003 to simplify the analyses. I used the estimate of conservation benefit, determined by the application of a conservation benefit index, combined with grassbank costs to determine grassbank cost-effectiveness.

Grassbank operators and scientists associated with each grassbank provided the following information: (1) conservation targets; (2) spatial extent (i.e., total acres) of conservation targets; (3) primary threats to conservation targets; and (4) potential strategies that could be used to abate such threats. The purpose of the resource allocation tool was to articulate potential conservation costs and benefits associated with proposed conservation actions or strategies.

Cost information was provided by grassbank operators and included both 2003 annual operating costs as well as annual land costs, which were amortized over ten years I developed a conservation benefit index, which provided a qualitative ranking of conservation benefits associated with treatments supported by each grassbank. The purpose of treatments (e.g., hazardous fuels reduction, invasive weed control) supported by a grassbank is to benefit a conservation target, which is defined as a species or a vegetation community. Treatments intended to improve the quality of vegetation communities or habitats of species were assigned ranks for four attributes; two (i.e., duration and size) address conservation target attributes associated with scale, and two (i.e., irreplaceability and vulnerability) address conservation attributes associated with biodiversity (e.g., target rarity, risk of conservation target decline). Each attribute is described in greater detail below. I assigned treatments a qualitative rank of very high, high, medium, or low for each attribute (i.e., benefit duration, proportion of target affected, irreplaceability, vulnerability). Rankings were determined through evaluation of peer reviewed literature. When peer-reviewed data were not available, rankings were based on expert opinion (i.e., the opinion of scientists associated with each grassbank), a technique regularly used in conservation planning exercises (e.g., Noss et al. 2002; Parrish et al. 2003) when decisions must be made but limited data is available.

Benefit Duration is an objective measure of the temporal scale associated with a treatment (i.e., treatment effect or duration). For example, implementation time for prescribed burning in ponderosa pine forest could be 1-3 years to allow growth of fine fuels, while the benefit duration is 10-30 years (Covington and Moore 1994). Benefit duration should be maximized on a per unit cost basis and so treatments with longer effects receive a higher qualitative rank (Table 4-1). Benefit duration was usually available in scientific literature and when it was not, was estimated by scientists associated with the grassbank

Proportion of Target Effected is an objective measure of the proportion of the target's spatial distribution affected by the treatment. Like benefit duration, proportion of target affected should be maximized on a cost per unit basis and so treatments affecting a larger proportion of the target's distribution receive a higher qualitative rank (Table 4-1).

Irreplaceability has been used in conservation planning to identify priority regions to target conservation activities (Margules and Pressey 2000; Pressey and Tafts 2001; Noss et al. 2002; Lawler et al. 2003) and is defined as the extent to which the loss of an area will compromise the ability to achieve conservation goals for a broader region. This same concept can be applied to conservation targets (i.e., species or vegetation communities) and in this context is a measure of rarity (Pressey and Tafts 2001). Irreplaceability was objectively determined for species using state Heritage ranks (see Keinath et al. 2003). Irreplaceability for vegetation communities was based on the expert opinion of scientists associated with each grassbank and supported with peer reviewed documentation when possible (Table 4-1).

Vulnerability is commonly used in conservation planning as an assessment species decline risk or transformation of an ecological community (Margules and Pressey 2000), and is increasingly being used in conjunction with irreplaceability to prioritize regions for conservation action (Pressey and Tafts 2001; Noss et al. 2002; Lawler et al. 2003). Vulnerability of conservation targets was subjectively ranked by scientists associated with each grassbank (Table 4-1).

A *Conservation Benefit Index (CBI)* was calculated for every proposed grassbank treatment from the rankings they received for duration, size, irreplaceability, and vulnerability. Qualitative rankings (i.e., very high, high, medium, and low) were assigned a numerical value (i.e., natural log function) to permit relative numerical comparisons among treatments. It is important to note that the quantitative number associated with the CBI does not have value in and of itself, but was generated to permit relative comparisons among treatments, as well as permit grassbank cost and conservation benefit to be graphed.

Three indices, scale, biodiversity, and combined scale and biodiversity, were calculated for each treatment. The scale index (0 – 23) is the product of the rankings associated with duration and treatment size; the treatment with a longer benefit duration and affecting a larger percentage of the spatial extent of the conservation target received the highest index score. Biodiversity index (0 – 17) is the product of rankings associated with irreplaceability and vulnerability; the treatment that affects the rarest and most threatened conservation targets received the highest index score. Finally, the combined index (0 – 40) is the sum of the scale and biodiversity indices. I calculated all three indices to make it more clear how the two scale attributes versus the two biodiversity attributes contributed to the estimated conservation benefit ratings.

4.5 Results

Conservation Benefit. All three grassbanks supported restoration treatments directly related to their conservation objectives on their landscapes (Table 4-1). Heart Mountain Grassbank supported the most restoration activities, and the treatment that targeted sage grouse habitat using prescribed fire and mechanical fuels treatments received the highest CBI scores in all categories (i.e., scale, biodiversity, combined [Table 4-2]). This treatment received high scores because the conservation target was relatively rare (i.e., irreplaceability) and threatened (i.e., vulnerability), and treatment duration (i.e., prescribed fire and mechanical treatments) was long (i.e., 25-100 yrs; Table 4-2). Both Heart Mountain Grassbank and Rocky Mountain Front Grassbank supported restoration treatments that received the lowest possible CBI score of <1 in all categories, a result of targeting more common species with treatments with a very limited duration (Table 4-2). Valle Grande Grassbank supported one treatment intended to restore the historic fire regime in ponderosa pine and received a combined CBI score of one; although vulnerability was ranked high for this treatment, the low ranks associated with scale and irreplaceability contributed to a lower CBI score (Table 4-2). The Rocky Mountain Front Grassbank received CBI scores of <1 for both scale and biodiversity, this result was not unexpected because this grassbank is a small pilot project and had 95% fewer AUMs than either Heart Mountain or Valle Grande Grassbanks. All treatments supported by the three grassbanks scored significantly lower than the maximum possible CBI score in all categories (i.e., scale [max. = 23]; biodiversity [max. = 17]; combined [max. = 40]), and none of the grassbank treatments affected more than one percent of the spatial area of a conservation target.

Cost-effectiveness. The Valle Grande Grassbank was the most costly grassbank (Figure 4-1), which is largely attributed to the high annual operating costs, land costs and significant administrative costs unique to it, such as complying with government environmental laws (e.g., NEPA). Likewise, Heart Mountain Grassbank, operated by The Nature Conservancy, also had significant land and personnel costs, and so it was only slightly less costly to operate than the Valle Grande Grassbank. Finally, the Rocky

Mountain Front Grassbank was the least costly because it had no land costs or personnel on payroll (Figure 4-1).

Although the Rocky Mountain Front Grassbank received very low CBI scores in every category (i.e., scale, biodiversity, combined [Table 4-2]), its operating costs were substantially lower than the other two grassbanks. Consequently, the Rocky Mountain Front Grassbank was the most efficient grassbank, yielding the highest conservation benefits for the lowest cost by these criteria (Figures 4-2, 3). The Valle Grande and Heart Mountain Grassbanks had similar annual operating costs (Figure 4-1). However, Heart Mountain Grassbank received higher CBI scores than Valle Grande, and so was more cost-effective than the Valle Grande Grassbank (Figures 4-2, 3).

4.6 Discussion

Conservation Benefit and Cost-Effectiveness of Grassbanks. Treatments supported by Heart Mountain Grassbank received the highest CBI biodiversity scores because treatments specifically targeted rare (i.e., irreplaceability) or threatened species (i.e., vulnerability). Likewise, this grassbank received the highest CBI scale and combined score because it supported treatments (i.e., prescribed fire) with a relatively long duration. The Valle Grande Grassbank also used prescribed fire to improve the health of ponderosa pine, but this treatment received lower CBI scores for scale because the benefit duration associated with prescribed fire in ponderosa pine is much shorter (2-10 yrs) than the benefit duration associated with prescribed fire in Douglas fir (25-100 yrs [Table 4-2]). In addition, Valle Grande supported prescribed burning on over three times as many acres as that supported by Heart Mountain Grassbank. However, both treatments received a low treatment size ranking because the prescribed fire treatment area was insignificant compared to the number of acres in both forests that have altered fire regimes. In fact, all treatments supported by the grassbanks affected less than one percent of the spatial area of conservation targets which was reflected in very low CBI scores (Table 4-2). These low CBI scores suggest that all three grassbanks significantly underperformed from a conservation benefit perspective.

The spatial extent of most conservation targets is substantial, often several hundred thousand acres, and restoration treatments were minuscule in comparison (e.g., hundreds of acres). This disparity between the restoration work that needs to be done and the treatments supported by the grassbanks suggests that grassbanks may not be the most effective strategy to restore large spatial areas, and that other strategies should be pursued, either separately, or in tandem with grassbanks. Alternatively, there are some conservation targets that have a relatively small spatial extent (e.g., there are 17,000 acres of prairie dog habitat in the Absarokas [Table 4-2]), and grassbanks could be a very effective strategy for improving these conservation targets that occur at a more reasonable scale.

The results of this analysis indicate that Rocky Mountain Front Grassbank is the most cost-effective grassbank model of those analyzed, which is a result of this grassbank having no land and personnel costs. Alternatively, even though the Heart Mountain and Valle Grande Grassbanks receive higher CBI scores when compared to the Rocky Mountain Front grassbank, their costs increased at a faster rate, hence, their ratio of costs to conservation benefits were not as high as the Rocky Mountain Front Grassbank (Figures 4-2, 3). Cost-effectiveness can be improved by maximizing the conservation benefit-cost ratio. Eliminating land investment (e.g., Rocky Mountain Front Grassbank), or leasing land to use as the grassbank is one way to achieve this goal. Alternatively, the cost/benefit ratio can be improved by increasing conservation benefit through supporting those treatments with longer lasting effects that target rare or declining conservation targets over a greater spatial scale.

The Broader Context of Conservation Resource Allocation Decisions. I emphasized ecological attributes when I developed the CBI because most grassbanks are owned and operated by nonprofits with biodiversity missions. However, conservation benefit is just one of many potential factors (e.g., opportunity, political feasibility, social capital) that are considered when allocating resources among different conservation projects. For example, the Valle Grande Grassbank is now owned by the Quivira Coalition, which has broad mission (i.e., to foster ecological, economic and social health on western landscapes), and so this group may want to modify the CBI index to explicitly capture additional factors such as social capital.

Ultimately, the acceptability of the return on investment, or cost-effectiveness of grassbanks, will be judged by those willing to fund the project. Even though a grassbank may yield limited conservation benefit per dollar spent, it may still have value as a tool to improve relations between agency personnel, environmentalists, and ranchers in local communities. For example, grassbanks are often pursued when other conservation tools, such as conservation easements, are unfeasible because landowners are not interested in restricting their development rights. Grassbanks are perceived by conservation practitioners as a way to build good will or social capital that may increase the likelihood that other conservation tools may be used in the future. Grassbank participants often cited improved community relations, trust, and increased social capital as a direct benefit of grassbanking (Gripne 2005). Like ecological factors, trust and community support are difficult to assign monetary value, although some argue these factors are critical for conservation success (Pretty 2004). Since most grassbanks have been financially supported by conservation organizations with biodiversity missions, project leaders and participants must convince financial contributors that factors such as community support will result in greater conservation benefits.

Calculating CBI and the associated cost-effectiveness analysis results in a clear understanding of conservation costs and benefits associated with a grassbank, and thus, enables operators and financial contributors to make more informed decisions about how much it 'costs' to improve trust in the community. For example, if a grassbank received very high CBI scores, financial contributors might be much more willing to continue to support it, and therefore, the additional benefit of improved community relations will be maintained. However, the three grassbanks I studied had low CBI scores and so financial backers might be less willing to continue to finance these initiatives, even if it means a loss of community support for conservation activities.

This analysis was completed after grassbank treatments had been implemented, but it could have just as easily been used prior to any proposed treatments to help grassbank operators prioritize treatments. The cost-effectiveness information provided here is useful to grassbank operators, as well as others who might consider starting a grassbank, because it clearly defines the predicted conservation benefit as well as the cost associated with the strategy. The strength of this conceptual tool is it forces conservation practitioners, or in this case, grassbank operators, to explicitly articulate the assumptions they are making about achieving conservation benefits, and perhaps more importantly, the cost associated with varying treatments. For example, the results of this work have already influenced the Heart Mountain Grassbank operators, who are now specifically targeting projects that will have a longer effect (i.e., duration) and affect rare (i.e., irreplaceability) or threatened (i.e., vulnerability) species or communities (pers. comm. M. Sonnet, February 8, 2005).

General Applicability. In the case of grassbanks, the information provided by CBI and the cost-effectiveness analysis is useful from two perspectives: (1) to prioritize treatments supported by the grassbank; and (2) to make decisions about the cost-effectiveness of the grassbank compared to other strategies. Indeed, the methodology I developed is general enough that it can be adapted to any conservation strategy. For example, the Wyoming Chapter of The Nature Conservancy has the objective of restoring the historic fire regime to the Absaroka Landscape, and the approach outlined here could be used to compare conservation benefits and costs associated with implementing different conservation tools (e.g., grassbank, fee purchase, agency partnerships) to achieve the fire restoration goal. Undoubtedly there will be uncertainty associated with the estimate of conservation benefits for varying conservation tools, but the power of this approach is in the ability to make relative comparisons among and within strategies. All conservation practitioners, organizations and individuals, have limited resources and the CBI tool and subsequent cost-effectiveness analysis can be used to make decisions about where to allocate those limited resources in a more systematic manner.

CBI should also be robust enough to be adapted to the particular needs of diverse users. For example, a federal agency may be more interested in restoration of ecological communities (e.g., ponderosa pine) while a nonprofit may want to maximize biodiversity. The agency could choose to calculate only the CBI score for scale while the nonprofit may only be interested in the CBI score for biodiversity. Or, there may be biological attributes different from irreplaceability, vulnerability, etc. that conservation practitioners may want to evaluate. It would be a relatively straightforward exercise to create a qualitative ranking for other biological attributes (e.g., species richness, abundance, etc.). The overall intent of the tool is to provide a simple conceptual approach that is not so complex that conservation practitioners will not use it. Too often, elegant conservation planning approaches and tools are not used because they are not easily implemented by practitioners.

One limitation of this research and approach is that I assumed that proposed treatments in fact achieved their purpose and resulted in real conservation benefits, yet I did not collect data to measure the actual conservation benefit. I echo the sentiments of others who have clearly articulated the need for effective measurement of conservation tools (Salafsky et al. 2002; Saterson et al. 2004), but this subject is beyond the scope of my study. Ideally, grassbank operators should have monitoring in place to measure treatment effect, which is occurring to some degree at all grassbanks. If conservation practitioners use this tool, monitoring priorities associated with each treatment could readily be identified. For my purposes, I made the assumption that treatments improve the status of conservation targets, and so the CBI scores shown here should be interpreted as the best case scenario. That is, if treatments are not having their intended effect then the CBI scores associated with each treatment would be even lower, and the resulting cost-effectiveness of each grassbank would also be lower.

4.7 Conclusion

Grassbanks are perceived by a growing number of individuals involved or interested in the field of rangeland ecology as a promising new tool for ecological restoration, benefiting environmentalists, ranchers, and local communities. The results of this research indicate that while grassbanks do support conservation activities, they do so at a high cost. The grassbanks that received the highest CBI score (i.e., Heart Mountain and Valle Grande Grassbank), were also the most costly. If they are to continue, grassbanks will have to increase the amount of conservation benefit they currently leverage and/or reduce costs. Existing grassbanks can improve their performance by targeting restoration treatments with a greater conservation effect (e.g., greater spatial scale or rare conservation targets) and/or take steps to reduce land and annual operating costs.

While the CBI that I developed and resulting cost-effectiveness information was used to compare different applications of the same conservation strategy (i.e., grassbanks), this approach would also be useful compare between potential conservation tools (e.g., grassbank vs. conservation easement, etc.). Accordingly, this resource allocation approach has the potential to save conservation organizations significant resources because it allows them to evaluate alternatives during strategy development as well as during implementation, thus increasing the likelihood of acceptable return on resources invested in conservation tools.

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Table 4-1. Description of rankings[1] applied to benefit duration, proportion of target affected, irreplaceability, and vulnerability. These factors determined overall conservation benefit associated with proposed grassbank treatments.

Factor	Conservation Benefit Ranking of Duration, Target Affected, Irreplaceability, and Vulnerability			
	Very High	High	Medium	Low
Benefit Duration[2]	> 20 yrs	10-20 yrs	3-10 yrs	1-2 yrs
Proportion of Target Affected[3]	≥10%	6-9%	1-5%	< 1%
Irreplaceability[4]	Conservation target is rare throughout its range, including the landscape of interest (S1).	Conservation target is rare in portions of its range, including the landscape of interest (S2).	Conservation target is not particularly rare, but may be an important community in the landscape of interest (S3-4).	Conservation target is not rare (S5).
Vulnerability[5]	Conservation target is likely to be destroyed or eliminated over some portion of the target's occurrence at the landscape of interest.	Conservation target is likely to seriously decline over some portion of the target's occurrence at the landscape of interest.	Conservation target is likely to moderately decline over some portion of target's occurrence at the landscape of interest.	Conservation target is likely to slightly decline over some portion of the target's occurrence at the landscape of interest.

[1] Qualitative ranks were assigned numerical values ranging from < 0.1 to 4 on an exponential scale. That is, treatments receive a higher numerical score for high or very high ranked projects compared to low or medium ranked projects. Duration was weighted to have the strongest exponential relationship.
[2] Benefit duration determined from scientific literature.
[3] Proportion of target affected determined from spatial data.
[4] Irreplaceability was determined for species from state Heritage ranks. Irreplaceability for vegetation communities was based on expert opinion of scientists associated with each grassbank and supported with scientific literature when possible.
[5] Vulnerability was subjectively ranked by scientists associated with each grassbank.

Table 4-2. Restoration treatments completed in 2003, and calculated conservation benefit indices associated with treatments supported by Heart Mountain Grassbank, Wyoming; Rocky Mountain Front Grassbank, Montana; and Valle Grande Grassbank, New Mexico.

Goal	Action	Benefit Duration (years)[1]	Benefit Duration Rank[2]	Target Size (acres)	Trtmt Size (acres)	Trtmt Size Rank[3]	Scale Score[4]	Vuln. Rank[5]	Irrepl. Rank[6]	Biod. Score[7]		Comb. Score[8]
Heart Mountain Grassbank												
Restore historic fire regime to douglas fir forest	Presc. fire and mech. thinning	25-100[9]	Very High	69,800[10]	219	Low	3	Med	Low	1		4
Improve elk winter range	Rest from cattle grazing	2[11]	Low	891,649[12]	5156	Low	<1	Low	Low	<1		<1
Provide prairie dog habitat	Rest from cattle grazing	2[11]	Low	17027[13]	180	Low	0	High	High	4		4
Provide sage grouse habitat	Mech. sage brush trtmt.	10-70[14]	Very High	379,000[15]	193	Low	3	High	Med	2		5
						Sub-total	6		Sub-total	7	**Total**	**13**
						GB Avg	1		GB Avg	2	**GB Total**	**3**

Rocky Mountain Front Grassbank

Improve viability of riparian vegetation	Weed control	2[16]	Low	~100,000[17]	380	Low	<1	Low	Low	<1		<1
Improve viability of riparian vegetation	Rest from cattle grazing	2[11]	Low	~100,000[18]	640	Low	<1	Low	Low	<1		<1
						Sub-total	<1		Sub-total	<1	**Total**	**<1**
						GB Avg.	<1		GB Avg.	<1	**GB Total**	**<1**

Valle Grande Grassbank

Restore historic fire regime to ponderosa pine forest	Presc. fire and mech. thinning	3-10[19]	medium	~300,000[20]	1200	Low	< 1	High	low	1		**1**
						Sub-total	<1		Sub-total	1	**Total**	**1**
						GB Avg.	<1		GB Avg.	1	**GB Total**	**1**

[1] Benefit duration is the estimated time that the conservation target will receive the conservation benefit associated with the treatment; it is assumed that the treatment is a one-time application versus continual (e.g., treating invasive weeds).

[2] Benefit rankings: very high (> 20 yrs); high (10-20 yrs); medium (3-10 yrs); low (1-2 yrs).

[3] Treatment size rank is the categorization of treatment size relative to target distribution (% of target affected). Rankings: very high (≥10%); high (6-9%); medium (1-5%); low (<1%).

[4] Scale score is the product of the rankings associated with duration and treatment size. The treatment that has a longer benefit duration and effect the largest percentage of the spatial extent of the conservation target receives the highest rank.

[5] Vulnerability is an assessment of risk that conservation targets will be converted, lost, or altered during a ten-year time period at the landscape of interest under current circumstances. Rankings: very high (conservation target is likely to be destroyed or eliminated over some portion of the target's occurrence at the landscape of interest); high (conservation target is likely to seriously decline over some portion of the target's occurrence at the landscape of interest); medium (conservation target is likely to moderately decline over some portion of target's occurrence at the landscape of interest); low (conservation target is likely to slightly decline over some portion of the target's occurrence at the landscape of interest). Vulnerability rankings were based on expert opinion of scientists associated with each grassbank project.

[6] Irreplaceability is an assessment of the extent to which the loss of the conservation target will affect biodiversity at the regional (i.e.,state) scale. Rankings: very high (conservation target is rare throughout its range, including the landscape of interest [S1]); high (conservation target is rare in portions of its range, including the landscape of interest [S2]); medium (conservation target is not particularly rare, but may be an important community in the landscape of interest [S3-4]); low (conservation target is not rare [S5]). Ranking for species was based on state Heritage rankings and vegetation community rankings were based on expert opinion of scientists involved with the grassbank project.

[7] Biodiversity score is the product of the rankings associated with vulnerability and irreplaceability.

[8] Combined score is the sum of the scale and biodiversity score. All factors (duration, treatment size, vulnerability, and irreplaceability have an exponential relationship (i.e., treatments receive a higher numerical score for high or very high ranked projects compared to low or medium ranked projects). Duration was weighted to have the strongest exponential relationship.

[9] Estimate of Douglas fir fire return interval in Greater Yellowstone Ecosystem is 25-100 yrs (Despain 1990).

[10] Douglas fir in Absarokas Landscape is 349,000 acres (WY GAP); Shoshone NF fire officers estimate ~20% of douglas fir out of historic fire regime.

[11] Rest from livestock grazing assumptions: (1) rested area had been overgrazed; (2) there is no guarantee that management of the grazed area will change. Accordingly, duration of benefit for rest is only equal to the amount of time the area is rested (1 yr).

[12] Source: 1999 Wyoming Game and Fish data.

[13] Source: 1998 Wyoming Game and Fish data.

[14] Successional effect of mechanical treatment assumed to be similar to fire; fire return interval estimate from fire effects website (www.fs.fed.us/database/feis/plants/shrub/arttriw/fire_ecology.html).

[15] 68 leks in Absarokas Landscape; lek/nesting habitat calculated using 2 mi radius around leks.

[16] Biological or chemical treatment indicates that species are established and will need continual treatment. Accordingly, estimated benefit duration associated with weed control is one year beyond the treatment (i.e., RMF Grassbank = 1 yr of treatment + 1 yr)

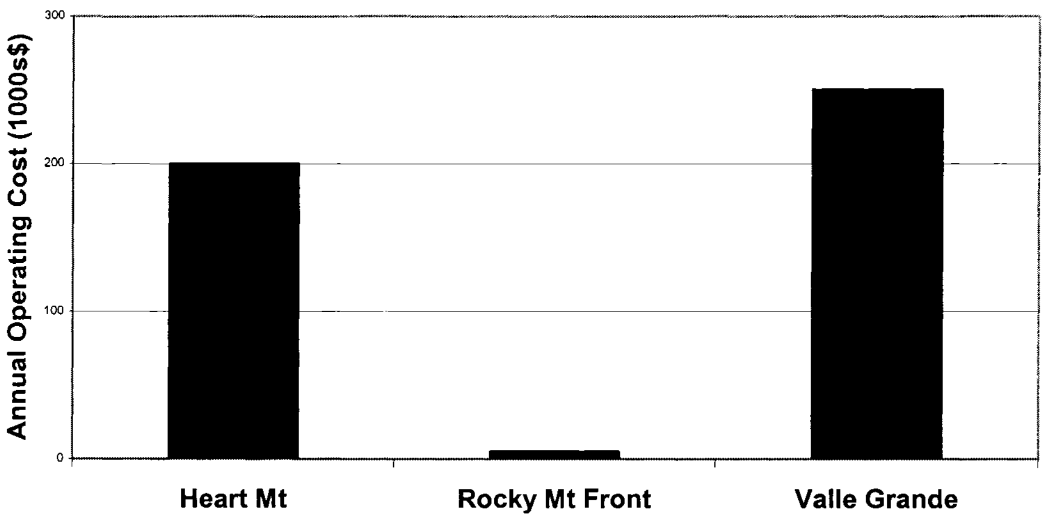
[17] Acreage estimate for Rocky Mt Front vegetation target

[18] Acreage estimate for Rocky Mt Front vegetation target.

[19] Estimated ponderosa pine fire return interval in New Mexico is 3-10 yrs (Touchan et al. 1996).

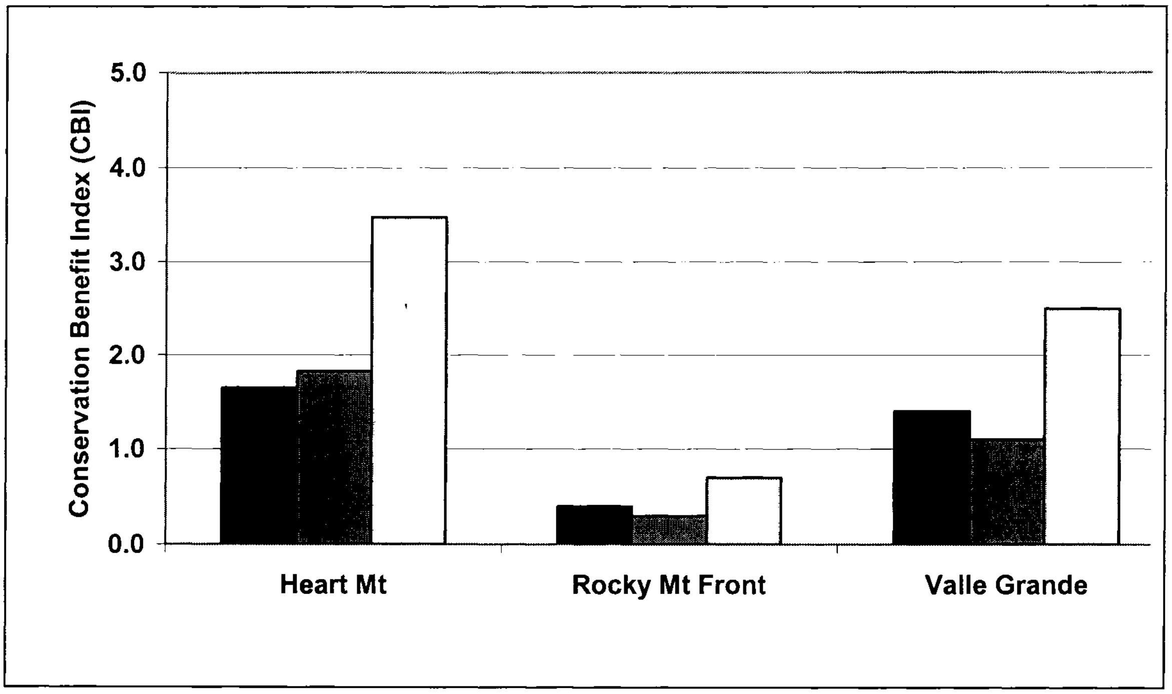
[20] Acreage estimate for Valle Grande ppine

Figure 4-1. Annual operating costs[1] associated with Heart Mountain Grassbank, Wyoming; Rocky Mountain Front Grassbank, Montana; and Valle Grande Grassbank, New Mexico.



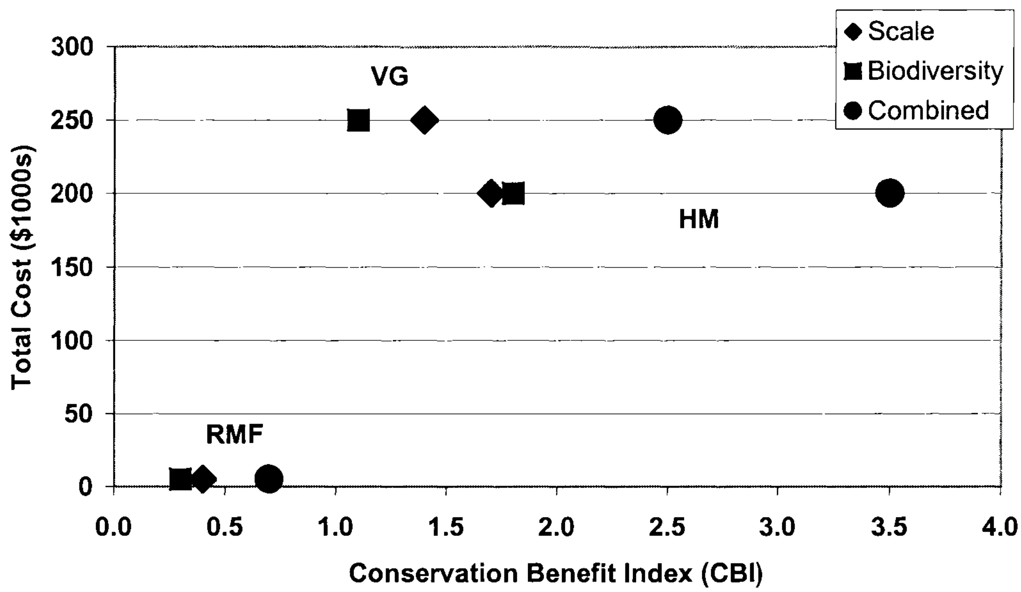
[1] Cost information included both 2003 annual operating costs (e.g., labor, electricity, machinery, fertilizer, etc) as well as annual land costs, which were amortized over ten years.

Figure 4-2. Scale, Biodiversity, and Combined Conservation Benefit Index (CBI) [1] for Heart Mountain Grassbank, Wyoming; Rocky Mountain Front Grassbank, Montana; and Valle Grande Grassbank, New Mexico.



[1] The Conservation Benefit Index (CBI) scores shown here are the average CBI calculated from the sum of individual treatments supported by each grassbank in 2003 (Heart Mt = 4 treatments; Rocky Mt. Front = 2 treatments; Valle Grande = 1 treatment). The CBI provided a qualitative ranking of conservation benefits associated with treatments supported by each grassbank. To calculate CBI, grassbank-supported treatments were assigned ranks for four attributes; two (i.e., duration and size) address attributes associated with scale, and two (i.e., irreplaceability and vulnerability) address attributes associated with biodiversity (e.g., target rarity, risk of conservation target decline). I assigned a qualitative rank of low, medium, high, or very high, to each of the four attributes and then converted the qualitative ratings to a quantitative number for the purpose of creating three different indices for each grassbank treatment. The scale index (0 – 23) is the product of the rankings associated with duration and treatment size; biodiversity index (0 – 17) is the product of rankings associated with irreplaceability and vulnerability; the combined index (0 – 40) is the sum of the scale and biodiversity indices.

Figure 4-3. Cost-effectiveness (cost and benefit) for Heart Mountain Grassbank, Wyoming; Rocky Mountain Front Grassbank, Montana; and Valle Grande Grassbank, New Mexico.



5 CHAPTER: CONSERVATION BENEFITS AND COST IMPLICATIONS RELATED TO GRASSBANK PROPERTY OWNERSHIP ARRANGEMENTS

5.1 Abstract

The cross-boundary principles of ecosystem management require the formation of partnerships that include all types of property owners, as well as the development of incentives to encourage management actions that encompass multiple property ownerships. Grassbanking is a conservation tool that attempts to develop conservation projects that work across property ownership boundaries. A grassbank refers to the exchange of forage for conservation benefit. Most grassbanks are located in the western U.S. and each typically involves at least two separate properties: one property, the grassbank, is used to provide alternative forage in exchange for a conservation benefit on another property, the management area. While all grassbanks exchange forage for conservation benefit, costs and conservation benefits vary with the property ownership arrangement of each grassbank. Using a comparative case-study, I evaluated grassbank outcomes and how those outcomes may be influenced by the different property ownership arrangements. The results of this research will help natural resource managers better understand which grassbank models may result in greater conservation benefits, and the tradeoffs associated with each model. More generally, the results help illuminate some of the challenges associated with practical implementation of ecosystem management.

5.2 Introduction

Effective application of ecosystem management requires that systems are managed according to their ecological characteristics, which often transcend political boundaries. However, despite the best efforts of many natural resource managers, who have advocated the restructuring of administrative boundaries to better reflect the ecological attributes of landscapes (e.g., watersheds), politically defined boundaries remain (Stegner 1992; Wright and Thompson 1935; Caldwell 1970; Craighead 1979; Newmark 1985). Accordingly, nearly all ecologically delineated landscapes (e.g., Greater Yellowstone Ecosystem) are characterized by a mixture of property ownerships, creating a myriad of challenges associated with implementing ecosystem management (Sample 1994). Any hope of effectively implementing the cross-boundary principles of ecosystem management requires the formation of partnerships that include all types of property owners, as well as the development of incentives to encourage management actions that encompass multiple property ownerships (Sample 1994).

Grassbanking is a conservation tool that has emerged in recent years within the context of ecosystem management that attempts to develop conservation projects that work across property ownership boundaries. A grassbank refers to the exchange of forage for conservation benefit. Most grassbanks are located in the western U.S. and each grassbank typically involves at least two separate properties. One property, the grassbank, is used to provide alternative forage in exchange for a conservation benefit on another property, the management area. While all grassbanks exchange forage for conservation benefit, costs and conservation benefits vary with the property ownership arrangement of each grassbank.

Using a comparative case-study, I evaluated grassbank outcomes and how those outcomes may be influenced by the different property ownership arrangements. The results of this research will help natural resource managers better understand which grassbank models may result in greater conservation benefits, and the tradeoffs associated with each model. More generally, the results help illuminate some of the challenges associated with practical implementation of ecosystem management.

5.3 Background

The Changing Landscape of the Western U.S. The western U.S. is characterized as a region with extensive amounts of publicly managed lands (e.g., Forest Service, Bureau of Land Management, National Park Service) that contain interspersed areas of sparsely populated, private land. During the latter half of the last century, formal institutions, such as the federal land management agencies, conducted most of the natural resource management in the western U.S. with the goals of maximization of outputs and production. Accordingly, industries (e.g., timber, mining) dependent upon those outputs, worked with the agencies as principle participants on natural resource management issues (Foss 1960; Miller 1985; Klyza 1996). Public land management agencies traditionally relied on scientific management, centralized planning, and governmental authority in managing the public lands, often with the effect of excluding private citizens from participation (Cortner and Moote 1999).

However, the social and political landscape of the western U.S. has changed during the past thirty years. Landmark legislation, such as the Endangered Species Act, which authorized the federal government to control management on private lands to a degree by prohibiting any private landowner action that results in the 'taking' of an endangered species, signified a fundamental shift in national policy. The shift continued with legislative mandates such as the National Forest Management Act (NFMA) and the National Environmental Policy Act (NEPA) enacted during the 60s and 70s, which reflected society's desire to place more emphasis on nonmarket ecosystem goods and services such as wilderness and wildlife populations and habitat. By the early 90s, federal agencies had grown accustomed to functioning within NEPA and NFLMA, but there were also multiple lawsuits associated with the Endangered Species Act which contended that the act violated rights of private landowners. Rather than weakening the act, the federal courts ruled that not only were private landowners prevented from 'taking' endangered species themselves, but they were also prohibited from harming or 'taking' habitat. This interpretation of the Endangered Species Act helped pave the way for a natural resource management approach focused not only on species' populations, but more broadly on their habitat as well. Accordingly, a more holistic management emphasis began to gain a foothold in federal land management agencies, and soon ecosystem management, with its focus on ecosystem health, combined with the integration of social and political concerns, emerged as a dominant federal policy (Cortner and Moote 1999).

Ecosystem Management and Property Ownership. One of the most important principles of ecosystem management is that natural resources should be managed according to ecological characteristics (e.g., watersheds) instead of political boundaries

(Grumbine 1994; Christensen et al. 1996). Because most communities and governments at all levels continue to characterize landscapes through political boundaries such as property ownership, implementation of ecosystem management has required the formation of partnerships to include representatives from federal agencies, state and local governments, as well as private landowners and citizens (Knight 1997).

Many have called for an increased emphasis on ecosystem management, while acknowledging the challenges associated with implementation (e.g., Sample 1994; Shogren 1999; Gripne and Thomas 2002; Hurley 2002). However, there has been little research evaluating outcomes associated with the attempted implementation of ecosystem management on multiple property ownerships. Instead, most work has focused on the language, meaning and discourse surrounding property ownership as it relates to ecosystem management (Hurley et al. 2004; Jackson-Smith et al. 2005). Wear et al. (1996) is one of the only studies that examined the implications of implementing ecosystem management principles in a mixed-ownership landscape. However, this research was based on spatial modeling and did not report the results of any actual management actions. More work is needed that attempts to identify successes and failures associated with ecosystem-management based actions taken in mixed-ownership landscapes.

There is a long history of tension between property ownership rights and natural resources management, and the cross-boundary nature of ecosystem management has often magnified the problem (Sample 1994; Wear et al. 1996; Yaffee et al. 1996). Potential solutions to the cross-boundary management challenge have included government regulation, voluntary actions, education, technical assistance, and incentives (Hurley et al. 2002). More broadly, there is an on-going academic debate about fundamental restructuring of current property laws and policy to a system that is more compatible with ecosystem management (Sax 1993).

Property is often thought of in terms of a dichotomous division of private and public property, but there is a growing awareness that property is more accurately characterized as fluid and continuous (Geisler and Salamon 1993; Fortmann 1996; Geisler 2000; Hurley et al. 2004; Jackson-Smith et al. 2005). For example, Geisler (2000) contends that much of what is considered private lands actually has many attributes of public lands, and vice versa. In addition, there is an increased prevalence of conservation easements, leases, and other variations of ownership arrangements that blur the line between public and private property. In many ways, current thinking around property parallels that of ecosystem management; both are uncertain, stochastic, and require adaptive approaches.

It may be true that property is often better defined as continuous, but I contend that there are instances when it is most instructive to discuss property ownership in the "traditional" terms of public or private, with the possible addition of nonprofit as a special case of private ownership, because there are clear differences in costs and benefits associated with management actions that can be directly linked to property ownership. Grassbanking is a relatively new conservation tool that provides a unique opportunity to explore some of the implications of attempting to implement ecosystem management using a strategy that varies by property arrangement.

Evaluating a New Conservation Tool for Ecosystem Management. Legally, defined, a grassbank refers to the exchange of forage for conservation benefit (Gripne 2005). The National Grassbank Network expanded on the legal trademarked definition to include a specific reference to cross-boundary ownership: "A partnership that leverages conservation practices across multiple land ownerships based on the exchange of forage for tangible conservation benefits" (National Grassbank Network 2005). Forage can be traded for a variety of treatments that lead to conservation benefits such as prescribed fire, mechanical thinning, and invasive weed control. Because of the perceived potential of grassbanks to help address numerous ecological problems in the western U.S., significant amounts of time and money have been invested by organizations and individuals to develop grassbanks. However, despite the large degree of optimism surrounding grassbanking, as well as significant investment thus far nonprofits, its effectiveness as a conservation tool has not been evaluated.

For the purpose analyzing the effectiveness of grassbanks as a conservation tool, property ownership is highly relevant because it dictates what organizations, laws, and incentives influence operations of the various grassbank models. For example, there are consistent outcomes and implications associated with any proposed management action on public land that require that the effects of those proposed actions be disclosed through the NEPA process; this is not the case for private or nonprofit property. Alternatively, while nonprofit land ownership is similar to private land ownership, nonprofits are tax exempt, saving these organizations thousands of dollars annually. Unlike nonprofits or governments, private landowners often do not have access to resources and organizational support (e.g., entities or groups providing resources) required to secure funding that would allow them to implement untested land management strategies. Hence, there are distinct differences in cost, conservation benefits, legal requirements, and levels of organizational support among the different property ownership arrangements of private, nonprofit, and public.

Grassbanks often involve at least two different properties: the property used to operate the grassbank and the property where management treatments occur. Accordingly, I have identified six different property ownership arrangements associated with grassbanks that include: (1) private grassbank/private management area; (2) private grassbank/public management area; (3) nonprofit grassbank/private management area; (4) nonprofit grassbank/public management area; (5) public grassbank/private management area; and (6) public grassbank/public management area (Figure 5-1). While the property ownership arrangements vary, the purpose of each of these grassbank initiatives is the same, the exchange of forage for conservation benefits. In this paper I take advantage of the singular purpose of grassbanks and make comparisons among them to determine the influence of the property ownership arrangement on the ability of grassbanks to achieve their goals.

The objective of this research was to evaluate grassbanking throughout the western U.S. and provide insight to some of the challenges associated with applying cross-boundary ecosystem management principles. In particular, do current laws and policies associated with property ownership provide incentives or disincentives to achieve the ecosystem management goals of grassbanks? Is there a particular grassbank property arrangement that is more successful at achieving cost-effective conservation benefits than others?

Following a description of methods, I discuss the six grassbank models distinguished by property arrangement. Next I present case studies for four of the models, because the other two do not currently exist. I describe how the property ownership arrangements associated with each model influenced the environmental and economic outcomes associated with three of the grassbank models for which financial data were available. I also explore the question of who should pay for the common pool resources that grassbanks are trying to sustain or improve, as well as issues of political feasibility (e.g., support or opposition from national interest groups and federal agencies) and organizational support (e.g., the number of formal nonprofit and/or state and federal organizations involved). I specifically address how both of these factors may have influenced the success of the different grassbanks. A concluding commentary follows the analysis.

5.4 Methods

I used both quantitative and qualitative methods, semi structured in depth interviews, phone surveys, and web surveys to develop a comparative case study evaluating grassbanks. The data were collected from June 2003 to May 2005. All grassbanks in this study shared the following characteristics, they: (1) exchanged alternative discounted forage from a grassbank for a conservation benefit; (2) were place-based [1]; (3) were composed of a variety of constituents; and (4) used a collaborative advisory group to make decisions. I studied four grassbanks over a two year period that represented four different property ownership arrangements, resulting in different costs and conservation benefits (Figure 5-1).

For this study I am concerned with the property ownership arrangements associated with each grassbank as a descriptor that results in relative patterns of environmental and economic outcomes. I use the terms public and private to refer specifically to the legal rights of owners as dictated by physical property ownership of the grassbank that provides the alternative forage, and the management area where the restoration treatments occur. I refer to the values typically associated with ecosystems (e.g., clean water, habitat) that the grassbank-supported treatments are intended to improve, as common pool resources (McKean 1996).

Data Collection. Since the number of people who are familiar with the conservation tool grassbanking is small (n < 500), the population is defined as a rare population. Most people are not aware of the concept of grassbanks, even in communities where a grassbank exist and so a random sample of a community where a grassbank exists would not yield useful information. Hence, directed snowball methods were used to define the grassbank population for the surveys. Participants were selected to reflect those who are in favor, not in favor, involved in administration, monitoring, participation, and funding grassbanks. In addition to the participants I have identified

[1] Communities of place are united through the specific geographic locale within which they are situated, and their common interest lies in the need for finding within a shared space the possibilities for shared inhabitation (Kemmis 1990; Duane 1997; Cestero 1999). Communities of interest refer to people who share commonalities in how they relate to a particular ecosystem or resource, though they are not geographically bounded (Duane 1997, Cestero 1999).

through professional contacts, other researchers, grassbanks, and the grassbank conference, each person who was surveyed or interviewed was asked for the names of other individuals who were aware of grassbanks.

The survey was designed to include primarily open-ended questions, and categories included after the open-ended questions were for conducting initial content analysis and to help the interviewer probe. The survey was reviewed by 10 researchers. A pilot sample of five individuals was conducted and the survey was further modified (Babbie 1998).

I conducted 51 semi-structured in person interviews with a response rate of 100%, 13 semi-structured phone interviews with a response rate of 100%, 120 phone surveys with a response rate of 98%, and 14 web surveys of grassbank participants and persons not directly involved with the grassbanks. All of the phone surveys were conducted by a single professional phone interviewer or me. I conducted all of the semi-structured in-person and phone interviews. Once I completed the interviews and surveys, I conducted a basic content analysis. Content analysis consisted of blind paired categorization of open-ended questions specific question. For the examples, for the question, "What is purpose of a grassbank?" I had developed categorizations of for each question that were also used for the web survey. An assistant and I classified the open-ended responses into the *a priori* categories for several questions independently. There was 97% to 99% agreement in our initial categorizations for the four questions included in this analysis. For those questions we did not have initial agreement, we agreed upon final categorization.

Estimating Grassbank Cost and Conservation Benefit. I evaluated each grassbank using measures associated with environmental and economic outcomes (Table 5-1). I limited the comparison of restoration treatments to those completed in 2003 to simplify the analyses. Cost information was provided by grassbank operators and included all expenses associated with operating the grassbank (e.g., labor, electricity, machinery, fertilizer, etc) in 2003 as well as annual land costs, which were amortized over ten years.

I needed to estimate conservation benefit associated with grassbank treatments, but did not have the financial resources to complete a contingent valuation study, the widely accepted methodology generally used to estimate conservation benefit (Arrow et al. 1993). Because I could not directly measure conservation benefit, I created a Conservation Benefit Index (CBI), to approximate conservation benefits associated with grassbank treatments. By calculating a CBI for each grassbank treatment, I was able to make relative comparisons of conservation benefit associated with various grassbank treatments.

Using basic principles of conservation biology, I chose the following four attributes to describe conservation benefit associated with each grassbank treatment: duration, size, irreplaceability, and vulnerability. Duration and size describe treatment scale, while irreplaceability and vulnerability describe biodiversity value associated with the treatment. I assigned a qualitative rank of low, medium, high, or very high, to each of the four attributes and used objective data whenever possible as the basis for my qualitative ratings. I then converted the qualitative ratings to a quantitative number for the purpose of creating three different conservation benefit indices for each grassbank treatment.

The first index I calculated was scale, and was the product of the rankings associated with duration and treatment size; the treatment with a longer benefit duration and affecting a larger percentage of the spatial extent of the conservation target received the highest index score. The second index was biodiversity, and was the product of rankings associated with irreplaceability and vulnerability; the treatment that affects the rarest and most threatened conservation targets received the highest index score. Finally, the combined index was the sum of the scale and biodiversity indices. I calculated all three indices to clarify how the scale attributes versus the biodiversity attributes contributed to the estimated conservation benefit ratings. It is important to note that the quantitative number associated with each CBI does not have value in and of itself, but was generated to permit relative comparisons among treatments. Detailed information about the CBI is provided in Chapter 4.

5.5 Grassbank Case Studies

Rocky Mountain Front Grassbank - Private Grassbank/Private Management Area[1]

No grassbank examples have emerged that would be classified as purely private grassbank/private management area efforts. However, that does not mean that there have

[1] Private grassbank refers to land ownership of the grassbank where forage is located; private management area refers to ownership of land where restoration work that is supported by the grassbank occurs.

not been several efforts to try and establish this type of grassbank. Throughout 2002-2005 I was contacted by several individuals throughout the U.S. who had learned about my research project through publications and my grassbank research website (www.compatibleventures.com). They contacted me to learn more about grassbanks, and in about half of these instances we discussed their interest in developing a local grassbank project. In 2003, I was contacted a rancher representing a group so neighboring of ranchers from Nevada for advice about starting a grassbank. This group wanted to purchase a local area ranch that was for sale for the purpose of starting a grassbank. The rancher expressed the desire of other ranchers to purchase the property for the purpose of developing a local grassbank that could potentially make neighboring ranches more economically sustainable. We discussed how the other grassbanks operated, and what their financial and personal requirements would be if they purchased the ranch for the purposes of developing a grassbank. Not only did this group lack the financial resources to purchase the ranch, they did not have any support of a person, group, or organization that was willing to commit time and resources to explore this possibility further. Ultimately, this effort by local area ranchers to purchase a ranch for the purpose of a private grassbank/private management area proved unsuccessful.

Of all of the grassbanks I studied, the Rocky Mountain Front (RMF) Grassbank is the closest to a private grassbank/private management area model. The RMF Grassbank is located in western Montana and the landscape of conservation interest for this grassbank is a two million-acre region of the east side of the northern Rockies characterized by mixed property ownership. The goal of the RMF Grassbank is to promote wide ranging carnivore (e.g., grizzly bear) habitat, invasive weeds management, and improved stewardship (Bay 2001).

The RMF Grassbank was created by the RMF Grassbank advisory group in 2001. The advisory group consists of 15 local community members and includes private landowners, agency personnel, private ranchers, nonprofit personnel, and professional community members (e.g., local banker). The RMF Grassbank advisory group formed in 1999 and visited the first known grassbank, the Malpai Borderlands/Gray Ranch in southern Arizona. The Malpai model, where a 300,000 acre ranch is used as a grassbank, was not monetarily feasible in their area, and so the advisory group decided to pursue a network of small private ranches whose owners are willing to donate their forage, forming a collective grassbank for use by local ranchers (Bay 2001).

The RMF grassbank, which is considered a small pilot project, currently consists a of a 380-acre parcel of private land that supports 120 animal unit months (AUMs) of forage. In this particular case, a private landowner donated forage or standing grass from their property, thus eliminated land investment costs. In 2003, the annual operating costs of the grassbank were $1,700, making it the least costly grassbank to operate (Figure 5-2). Treatments completed in 2003 that were supported by the grassbank included 380 acres of weed control on the grassbank and 640 acres of rested pasture (i.e., removal of cattle grazing) on the management area.

The RMF Grassbank received the lowest conservation benefit score (Figure 5-3). This result is not surprising because this grassbank is a pilot project with very few AUMs compared to the other grassbanks, and restoration treatments benefited relatively common species and communities. Of the grassbanks I studied, the RMF Grassbank had the least amount of formal or informal support from nonprofits and government agencies. Staff from the Montana Chapter of The Nature Conservancy (TNC) provided the catalyst for initially pulling together the RMF Grassbank advisory group and they currently provide support for meetings, contracts, grant writing, and monitoring, although they don't have full time staff dedicated to the project. Because the grassbank property and management area were nearly all private with a small amount (e.g., < 20 acres) of state leased land, this model does not attract opposition from national anti-grazing groups, livestock groups, or federal agencies that oppose grassbanks on public land. Hence, political feasibility was high for this grassbank. In addition cost was low and implementation time rapid because the management area was private.

Private Grassbank/Public Management Area

A private grassbank that supports conservation activities on public land does not currently exist. Presently there are few incentives to encourage the creation of this type of grassbank. Under this property ownership arrangement, a private landowner would be expected to essentially make a donation to public land management. One possible scenario where this might happen would be where a private landowner offered his/her standing grass in exchange for restoration treatments (e.g., prescribed burning) on either public land (Gripne 2005). Or a nonprofit could establish a regional grassbank endowment that private landowners and nonprofits could use to supplement their individual grassbank efforts. Hence, the development of tax incentives and or direct payments could potentially encourage this type of grassbank model (Gripne 2005).

Lassen Foothills Grassbank- Nonprofit Grassbank/Private Management Area[1]

The Lassen Foothills (LF) Grassbank is located in central California and the landscape of conservation interest for this grassbank is a one million-acre region of predominantly private land, stretching from Mount Lassen to the northern Sacramento Valley. The LF Grassbank is located on the Vina Plains Preserve and is owned and operated by the California Chapter of TNC.

This property was initially purchased in 1997 to achieve conservation goals independent of grassbanking. Like the RMF Grassbank, motivation to form the LF Grassbank followed a TNC staff visit to the Malpai Grassbank. After speaking with ranchers and observing landowner interest grow in prescribed burning to control invasive weeds, TNC transitioned the majority of the 4,600-acre Vina Plains Preserve, that supports 1000 AUMs, into a grassbank so that local ranchers could undertake conservation practices, including prescribed burns, on their ranches in exchange for a reduced forage rent at the preserve. Like the RMF Grassbank, an advisory group was formed, with representatives from a local landowner conservancy, the county cattlemen's organization, Natural Resources Conservation Service and the University of California

[1] Nonprofit grassbank refers to land ownership of the grassbank where forage is located; private management area refers to ownership of land where restoration work that is supported by the grassbank occurs.

Extension Service. The purpose of the advisory group was to work through issues, establish criteria and help select participants in the grassbank.

The advisory group's charter listed five goals for the LF Grassbank: (1) test a new model for managing conservation organization-owned grasslands in California; (2) enable ranchers to rest their pastures when they conduct prescribed burns for weed control or other conservation practices; (3) increase the productivity of the region's ranches, thus supporting their ability to continue ranching; (4) encourage local ranchers to consider other conservation tools; and (5) provide for local involvement in the management of Vina Plains Preserve (McNutt 2001).

The primary conservation practice the grassbank supported was prescribed burning to control invasive plants. The LF Grassbank began operating in 2001 and approximately 500 acres were burned in 2003 on the private property of one rancher. Land investment cost was much higher than the RMF Grassbank because it involved the continued ownership of 4600-acre ranch in California that could otherwise be sold to a conservation buyer[1]. Specific financial information, including land investment and annual operating costs, was not available for public use and so costs and conservation benefits were not displayed for the LF Grassbank.

Like the RMF Grassbank, the LF Grassbank and affected management area is private, and so bureaucratic issues and costs associated with working on public lands are reduced. Political feasibility of achieving conservation goals is high because the grassbank is nonprofit and the management area is private, which makes the protests

[1] A conservation buyer generally means an individual is willing to purchase a property with a conservation easement on the property.

from anti-grazing interest groups as well as national cattle industry groups unlikely. This grassbank has had formal organizational support from TNC, which increased the monetary costs associated with the grassbank because of personnel costs, overhead, etc., but also increased support and resources available for tasks such as fundraising and monitoring effects of prescribed burning.

As of 2004, the LF Grassbank is no longer in operation. The primary reason given for this is "that when operated at this scale, and in this particular community, the cost of operation (logistics) seems to overwhelm the conservation benefits" (pers. comm. Rich Reiner June 2, 2004). Because the size of many of the remaining area ranches are so large, many of these corporate and private ranch operations essentially already have a grassbank or some form of rest rotation built into their programs that would allow them to engage in prescribed burning, weed control, etc. that might require that the cattle be temporarily displaced. Furthermore, TNC is in a position where they have more willing easement participants than they can financially accommodate at this time. Hence, any need for generating good will that would lead to partnerships and potential conservation easements is not needed at this time. The bottom line for the LF Grassbank was that the conservation benefits achieved did not justify the expenditures to achieve them.

Heart Mountain Grassbank - Nonprofit Grassbank/Public Management Area

Heart Mountain Grassbank is located in northwest Wyoming and is owned and operated by the Wyoming Chapter of TNC. The landscape of conservation interest for this grassbank is the Eastern Absaroka Front, and encompasses over three million acres along the eastern flank of the Greater Yellowstone Ecosystem, dominated by public land ownership.

The grassbank was formed because TNC staff learned from both private ranchers and federal land managers (e.g., BLM, Forest Service) that lack of forage options was a serious obstacle to performing ecological range restoration work, such as prescribed burning, on public lands that required livestock to be temporarily removed from their ranges (e.g., federal allotments). Like the previous two grassbanks, an advisory group was formed, with members from the Forest Service, Bureau of Land Management, Wyoming Game and Fish, nonprofits (e.g., Greater Yellowstone Coalition; Rocky Mountain Elk Foundation), conservationists, and ranchers was formed for HM Grassbank. This advisory group drafted the following mission statement: "The mission of the Heart Mountain Grassbank is to maintain open space, wildlife species and their habitats, and natural communities and ecological processes within the Eastern Absarokas Landscape by providing a forage base that affords land management flexibility and local economic opportunity" (Heart Mountain Grassbank Business Plan 2002). HM Grassbank also has the additional TNC goal, which is to support ecological restoration treatments that sustains or improves the viability of conservation targets (e.g., sage grouse, mixed conifer forest) in the region.

Heart Mountain Grassbank consists of 600 acres of irrigated pasture that generates forage that supports up to approximately 3,000 AUMs annually. The 600 acres are one portion of Heart Mountain Ranch, a 15,000 acre ranch purchased by TNC in 1998 to prevent rural residential development in ecologically important areas. Land investment cost for HM Ranch was substantial (~3 million dollars), but like the Vina Plains Preserve, the ranch was originally purchased for conservation purposes independent of grassbanking. The land cost of the portion of the ranch that is has been attributed to the grassbank is approximately 1 million dollars. The grassbank has been operating since 2001 and annual operating costs are approximately $80,000 (Figure 5-2) during the two years of the study. In 2003, the grassbank supported four projects on public land that included 200 acres of mechanical treatment and prescribed burning in Douglas Fir forest, 5,100 acres of elk winter range rested from domestic cattle grazing, and habitat improvements on 180 acres of prairie dogs towns and 200 acres of sage grouse breeding grounds.

Heart Mountain Grassbank had the highest conservation benefit score in the analysis, primarily because their conservation targets were rare species (i.e., sage grouse, black-tailed prairie dog), which resulted in a higher conservation benefit score than if a common community or species (i.e., Douglas fir forest) were the target (Figure 5-3). Because the treatments occur on public land, implementation can, and has been delayed because of the time needed to fulfill NEPA requirements and address any litigation issues. In once instance, an environmental assessment for a proposed rangeland treatment was left half finished for several years. However, political feasibility is high because the grassbank property is on private land and so this model does not attract opposition from national anti-grazing groups, livestock groups, or federal agencies that oppose grassbanks on public land.

Heart Mountain Grassbank is the only grassbank I studied that uses irrigated pasture to generate forage, a significant consequence of this is higher implementation cost compared to the other grassbank because of significant funding needed to pay for irrigation water, electricity, maintenance of the watering system, as well as labor to operate the grassbank. Even though there are higher costs associated with this model, TNC, as well as state and federal agencies have supported this grassbank and hence, there have been resources available to fundraise for annual operating expenses as well as staff available for monitoring. For example, the federal agencies have supported all of the ecological monitoring associated with the prescribed burn and allotment rest.

Public Grassbank/Private Management Area

At this time, a pure public land grassbank/private management grassbank does not exist. This result is not unexpected given the current lack of incentives for cross-boundary management. However, there are some experimental options available, such as the Wyden Amendment Authority, which has allowed public land agencies to support restoration treatments on private land when there is a clear public benefit. This law authorizes the Forest Service to enter into cooperative agreements with willing Federal, tribal, State and local governments, private and nonprofit entities, and landowners for the protection, restoration, and enhancement of fish and wildlife habitat, and other resources on public or private land, the reduction of risk from natural disaster where public safety is threatened, or a combination thereof or both that benefit these resources within the watershed (USDA Forest Service 2004). The Wyden Amendment provides the Forest

Service a tool to operate more efficiently across multiple ownerships. While this law has provided a mechanism to use appropriated federal dollars for restoration on private land, this same funding is also available for projects on federal land, and many federal land restoration projects are currently unfunded. Hence, when a private land project must compete with a public land project, the public land project typically is awarded the money.

Valle Grande Grassbank - Public Land Grassbank/Public Management Area

The Valle Grande (VG) Grassbank is located in northern New Mexico and the landscape of conservation interest is a region encompassing approximately 3.1 million acres, nearly all of it Forest Service land. This grassbank is the closest example of a public grassbank/public management area model. The objectives of the VG Grassbank include promoting ecological health, the economic and cultural landscape of northern New Mexico, and demonstration of the value of partnerships (Harper 2002).

This grassbank is a partnership that includes the Northern New Mexico Stockman's Association, the Forest Service, the New Mexico State University Cooperative Extension Service, and The Conservation Fund. The partners share equal representation on the VG Grassbank Steering Committee. The steering committee reviews applications for grassbank participation from allotments throughout the Santa Fe and Carson National Forests. The supervisor of the Santa Fe National Forest then selects participants based on the Committee's recommendation.

The grassbank is a 36,000-acre Forest Service grazing allotment that supports up to 3,900 AUMs annually. The Conservation Fund, a nonprofit, has owned the 240 acre parcel that is associated with the federal allotment being used as a grassbank[1]. The Conservation Fund purchased the 36,000-acre ranch/grazing allotment for $480,000 and in 2003 the annual operating costs were approximately $100,000 (deBuys 1999). The VG Grassbank has been operating since 1998, and in 2003 supported 1,200 acres of prescribed fire and 300 acres of mechanical vegetation treatment in ponderosa pine forest.

Conservation benefits were greater than those associated with the RMF Grassbank, but less than HM Grassbank (Figure 5-3), primarily because the conservation target was ponderosa pine, which is a relatively common vegetation community. This grassbank enjoys the most organizational support with both a nonprofit and the federal government providing funding and staff time. One consequence of increased organizational support is a higher annual operating cost. Increased organizational support, coupled with land investment expenses, and higher implementation costs resulted in this grassbank model having the highest annual operation costs (Figure 5-2). Specifically, the land investment costs are relatively high because private land had to be purchased in order to use the federal grazing allotment. Implementation costs are also

[1] The Quivira Coalition recently purchased the Valle Grande Grassbank from the Conservation Fund and has renamed it "Rowe Mesa" to avoid confusion with the nearby Valle Caldera Project that is also sometimes referred to as the Valle Grande and has also experimented with some grazing conservation projects.

high because treatments are completed on public land and so there are additional costs associated with completing NEPA and addressing any litigation challenges. These same issues result in a longer time required for implementation compared to grassbanks with a private management area. This grassbank operated on public land, which is opposed both by national anti-grazing groups and livestock groups. In addition, some federal agency employees are opposed to the use of federal grazing allotments as a grassbank. Consequently, political feasibility associated with this grassbank was low.

5.6 Analysis and Discussion

Environmental Outcomes. The nonprofit or public grassbank ownership models provided an opportunity to achieve relatively higher conservation benefits because the organizational support associated with these models was much higher than the private model. Specifically, increased financial resources resulted in the creation of grassbanks that allowed them to offer significantly more AUMs, thus enabling the nonprofit or public grassbanks to support more projects and increase their conservation benefit index scores (Figure 5-3). Without the formal organizational support of a nonprofit or state or federal agency, the private grassbank/private management area model does not appear to be financially sustainable. This result suggests that there is some minimal threshold of organizational support (Agrawal 2000; Futemma et al. 2002) needed to sustain grassbank initiatives. On the other hand, even though nonprofits and governments can support experimental initiatives such as grassbanks, these efforts cannot be supported indefinitely without incentives or government sponsored mechanisms to cover the cost. Ultimately, if the cost is not justified by the amount of conservation benefits attained.

In addition to availability of financial resources, another potential benefit of increased organizational support associated with the nonprofit or public grassbanks is the ability to influence conservation outcomes. That is, nonprofit or public land agencies can dedicate staff and resources that may not be available to private landowner to ensure that grassbank-supported restoration treatments, in fact, result in conservation benefits.

Quality control has consistently been a concern for individuals involved in the grassbank movement and grassbank practitioners feel pressure to demonstrate that grassbank treatments do result in conservation benefits. Skeptics of grassbanks have argued that grassbanks may, in fact, reward bad management and contribute to continued degradation of habitat. One rancher and grassbank advisory group member commented:

> "We [conservation groups supporting grassbanks and grassbank participants] need to go beyond saying that rest is good and the grassbank afforded it, and say now wait a minute, why did this [the management area] need rest? Was it because of drought or because people weren't managing well? If you have 10 years of drought and you want to maintain an economic system on the landscape you try to have stop-gaps for helping people with a drought situation, but that's different than continual mismanagement and continual overgrazing".

Some survey respondents specifically identified the need for organizational support to ensure proper management. As one public land agency employee stated:

> "It's true that the grassbanking system can be abused where folks [grassbank participating ranchers] can use it as an excuse, say boy I'm going to manage my land poorly and just overgraze the heck out of it, and then it's okay because I have this backup [grassbank] here, that's the tragedy of the commons in a sense. But I think in reality, there has to be those checks and balances, someone has to

> be overseeing and coordinating this, when it's used and not abused it's a system where now people can in fact correct poor management practices and that's the encouragement and incentives that have to follow. In fact I see it, when [the grassbank is] managed properly as an incentive for someone to do [restoration treatments] what they say they wanted to do in many cases or know they need to do for a long time and change their management system".

While the current level of organizational support for nonprofit and public grassbanks is higher than private grassbanks, it appears that organizational support for all models is still less than the perceived need. Forty-three percent of respondents cited organizational support issues, such as the need for assistance with rancher compliance, monitoring, and valuing conservation benefits as the biggest challenge currently facing grassbanks.

These results suggest that while nonprofits or federal agencies have resources available to contribute toward grassbanks, they are not doing so at a level that necessarily ensures sufficient organizational support. For example, while the nonprofit grassbank/public management area model (i.e., HM Grassbank) had significant resources invested in the land used as the grassbank, the staff capacity to operate the grassbank was quite limited. There was a ranch manager, but coordination, outreach, and fundraising was dependent on limited paid staff involvement and some volunteer help. Conservation benefits might have been much higher for HM Grassbank if staffing had been sufficient to promote collaboration with landowners and other partners. In part due to the preliminary findings of this study, TNC has increased staffing at HM Grassbank with the goal of improving conservation benefits associated with grassbank-supported restoration treatments.

Economic Outcomes. When discussing costs associated with the grassbank models, it is helpful to frame the discussion of costs in terms of AUMs since that is the currency of the forage discount (Figure 5-4). For example, in 2003 the annual operating cost of HM Grassbank was $80,000 and the grassbank used 1,700 of the potential 3,000 AUMs to support projects. The cost of producing an AUM was $47, which was substantially higher than the fair market value of $25/AUM. However, the cost of producing the AUM is not equivalent to the forage discount. The total value of the forage discount is the fair market value of the AUM ($25) less the amount charged to the grassbank participant ($12/AUM). In this case the value of the forage discount is $13/AUM. The total forage discount is the product of the forage discount ($13/AUM) and the total number of AUMs (1700), which is $22,100[1]. Using this same formula, the cost of producing an AUM at RMF Grassbank and VG Grassbank is $14 and $128[2], respectively (Figure 5-4).

The implication of these cost scenarios related to property ownership arrangements is significant. Only a nonprofit or public grassbank model has the financial resources to experiment with a grassbank producing an AUM for $47 that is only worth $25, albeit nonprofits do have their limits too. The private grassbank model is similar to a private business in that if it does not generate more revenue than expenses then it will not survive. Accordingly, the financial resources and organizational support of a

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[1] $22,100 is the total alternative forage discount in this scenario and does not include any of the actual treatment costs, just the cost of providing the discount for the alternative forage

[2] The VG Grassbank used 1,873 of the permitted 3,900 AUMs in 2003.

nonprofit or public agency allows for experimentation that the private model generally would not tolerate.

The pattern of cost is the same when property ownership of the management area is considered. The private management area model has the least cost (i.e., RMF Grassbank at $1,700) and also the least organizational support (e.g., private individuals with informal support from TNC), whereas the two grassbanks that had public management areas (i.e., HM Grassbank and VG Grassbank) had the most costs (i.e., overhead administration and NEPA in the case of the public model), but also the most organizational support. Consequently, the implications of conducting restoration treatments on private and public management areas result in the following dilemma: transaction costs (e.g., minimal staff, overhead, and NEPA) of working on private land are relatively low, but resources are limited to support restoration treatments that lead to increased levels of conservation benefits, whereas transaction costs are high when working on public management areas, but organizational support is high as well, which should lead to higher conservation benefits.

The economic value of conservation benefits supported by the grassbank is another important economic consideration. The definition of grassbanks refers to the exchange of forage for conservation benefit, however, in the case of nonprofits, this is actually a legal requirement: IRS private benefit regulations (see Chapter 3 for a more detailed discussion of the trademark and IRS private benefit) require all grassbanks to demonstrate a *quid pro quo* transaction where the economic value of the conservation benefit equals or exceeds the value of the forage discount (Gripne 2005). For example, in the scenario described above for HM Grassbank, the forage discount is $22,100 and the associated conservation benefits are: (1) 219 acres of restored Douglas fir habitat; (2) 5156 acres of rest for improved elk habitat; (3) 180 acres of rest for improved prairie dog habitat; and (4) 193 acres of mechanically improved sage grouse habitat. Are these conservation benefits worth $22,100? In economic terms, this is a question of willingness to accept.

Paying for Common Pool Resources. The issue of acceptability of cost associated with operating a grassbank in order to generate a given amount of conservation benefit is directly linked to a fundamental challenge of ecosystem management: who should pay for the common pool resources associated with ecosystems, such as wildlife habitat and healthy watersheds?

Early on, the grassbank movement was based on the premise that the market could cover the cost of the discounted forage. A fundamental assumption associated with the tool is that ranches are ecologically more desirable than subdivision (Maestas et al. 2003), and that ranchers are good land stewards who are more than willing to produce conservation benefits when given financial incentives (Gripne and Thomas 2002) such as discounted alternative forage. Specifically, if individual donors, foundations, and communities approved of a project that achieved ecosystem management goals (e.g., invasive weed treatment), they would be willing to cover grassbank operating costs, attempting to at least partially internalize some of the public goods that ranchers provide. However, my analysis of existing grassbanks does not support this premise. All grassbanks have been, or are becoming increasingly dependent upon financial resources from foundations, nonprofits, or other public funding sources that are short-term in nature.

The majority of people I interviewed believe that funding for grassbanks should come from a combination of sources; most believe that government entities should pay for the discounted forage offered by grassbanks (45%), and about an equal amount believe that private donations (27%) and ranchers that use the grassbank (28%) should pay. However, individuals opposed to public lands grazing also responded to the survey, and they, along with many other respondents who are not opposed to public lands grazing, stated that they do not support the federal government funding grassbanks. Most of these individuals believe that the benefactors of grassbanks should pay for them.

Who should pay for grassbanking appears to depend, in part on organizational affiliation. In most instances, ranchers feel that nonprofits or the government should pay for grassbanks, whereas nonprofit employees feel that the government and ranchers should pay. For example, when asked how grassbanks should be funded, a federal agency employee stated, "Let the conservation groups put their money where their mouth is," while a nonprofit employee response indicated "The private philanthropy approach is okay for an experimental period of time, but that isn't sustainable — we need to be more creative than that...public sources offer some interesting opportunities". Finally, many respondents stated the desire for grassbanks to be self-sustaining. While all respondents acknowledge the importance of conservation benefits, there is little consensus about who should actually pay for them.

Political Feasibility. Political feasibility associated with grassbank ownership is a substantial issue that can impact grassbank sustainability. I found that political feasibility is more directly related to the grassbank property itself, and less so to the management area property. There are no national groups or federal land agencies that oppose using private or nonprofit land as a grassbank which in turn supports management activities on public land. Hence, private and nonprofit grassbanks both have high political feasibility, and this is true for two reasons: (1) many environmental groups generally limit their criticisms of grazing to public lands; and, (2) neither model threatens to reduce net AUMs on public land, which is a concern for the national livestock industry. One survey respondent described the agricultural industry's feelings about grassbanking in the following manner: "Industry seems to dislike it for some reason…I can't really put my finger on the bugaboo that they are concerned about. Other than they seem to link it to the environmental movement and they are concerned that somehow overall there will be some sort of reduction in the AUMs the federal government will authorize". Staying out of contentious public land management debates affords much higher political feasibility for private and nonprofit grassbanks, especially if the nonprofit does not use public funding to run the grassbanks.

5.7 Implications

There was no clear grassbank model that has outperformed the other grassbanks when both cost and conservation benefit are considered, suggesting that at present, no particular property ownership arrangement is more promising than another for achieving cross-boundary ecosystem management goals. Nevertheless, there were relative differences in the grassbank models when the metrics of cost and conservation benefit are evaluated separately.

The nonprofit and public grassbanks working on public land achieved relatively higher conservation benefits than the private grassbank/private management area model. However, it should be noted that the LF Grassbank, a nonprofit grassbank operating on private land, was not included in the cost-benefit analysis. Further, the other nonprofit grassbank described here (i.e., Heart Mountain) could have conducted restoration treatments on private land. Therefore, the result that nonprofit and public grassbanks had greater conservation benefits is not directly attributable to the fact that their restoration treatments occurred on public land. Instead, the greater conservation benefit associated with these models is due to much higher levels of organizational support (e.g., staffing and financing) enjoyed by each model, the result of which was the ability to support larger restoration treatments. The private grassbank operating on a private management area model continues to function at the pilot project level, largely because of lack of organizational and financial support. Finally, purely private grassbank/private management area efforts have not moved past the conceptual stage because some minimal level of organizational support (e.g., staff to coordinate meetings, the selection process, monitoring, and fundraising), is required.

One significant consequence of increased organizational support is much higher expenses for the nonprofit and public grassbank ownership models compared to the private grassbank model. The nonprofit grassbank/public management area and public grassbank/public management area models are likely not sustainable over the long-term because of high annual operating and land costs relative to the conservation benefits achieved. Based on the data reported here, I propose that the model that holds the most promise to be financially sustainable is one that doesn't currently exist: a true public grassbank that uses vacant allotments (e.g., swing allotments, forage reserves, common reserve allotments) of different federal land management agencies to support restoration on other public lands. However, drawbacks do exist for this model. Historically, there have been few vacant allotments available. For those that were available there has been limited roles for other partner organizations to participate, which many agency, conservation groups, and ranchers feel is essential to increase the quality of the projects beyond traditional swing allotments. There is also resistance from the cattle/agriculture industry and anti-grazing groups to this type of grassbank model.

As long as current property laws and policies remain, grassbanks, along with other approaches designed to achieve ecosystem management goals, will require additional incentives for private and nonprofit landowners. Alternatively, all levels of government need to create mechanisms to pay for the management of common pool resources that characterize ecosystems. Unless incentives and other payment mechanisms are increased, inventive approaches to ecosystem management, such as grassbanks, will be admired for their creativity, but will ultimately fail to generate significant conservation benefits and/or be sustainable over the long term.

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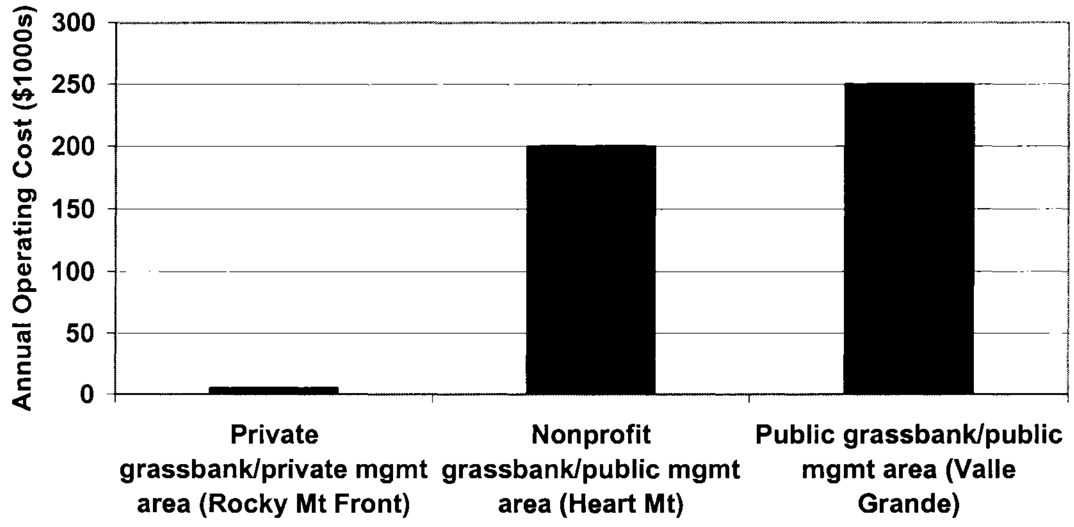
Table 5-1. Evaluation criteria used to compare grassbank models associated with varying property ownership arrangements.

Dimension	Description	Measure
Economic Outcome	Amount of money required to purchase land for a grassbank, and the amount of money required annually to operate the grassbank	Land Investment (US Dollars); Annual Operating Cost (US Dollars)
Environmental Outcome[1]	A qualitative assessment of the conservation benefit achieved by treatments (e.g., prescribed fire) that were supported by the grassbank. Each treatment received a rank score. Rank scores permit assessment of the conservation value of a treatment as well as comparisons of treatment values among and between grassbanks.	Rank score (minimum < 1 to maximum of 40 [unitless])

[1] This assessment was not a direct measurement of benefit associated with a treatment (i.e., tree mortality associated with a prescribed fire). Most grassbank operators have monitoring plans that measure treatment impact.

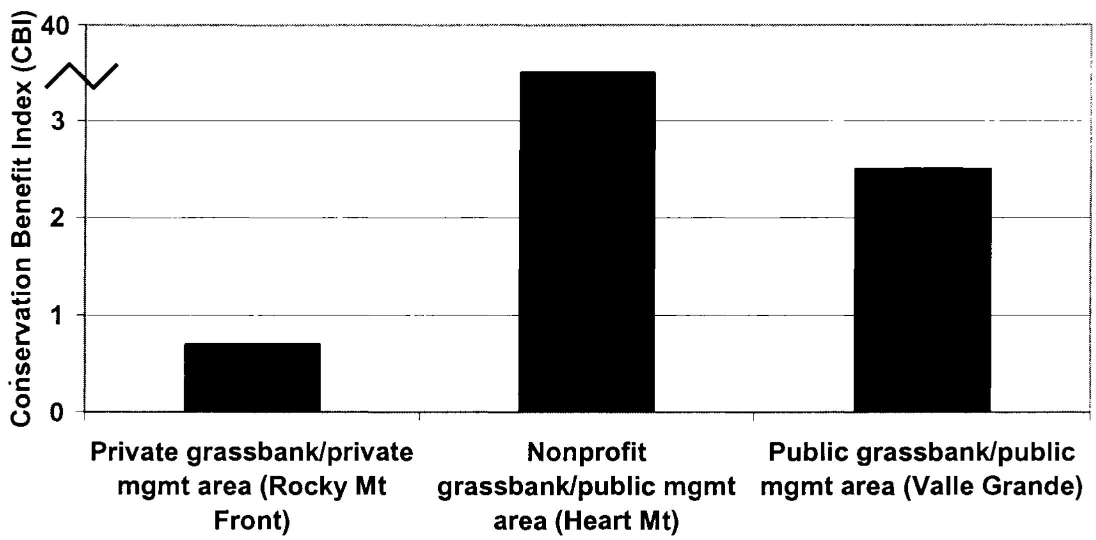
Figure 5-1. Potential grassbank models described by property ownership arrangement, which is defined by the property ownership of the grassbank and property ownership of the management area. Grassbank models included in this analysis are marked with an "x".

Figure 5-2. Annual operating costs[1] associated with the private grassbank/private management area, nonprofit grassbank/public management area, and public grassbank/public management area grassbanks.



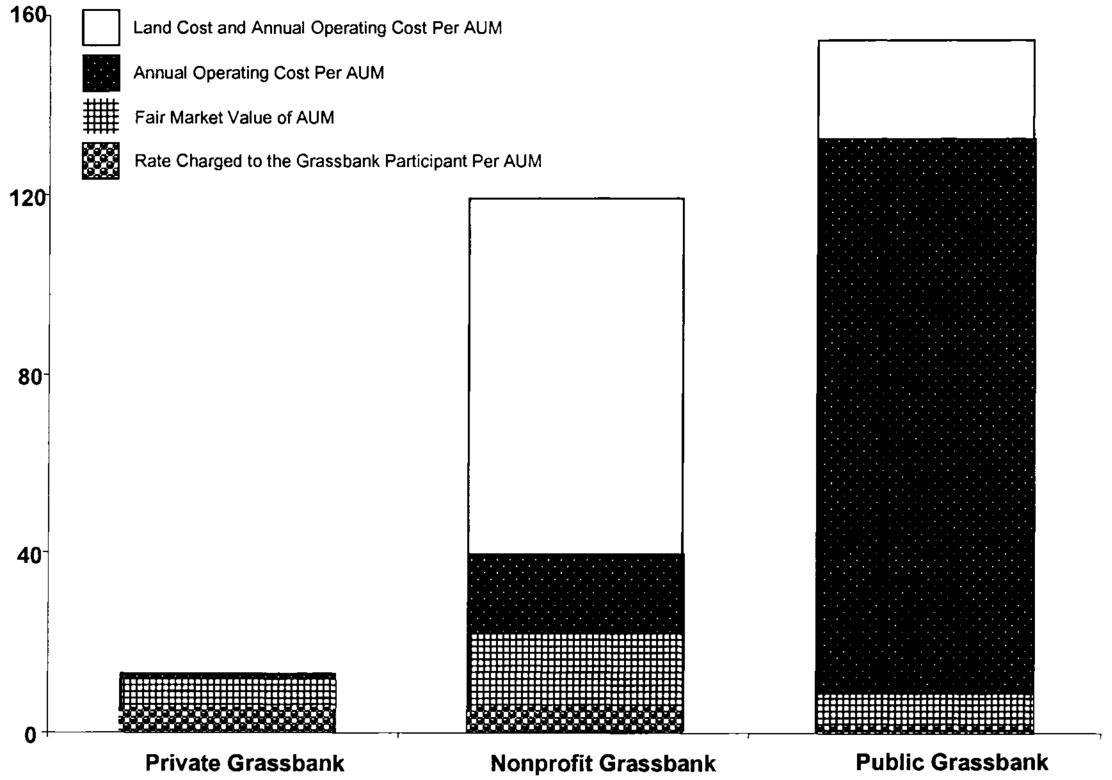
[1] Cost information included both 2003 annual operating costs (e.g., labor, electricity, machinery, fertilizer, etc) as well as annual land costs, which were amortized over ten years.

Figure 5-3. Estimated Conservation Benefit Index (CBI)[1] scores for the private grassbank/private management area, nonprofit grassbank/public management area, and public grassbank/public management area grassbanks.



[1] The Conservation Benefit Index (CBI) scores shown here are the average CBI calculated from the sum of individual treatments supported by each grassbank in 2003 (Heart Mt = 4 treatments; Rocky Mt. Front = 2 treatments; Valle Grande = 1 treatment). The CBI provided a qualitative ranking of conservation benefits associated with treatments supported by each grassbank. To calculate CBI, grassbank-supported treatments were assigned ranks for four attributes; two (i.e., duration and size) address attributes associated with scale, and two (i.e., irreplaceability and vulnerability) address attributes associated with biodiversity (e.g., target rarity, risk of conservation target decline). I assigned a qualitative rank of low, medium, high, or very high, to each of the four attributes and then converted the qualitative ratings to a quantitative number for the purpose of creating three different indices for each grassbank treatment. The CBI is the sum of (duration rating * size rating) and (irreplaceability rating + vulnerability rating).

Figure 5-4. Land cost, annual operating cost, fair market value, and AUM rate charged for private, nonprofit, and public grassbanks.



6 APPENDICES

Appendix 1. Grassbank Interview Guide

Interviewer ______________________ Date ____________
Interviewee ________________________

Introduction: Hello, my name is ______, I am calling on behalf of Stephanie Gripne, a graduate student at The University of Montana in Missoula. She is conducting a research project about Grassbanking for her PhD. She obtained your phone number through the Grassbank Conference mailing list. We would really appreciate your input and comments. Regarding this survey, you can refuse to answer any question or can terminate the interview at any time. Your name will not be associated with any of your comments. Your participation is entirely voluntary and will take approximately 20 minutes. There are no right or wrong answers, we are just looking for your input regarding grassbanking. Do you want to participate? Is this a good time to answer some questions? If not, can we set up a better time to do the survey?

1. Do you know what a grassbank is? Yes ___ No ___ If Yes, ask 1b, If no, terminate interview

____

1b. How did you first learn about the concept of grassbanks?

____
____
____

2. How would you define a grassbank in you own words?

____
____
____

3. What do you consider to be the primary purpose of grassbanking?

____
____
____

4. Do you think grassbanking results in conservation benefits? Yes ___ No ___

Yes- Can you describe the primary conservation benefits you have in mind?

No- Would you please explain why you don't think grassbanking results in conservation benefits?

5a. Are you familiar with any particular grassbanks? If no, ask 12.
Heart Mountain ___ Malpai __ Matador __ Rocky Mt Front __ Valle Grande __
Vina Plains __

If more than one- 5b. Which grassbank are you most familiar with?

5c. How did you learn about XXX Grassbank?

5d. What do you know about XXX Grassbank?

If grassbank listed in 5b is not (Heart Mountain, Malpai, Matador, Rocky Mt Front, Vina Plains), then ask:

5e. What can you tell me about who is involved (what organizations, agencies, etc), where is it, and what is its primary purpose? Do you have contact information?

6. Are you actively engaged now, or have you been actively engaged in the past with the grassbank you are most familiar with? Yes ____ No ____ If no, ask 12.

7. Has the grassbank changed how people such as ranchers, government employees, nonprofits, and private citizens interact with each other? Yes ____ No ____

Yes- 7b. Can you tell me how the interactions have changed?
____
____

No- 7c. Can you explain why you think the grassbank has not resulted in how people interact?
____
____

If respondent answered Heart Mountain, Rocky Mountain Front, Valle Grande, or Vina Plains in question 5b, ask 8 otherwise ask 9

8. For the following question, please rate your response as: very favorable, slightly favorable, slightly unfavorable, very unfavorable, undecided, or doesn't care.

Heart Mountain Grassbank's annual operating costs were XXX last year, and XXX acres were treated. Is this an acceptable exchange for you?
Very favorable ____ Slightly favorable ____ Slightly unfavorable ____ Very unfavorable ___
Undecided ____ Doesn't Care ____

Rocky Mountain Fronts Grassbank's annual operating costs were XXX last year, and XXX acres were treated. Is this an acceptable exchange for you?
Very favorable ____ Slightly favorable ____ Slightly unfavorable ____ Very unfavorable ___
Undecided ____ Doesn't Care ____

Valle Grande Grassbank's annual operating costs were XXX last year, and XXX acres were treated. Is this an acceptable exchange for you?
Very favorable ____ Slightly favorable ____ Slightly unfavorable ____ Very unfavorable ___
Undecided ____ Doesn't Care ____

Lassen Foothills Grassbank's annual operating costs were XXX last year, and XXX acres were treated. Is this an acceptable exchange for you?
Very favorable ____ Slightly favorable ____ Slightly unfavorable ____ Very unfavorable ___
Undecided ____ Doesn't Care ____

If answer very or slightly unfavorable, ask 8b, all other answers ask 9.
8b. What do you think would need to change to this more acceptable to you?

____
____
____
____

9. How are participants selected for XXX Grassbank?

____
____

9a. Do you think this selection process is fair?

____
____

9b. Why or why not?

____
____

10. What do you see as the biggest challenges associated with grassbanking?

____
____

11. Can you describe how XXX Grassbank has received most of its funding?

____
____

12. In your opinion, how do you think grassbanks should be funded?

____
____
____
____

13. Are you aware of anyone else who is familiar with grassbanking that we should talk to and would be willing to do this study? Yes ____ No ____

Yes-13a. We would be interested in getting their input. Would you be willing to give us their contact information?

____
____

No-ask 14

14. Have you heard of Grassbank Inc?

____

Yes- 14a. What do you know about Grassbank, Inc?

____

____

____

No- ask 15

The following questions are for classification purposes only.
16. How many years have you lived at your current residence? _____________

17. What is your Zip Code? ___________________

18. How old were you on your last birthday?
Under 21 ___ 21-30 ___ 31-40 ___ 41-50 ___ 51-60 ___ over 60 ___

19. Which of the following best describes your relationship to grassbanking in general or a specific grassbank?
Federal employee__ State employee__ Local employee__ Nonprofit employee___
Private citizen ___ Rancher ___ Donor ___ Fundraiser ___

20. Did you attend the grassbank meeting held in Santa Fe in 2000? Yes ___ No ___

21. Would you be interested in receiving information regarding future potential meetings associated with grassbanking via email? Yes ___ No ___

22. Were you previously interviewed by Christy Edwards for her graduate research?
Yes ___ No ___

23. Were you previously interviewed by Claire Harper for her graduate research?
Yes ___ No ___

24. Do you have any final comments you would like to make regarding grassbanking?

____

____

____

A final copy of the reports that result from this work will be available on the internet. Would you like the internet address? (a hard copy can be mailed to those people who do not have access to the internet) (WEB ADDRESS: www.compatibleventures.com).

Thanks very much for your cooperation. If you have any additional comments or questions you can contact Steph Gripne at steph@compatibleventures.com

Respondent's gender Female ___ Male ___
Estimated interview time __________

Appendix 2. Permission for Stephanie Gripne to used the trademarked term, grassbank.

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MALPAI BORDERLANDS GROUP
6226 GERONIMO TRAIL ROAD
P.O. DRAWER 3536
DOUGLAS, AZ 85608
PHONE (520) 558-2470 FAX (520) 558-2314

To Whom it May Concern:

Stephanie Gripne is given permission by the Malpai Borderlands Group to use our trademarked term Grassbank. Please contact the phone number or address above if you have any questions regarding this matter. Thank you.

Sincerely,

Bill McDonald

Bill McDonald
Executive Director