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PUBLIC-PRIVATE WATER CONSERVATION: AN ASSESSMENT OF ATTITUDES IN THE DEER LODGE VALLEY, MONTANA

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PUBLIC-PRIVATE WATER CONSERVATION: AN ASSESSMENT OF ATTITUDES IN THE DEER LODGE VALLEY, MONTANA

BY
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INTRODUCTION

Historic mining pollution in the headwaters of the Clark Fork River resulted in toxic pollution of the mainstem of the Clark Fork River and some of its tributaries, creating the largest Superfund complex in the country (Berg, 2013). One of the sites in the complex, the Upper Clark Fork River Operable Unit, is located over a span of 43 miles (Montana Department of Environmental Quality, 2014) with a significant portion of that stretch traveling through the Deer Lodge Valley. Superfund remediation and restoration of this stretch began in 2014; full restoration is expected to take a little over a year before completion of remediation (Montana Department of Environmental Quality, 2014). The Montana Department of Environmental Quality (DEQ) is currently working with private landowners on remediation design plans of additional Superfund sites in the Upper Clark Fork Operable Unit. It is anticipated that remediation of the Upper Clark Fork will not be complete for 10-12 years (Montana Department of Environmental Quality, 2014). As remediation of the Clark Fork River continues, it is critical that the water resources throughout the Clark Fork basin are managed effectively, so that restoring this stretch of the watershed to full health is possible.

The Environmental Protection Agency is working to remediate and restore the portions of the Clark Fork River that have been listed as a federal Superfund site (Environmental Protection Agency, 2011). The ecological damage caused by this contamination has degraded the Clark Fork River’s streambeds, streambanks, and floodplains threatening the ecological health and integrity of the entire watershed. As Superfund cleanup progresses, the watershed will begin its recovery toward full health, restoring the economic and cultural assets afforded by healthy watersheds to riverside communities. Postel & Thompson (2005) identified valuable services that healthy watersheds provide to society. These services included: “Water supplies for agricultural,
industrial, and urban-domestic users, flow regulation, the support of recreation and tourism, habitat that safeguards fisheries, and aesthetic enjoyment” (2005, p.98). Remediation of the Upper Clark Fork River will greatly improve the quality of water resources in the Clark Fork basin, however without effective management of water resources water quantity will become another barrier in benefiting from the services that watershed resources can provide to communities.

Effective management of water resources faces many challenges. Montana Fish, Wildlife, and Parks recognize “varied land ownership” as one of the challenges they face in managing natural resources (Montana Fish Wildlife & Parks, 2014). In the Deer Lodge Valley (consisting of Powell and Deer Lodge Counties), 79.5 percent of land is privately owned (Montana.gov, 2014). This means watershed-wide restoration must involve effective partnerships with property owners. Since a large percentage of land is privately owned, natural resource managers have to rely on partnerships to achieve their conservation goals. By understanding what factors motivate and constrain landowners to participate in conservation projects on their property, land ownership may become less of a barrier to the management of water resources in this region.

Also complicating natural resource management, specifically the management of water resources, are the unique issues surrounding water rights. Shively & Mueller recognize that issues of water quantity are some of the biggest challenges facing water resources in Montana (2010). This challenge largely stems from Montana’s prior appropriation doctrine, which is summarized as “first in time first in right” (M.C.A. §85-2-401). According to Morris (1992) “Under this doctrine, surface water within our streams and river systems is held in trust by the State and users are permitted to divert water from a natural stream only if and when it is put to ‘beneficial use’”. Beneficial uses include, but are not limited to: “agricultural (including stock
water), domestic, fish and wildlife, industrial, irrigation, mining, municipal, power and recreation uses” (M.C.A. §85-2-102). Additionally, another rule within the doctrine requires water users to use, “all or part of their appropriation right” or it will be presumed the, “appropriator has abandoned the right for the part not used” (M.C.A. §85-2-404), also referred to as the, “use it or lose it” rule. “The doctrine was intended to encourage reasonable water use and minimize speculation; however, it often encourages waste simply because landowners want to ensure that they don’t lose their water right through abandonment” (Clark Fork Coalition, 2014). The overuse of water resources coupled with the difficulty of legal enforcement creates many challenges for implementing the doctrine as it was originally intended and for conserving Montana’s water resources (Clark Fork River Basin Task Force, 2008).

Fortunately, “Montana has consistently been on the forefront of water conservation and protection in the West” (Berg, 2013). Nonprofit organizations such as Trout Unlimited and the Clark Fork Coalition work to create solutions to water quantity issues that support the landowners who depend on water resources such as agriculturalists, and return water to Montana’s rivers and streams, also referred to as ‘rewatering’ (Berg, 2013).

Restoring watershed health is a collaborative endeavor and requires action by both public and private land managers (Rosenberg, 2005). Sanders (2005) describes the success of private land conservation as being largely influenced by the rate at which the program is adopted by landowners. Some agency led conservation programs on rural property have been successful because of the agency’s ability to provide landowners with incentives to support environmentally compatible land management as an alternative to regulatory measures (Plummer & Armitage, 2007). However, landowners must be willing to participate before conservation initiatives are
effective. Sanders (2005) identified landowners’ attitudes as a primary factor driving adoption or rejection of conservation programs.

With this study, I aimed to identify constraints to water conservation on private land by fully understanding rural landowners’ environmental attitudes towards protecting water resources on their property and towards partnering with agencies, NGOs and other ‘outside’ conservation entities. By identifying these constraints, I seek to help water conservation agencies design better landowner partnership programs and independent water conservation efforts to improve relationships and collaborative efforts among agencies, NGOs and landowners.

STUDY OBJECTIVES:

Watershed health is critically important to communities in the Clark Fork basin. If Superfund remediation is successful, communities can expect substantial economic growth, cultural, and ecological benefits for many years to come. As drought conditions persist or worsen, water quantity issues will become more challenging to overcome (Berg, 2013). Identifying and understanding the constraints of water resource conservation on private lands can help improve the effectiveness of conservation programs in a watershed dominated by private ownership. Lastly, by assessing the attitudes of water conservation agencies towards water conservation projects initiated on private land increases the potential to identify the similarities and differences that agencies and landowners have towards these projects. This could ultimately help increase public-private partnerships relating to water conservation throughout the Clark Fork Basin.
RESEARCH QUESTIONS:

R1: What are landowners’ attitudes towards conserving water resources on their property?

R2: What behaviors do private landowners currently use to conserve water resources?

R3: What are NGOs’ attitudes towards conserving water resources on private land?

R4: What behaviors do NGOs’ advocate for on private land?

R5: What are the constraints to water conservation on private land?

R6: What suggestions do respondents have for negotiating the constraints that limit conservation on private property?

LITERATURE REVIEW

Rural Landowners and Conservation on Private Property:

The Western United States has been defined by its large, rural landscapes since European settlement. The ecological and biological diversity of these landscapes is in large part what motivates conservationists to strive for protecting these areas (Institute for Ecological Health, 2000). It is important to understand how to promote conservation behaviors to rural residents in order to protect rural landscapes. In order to promote conservation partnerships with rural residents, it is necessary to understand the characteristics that define this population.

Shandas (2007) identified some ways in which attitudes influenced participation in conservation initiatives, writing, “if residents value environmental protection, ecological and environmental stewardship, or preserving a way of life, they will probably derive intrinsic satisfaction from conservation efforts” (p.175). Shandas (2007) concluded that landowners who value property rights over the environment are more likely to exhibit hostility toward outside
intentions in land management issues. Attitudes clearly influence participation in conservation projects (Shandas, 2007; Vaske & Donnelly, 1999); in order to help inform conservation agencies and NGOs implementation of conservation projects on private property, it is important to understand rural landowner’s attitudes towards conservation. This is especially important when considering rural landowners, as they are “a diverse group of people not bound by a single land philosophy” (James, 2001).

Some scholars argue that rural landowners consider themselves environmental stewards (James, 2001). Hill defined environmental stewardship as, “any action an individual takes in order to conserve natural resources or mitigate their impact on the environment. It includes but is not limited to conservation practices” (2013 p.18). James described rural stewards as people who, “consider themselves caretakers of the land and adopt conservation strategies so that future generations may benefit” (2001, p.269). They also identified with their rural heritage and ties to the land, and were likely a good group to participate in conservation programs (James, 2001, p.269).

In addition to attitudes shaping a person’s willingness to participate in a stewardship projects there are other factors that need to be determined before a project occurs, for example where the project is implemented. Engaging people in conservation projects on their property can be challenging. Shandas (2007) identifies four primary challenges to engaging property owners in conservation projects on private property: 1) aesthetics, 2) trust, 3) obstacles that property owners face when considering changes to their land (i.e. costs, maintenance time, labor, etc.), and, 4) personal attitudes towards conservation. Understanding how environmental attitudes contribute to participation in conservation projects is essential for protecting water resources on
private property, as this cognition is extremely valuable in shaping behavior, as described in the next section.

**Environmental Attitudes**

There are several social-psychological theoretical frameworks that explain how attitudes influence pro-environmental behavior. Pro-environmental behavior is defined as, “behavior that consciously seeks to minimize the negative impacts of one’s actions on the natural world” (Kollmuss & Agyeman, 2002). Vaske and Donnelly’s cognitive hierarchy model, “suggests that an individual’s view of the environment in which he or she lives can be organized into a cognitive hierarchy of value orientations (i.e. patterns of basic beliefs), attitude/norms, behavioral intentions, and behaviors,” (figure 1) (1999, p.525). This theory provides evidence that supports the relationships between values, attitudes, and behavior (Vaske & Donnelly, 1999). According to Bruskotter and Fulton (2007), this theory proposes that an individual’s thoughts (i.e. values, attitudes, beliefs) regarding a topic will tend to be evaluatively consistent with one another.
Vaske and Donnelly and Milfont et al. have assessed this theory in relation to environmental issues have examined the influence of values on environmental attitudes and ecological behaviors, or the mediating role of environmental attitudes (Vaske & Donnelly, 1999 and Milfont et al., 2010). This mediating role has been demonstrated by Homer and Kahe (1988) through research identifying support for a value>attitude> behavior hierarchy, establishing that attitudes mediate the relationship between values and behavior.

Because this study is interested in water conservation with a specific focus on environmental attitudes, the cognitive hierarchy model will be used to examine the mediating role of attitudes in this process. It is imperative that the differences among values, attitudes, and beliefs are identified to clarify how each influences the others, and to avoid confusion about what environmental attitudes are and how they will be assessed throughout this research.

Fulton et al. (1996) recognized values as the most fundamental concept within the cognitive hierarchy; without an understanding of their role in this theory it would be difficult to...
recognize how values influence attitudes. For the purposes of this study, values will be defined as “enduring beliefs about abstract concepts that guide evaluations and behaviors across a variety of contexts” (Schwartz & Bilsky, 1987). Values reflect the most basic characteristics of adaptation and serve as “prototypes from which attitudes and behaviors are manufactured” (Homer & Kahle, 1988, p.638). It is also important to recognize that “values also guide individuals about which situations to enter and about what they do in those situations” (Homer & Khale, 1988, p.638).

As values impact attitudes and behaviors they also influence specific cognitions (Fulton et al., 1996), defined as the mental processes people use in thinking about and understanding situations (Vaske et al., 2011). These cognitions are what create value orientations which are responsible for influencing a person’s attitude (Vaske & Donnelly, 1999). Vaske and Donnelly (1999) have found that differences in values have been relatable to differences in a variety of attitudinal and behavioral outcomes. According to Bruskotter “research also indicates that value orientations are useful for predicting attitudes and norms regarding natural resources management” (2007, p.10).

Literature includes several alternative definitions of attitudes (Vaske & Donnelly, 1999. However, a commonality across all of these definitions is that an “attitude is a mental state and must refer to some object” (Vaske & Donnelly, 1999, p.526). For the purposes of this thesis, environmental attitudes will be defined as an evaluation of something that produces positive or negative feeling towards the natural environment (Heberlein, 2012). Environmental attitudes also encompass responses to the environment as a whole, or other individual topics that have a direct link to the environment (Heberlein, 2012).
Social-psychology literature assessing the theoretical frameworks of how attitudes influence pro-environmental behavior is varied and often contradictory, specifically when considering whether or not attitudes directly or indirectly influence behavior (Vaske & Donnelly, 1999; Kollmuss & Agyeman, 2002). Despite differences in theories, researchers agree that attitudes do play a role in the decision-making process. For example, Fulton et al. (1996) demonstrated how attitudes can be influenced, the relationships between how values influence attitudes, and how attitudes influence behaviors: “two wildlife value orientations (i.e., protection/use and benefits/existence) predicted respondents’ attitude toward hunting and fishing” (Vaske & Donnelly, 1999, p.527). This example illustrates how attitudes act as a mediator between value orientations and behavioral intentions to engage in these activities (Vaske & Donnelly, 1999).

Beliefs are closely related to attitudes and values. In Rokeach’s original 1968 cognitive hierarchy theory, beliefs are defined as “judgments about what is true or false” (Allen et al., 2009, p.23). Throughout this hierarchy model, beliefs are referred to as basic beliefs, the way in which individuals process thoughts about objects or issues and give meaning to the cognitions that are represented in values (Vaske et al., 2011). As mentioned previously, it is these basic beliefs that form value orientations, which help influence attitudes by “giving meaning to fundamental values” (Vaske & Donnelly, 1999, p.525). Understanding how beliefs influence attitudes and values confirms how the value>attitude>behavior hierarchy functions. This hierarchy also confirms the value of assessing attitudes, as they have proven to be influential the decision making process.

**Constraints**

To assess the constraints that limit private landowners from participating in water protection and conservation initiatives on their property, Crawford, Jackson, and Godbey’s 1991
hierarchical model of leisure constraints will be used. Although this model is most frequently applied to decision making regarding tourism and recreation, a minor modification to this model could prove to be equally beneficial in assessing participation in conservation projects (Figure 2).

![Diagram of hierarchical model of water conservation constraints]

FIGURE 2 A hierarchical model of water conservation constraints

This model is organized into three hierarchical categories arranged from most proximal to most distal: intrapersonal, interpersonal, and structural (Crawford et al., 1991). Crawford et al. proposed that “leisure participation is heavily dependent on negotiating through an alignment of multiple factors, arranged sequentially (the hierarchical categories), that must be overcome to maintain an individual’s impetus through these systematic levels” (1991, p.314). The assessment of constraint categories throughout the decision making process with regard to water conservation on private land will provide valuable insight to the factors influencing an individual’s choice to participate in water conservation and help to identify the constraints to meeting conservation goals.

According to Nyaupane et al. (2004), an individual’s motivation to participate is first challenged by intrapersonal constraints. Examples of intrapersonal constraints include individual
psychological states and attributes that interact with preferences such as reference group attitudes, stress, perceived self-skill, and anxiety (Nyaupane et al., 2004). Intrapersonal constraints are, “conceptualized as being the most powerful, due to the fact that they condition the will to act, or motivation for participation” (Crawford et al., 1991, p.314). Landowners with water resource conservation objectives for their property may face intrapersonal constraints such as a lack of confidence in their ability to communicate with agency partners or the perception that other community members may have of them for engaging in a partnership with a conservation agency.

If intrapersonal constraints are either absent or overcome and the activity requires at least one partner, interpersonal constraints may then be evident (Nyaupane et al., 2004). Landowners seeking to implement water conservation measures on their property may face this challenge if trust between partners has not been established prior to collaboration.

The third factor in constraint theory is structural. Examples of structural constraints include: the scheduling of work time, availability of opportunity, season, climate, family financial resources, etc. (Crawford et al., 1991). Structural constraints such as climate, season, and limited financial support from the government agencies are potential constraints that landowners may face when making the decision about whether or not to participate in a conservation project. Crawford et al. note that, “if structural constraints are too sufficiently strong, however, the outcome will be nonparticipation” (1991, p. 313). Crawford et al. also explained that participation in an activity, “depends on the successful confrontation of each constraint level in turn, whereas nonparticipation can occur because of the order of operation of constraints at several stages in the process” (1991 p. 314).
Substituting water conservation attitudes in place of leisure preference into Crawford, Jackson, and Godbey’s model, presents an opportunity to assess how hierachical constraints may impact landowners’ decisions to participate (or not) in water conservation initiatives. Assessing these constraints at an attitudinal level may inform water conservation and protection agencies of the limitations to widespread participation, as well as identify patterns of constraints among property owners. By Identifying constraints I hope to compare agreements and disagreements between agencies and landowners to help enhance water conservation efforts in landscapes with substantial private ownership. Additionally, this assessment will ultimately offer a basis for understanding landowners’ constraints and attitudes so conservation strategies can evolve to directly address or navigate these factors, thus increasing participation in water conservation efforts.

**Trust and Communication**

Trust has been shown to be a critical dimension of natural resource planning and management (Shindler & Cramer 1999; Wondeleck & Yaffee 2000; Pretty & Ward 2001). In the literature it is widely accepted that trust is integral to effective natural resource decision making and implementation”. Hindee claimed that the presence of distrust, has long been recognized as one of the biggest obstacles to effective natural resource management (Hendee, 1984). Since Hendee’s research, numerous studies supported his claim and acknowledge that distrust remains a common constraint to achieving multi-stakeholder conservation initiatives on private property (Metcalf et al., 2015, Olsen & Shindler 2010, Lachapelle et al., 2003, Davenport et al., 2007). Despite the broad discussion of trust/distrust in the literature, this dimension of natural resource management warrants further exploration, particularly its role in water resource conservation and partnerships among agencies/NGOs and individual rural landowners.
The benefits of trust are numerous and widely accepted across the social sciences. It is theorized trust can contribute to natural resource management by reducing conflict, encouraging cooperation, and aiding in the understanding of interests across stakeholder groups (Olsen & Shindler, 2010), all of which are important for implementing multi-stakeholder conservation projects. Establishing trust is inherently interpersonal and includes honesty, benevolence, and reciprocity (Lachapelle et. al, 2003,). The importance of identifying the interpersonal component of trust is based on the assumption that communicative interactions between natural resource personnel and landowners are foundational to the establishment of trust. Current research (Davenport et. al. 2007; Petts 2008; Hamm et al. 2013) asserts that, “effective communication, public engagement, integration of local concerns and knowledge, and trustworthiness build trust,” (Metcalf et al., 2015). Davenport and colleagues (2007) found unclear communication by natural resource agencies as a constraint in building trust. Additionally, in the same study, results indicated that community participants valued, “honest communication, sincere and meaningful collaboration and jointly implemented and mutually benefitting actions.” Building on these characteristics, several similar factors contributed to trust when dealing specifically with rural residents including, “respect for the rights, needs, and knowledge of rural people” (James 2002). Alternatively, resource planners have attributed poor communication to the diminished ability of diverse stakeholders to share in learning and building relationships (Lachapelle, 2003).

Despite the benefits associated with achieving trust across stakeholder groups, the consequences of distrust can be detrimental to the success of collaborative conservation. Wondelleck & Yaffee (2000) suggested “fear, skepticism, and opposition” as specific factors contributing to why their sample of landowners did not trust natural resource agencies. Maintaining trust once established is a critical to fostering positive relationships among
stakeholders. Olsen & Shindler (2010) emphasized the importance of maintaining trust stating, “trust is centered on frequency, reliability, and predictability of contact over the history of a relationship.”

Recent research exploring the role of trust in collaborative natural resource management in the study area has found landowners do not trust natural resource agencies and conservation NGOs (Metcalf et. al, 2015). Ineffective communication between stakeholders further deepens the distrust that landowners feel towards agency/NGO personnel. Additionally, an inability of agency/NGO personnel to successfully share educational resources in ways that are most conducive to the landowner audience also contributes to distrust.

METHODS

This study utilized in-depth, one-on-one interviews to survey the environmental attitudes of rural landowners and conservation professionals working in the Deer Lodge Valley. Existing studies have suggested that qualitative methods are most appropriate for drawing out in-depth, personal information from individuals (Warren & Karner, 2010). Therefore, the research questions in this study will be best met through qualitative methods because of the complexity of the issues that they address as well as a lack of existing in-depth information on the topics explored in this study.

Context and access:

The Deer Lodge Valley is roughly 10 miles wide stretching about 60 miles between the Flint Creek Mountain Range and the Boulder Mountains in Western Montana. The Valley is split between Deer Lodge and Powell Counties; both counties were included in the study area (Figure
3). According to the U.S. Census (2010), both counties are considered ‘rural areas’, with Powell County’s having a population of 7,027 and Deer Lodge County 9,298.

While conducting this study I was also employed at the Clark Fork Coalition (CFC), a Missoula based water conservation organization. In this capacity I worked with several other conservation agencies and landowners in Deer Lodge and Powell Counties. The relationships I established through this job assisted me in gaining access to respondents, through connections and professional networks.

**Participant Recruitment and Selection:**

To answer my research questions, I conducted interviews within two distinct populations: (1) conservation agencies and NGOs and (2) landowners. To identify research participants I first, identified conservation agencies (nonprofit and government) that have active water protection or conservation projects going on in Deer Lodge or Powell Counties. As a result of the rural location of the study area the number of natural resource agencies and NGO’s were limited. Selecting organizations specifically concentrating on issues related to water resources the number of agencies and NGO’s was further reduced. Given the small number of these organizations, natural resource agencies and NGO’s were grouped into the same category. Although these groups differ significantly, mainly in terms of governmental affiliation and oversight, these differences are not anticipated to influence the results of this study.

In addition to this group, landowners living on waterfront property were also identified as potential participants. Specific landowners were identified by using the Cadastral Geographic Information Directory to identify waterfront property owners along the Clark Fork River and its tributaries in both counties. In addition to this sampling method, chain referral was also
successfully used as a method for identifying potential participants in each respondent groups once time limitations arose towards the end of the study.

Potential respondents were randomly selected from the population of landowners who: (1) owned at least 40 acres of property in the Deer Lodge Valley adjacent to the main stem of the Clark Fork River or major tributaries. Major tributaries were defined as streams of order 1 and 2 (i.e., enough water to warrant conservation attention) and those within significant conservation value (Clark Fork Coalition, 2011). The Deer Lodge Valley was defined as any land from Warm Springs Ponds downstream to the intersection of Interstate 90 and Montana State Highway 12 (Figure 3). The lower property size limit of 40 acres focused our sample not on non-residential property owners, but rather those owners more likely to use large quantities of water for ranching.

The landowner candidates that were selected based on this criteria fit into several different categories of landowners. These categories include, property owners, businesses and LLCs owners, resident land managers, and trustees. There are several difference in these types of landowners. In some cases, landowners may fit into more than one of these categories for example, one landowner may be the property owner who also is the resident land manager of a ranching or agricultural operation. In other cases it is common for the property owner to live out of state leaving another individual responsible for managing the property owner’s land and or agricultural/ranching operation. Although this group of respondents are all considered landowners for the purposes of this study, there is a large diversity of the types of landowners that make up this population.

My goal was to conduct interviews with approximately 10 landowners and 10 agency/NGO personnel. To achieve this, I randomly selected 124 landowners and 10
agency/NGO personnel to recruit. I contact potential respondents via telephone to arrange interview dates, times, and locations. Interviews were conducted until I felt the information I was hearing was redundant or I could not find additional research participants. All study participants were consenting individuals over the age of 18. All study methods were pre-approved by the University of Montana Institutional Review Board.

**Data Collection**

Data collection began in August 2014 by conducting interviews with representatives from conservation agencies/NGOs. Interviews continued throughout the remainder of 2014 and were completed in June 2015. I began interviews with agency/NGO personnel to avoid the haying season (early June- late August) during which many landowners availability was likely limited.

The landowner interview guide (Appendix 1) was tested on a pilot group of two individuals which allowed for modifications to be made to the questions prior to data collection. Interviews were semi-structured and contained open-ended questions, asked to encourage in-depth, detailed responses from participants. When necessary, the researcher prompted interviewees with probe questions for more information about a specific topic or to keep the interviewee on topic.

The interview guide provided an outline of the questions that were used during each interview. Each question was designed to 1) gain insight into the interviewee’s environmental attitudes and behaviors towards water protection and conservation projects on private property, 2) identify any areas of overlap (either in agreement or disagreement) in attitudes between conservation agencies and landowners, 3) provide an understanding of the constraints to conserving water resources on private land.
A total of eighteen landowner interviews were conducted. All of which were one-on-one, face-to-face and took place either in the Deer Lodge Valley. A total of twenty-eight landowners were contacted for recruitment in this study. Of those individuals, four people declined participation, 14 people did not respond to multiple voicemail message that were left for them, making them unreachable, and the remaining 10 individuals agreed to participate in this study.

All of the nine agency/ NGO personnel that were contacted during recruitment agreed to participate in this study. These interviews took place at either the Deer Lodge or Missoula offices of each conservation agency or NGO.

The duration of each interview ranged from 30 to 150 minutes in length. All interviews were recorded with a digital audio recording device. All participants’ identities remained confidential and all audio recordings and transcriptions of the interviews were locked in a secure location on the University of Montana campus, accessible only by the researcher. Upon completion of data collection, all interviews were transcribed by a hired, professional transcriber through the University of Montana. Approximately three months after the transcription of the interviews the audio recordings of each interview were destroyed. A pseudonym has been used in place of the actual interviewee’s name and will remain in place in any subsequent publications of this research.

Data Analysis:

Once interviews were transcribed, my study advisor and I reviewed the information and research questions in order to identify the most prominent themes. This defined the scope of qualitative coding. The researcher utilized NVivo, a qualitative analysis software to develop codes
for each research question, to organize data, and to further analyze overarching themes from the data.

Figure 3: Map of Clark Fork River Superfund site (Montana Department of Environmental Quality, 2014)

LIMITATIONS

A qualitative research design was the most appropriate method to obtain in-depth subjective information on attitudes and identify the constraints and potential solutions to implementing public-private water conservation initiatives on private property. However, a longitudinal effect of this study was time constraints. With additional time, site visits could have
been extended allowing for an enhanced understanding of interviewees’ perspectives on water conservation. For example, many interviewees had expressed interest in physically showing the researcher specific locations or projects that they had described in their interview. However, due to time limitations the researcher was typically unable to witness these projects.

The largest limitation was the sample size. The lack of a larger sample size within each respondent group made it difficult find sufficient data to support certain themes, identify significant relationships, or draw conclusive generalizations representative of the respondent’s populations.

A lack of experience in conducting one-on-one, semi-structured interviews resulted in inconsistent questioning and probing as well as the occasional use of leading questions in the first several interviews. As the researcher became more comfortable with the interview process this limitation was largely resolved. Additionally, during the time of this study the researcher was employed by a conservation organization that has active water conservation projects within the study area. This may have influenced the scope and detail of information that some interviewees chose to share with the researcher. It also created a potential bias in the data analysis. However, the researcher was cognizant of this and aware of the necessity to remain objective.

RESULTS

**Landowner Attitudes Toward Water Resource Conservation**

Results indicated landowners have positive attitudes towards water conservation on their individual properties. Several key factors supported this claim such as, the contribution of healthy and abundant water resources to livelihood success, implementing a stewardship ethic.
while making land management decisions, and a sense of collective responsibility for maintaining watershed health. However, within this sample of landowners, the definition of water conservation was varied; I will explore this in more detail below.

Understanding landowners’ feelings towards the environment, and more specifically towards conserving water resources on their property will provide insight into the motivations behind engaging in water conservation initiatives and the types of conservation projects landowners choose to implement.

**Livelihood Dependency on Water Resources**

All individuals interviewed in this study utilize their property to support agricultural or ranching operations; their livelihoods and way of life were directly linked to the utilization of water resources on a daily basis. This connection greatly influenced how these landowners defined conservation and approach conservation practices on their land.

Generally, respondents considered water resources to be a critical aspect in sustaining the way in which they utilize their property; for raising livestock or producing agricultural crops. Most respondents engage in both of these activities. Since water is necessary to sustain life, landowners understood the basic need for access to abundant and healthy water resources. This concept was reinforced through multiple responses. Landowners frequently remarked that without water, ranchers and agriculturalists simply wouldn’t exist, as seen in the selected quotes in Table 1.

| Table 1. Selected quotes on livelihood dependency on water resources. |
“I guess basically water is liquid gold. With no water, we wouldn’t be ranching. Our family would be somewhere else doing something else. We wouldn’t be able to stay here with no water. Water is one of the most important things for the operation.” – Landowner 1

“Water is the basis of everything, basically, but especially on an agricultural operation, you see how water impacts the circle of life. Without it, my livelihood and many others would be lost. I think that water conservation is extremely important and should be in the top five priorities of anybody who is making a living off of the landscape.”- Landowner 2

“Water is necessary for the crops to grow, and the crops mean hay for the cows for the winter and of course income for certain people.”- Landowner 8.

“At the end of the day, the water resources that are available to that landscape make or break how profitable my business is."- Landowner 2.

“Healthy resources, of course, allow the ranching thing to happen… but without that resource out there, they wouldn’t be able to survive.”- Landowner 4

Landowners saw the benefit of maintaining the health and availability of water resources to ensure the long-term sustainability of their utilization of this resource. When respondents were asked to discuss the importance of water conservation, almost every response included a reference to the individual’s dependence on this resource to utilize the land to support a livelihood (Table 2).

The magnitude that water resources play in sustaining these livelihoods places a high value on this resource by the landowner. The statements provided support that this group of landowners have a positive attitude towards water conservation on their property, which is motivated by economic and environmental considerations. The direct association between water resource health and availability and livelihood sustainability facilitates the motivation for water users to conservation this resource.
Table 2. Selected quotes on the importance of water resources to landowners.

<table>
<thead>
<tr>
<th>Quote</th>
<th>Landowner</th>
</tr>
</thead>
<tbody>
<tr>
<td>“It made a difference. Any of these things you do to improve the land, to improve your crops, takes water. It all revolves around having the water.”</td>
<td>Landowner 6</td>
</tr>
<tr>
<td>“Water conservation is almost as important as oxygen. Without it, we will not live. And we wouldn’t have the life that I have. And I’ve been telling people ever since they came up with bottled water that water is more valuable than gas and oil.”</td>
<td>Landowner 7</td>
</tr>
<tr>
<td>“Water conservation is extremely important. We don’t like to see anybody falsely use the water or wastefully use the water. We use it for a purpose as well as those ranchers who are relying on the water for two-fold, one for irrigation of crops, and two for stock.”</td>
<td>Landowner 8</td>
</tr>
<tr>
<td>“We have to have irrigation or we don’t have anything. I think without irrigation the other interests don’t have anything either…”</td>
<td>Landowner 10</td>
</tr>
</tbody>
</table>

Stewards of the Land

The majority of respondents shared motivations for conserving water resources on their property. All of the landowners that were interviewed are the primary land managers of the properties that they work and in most circumstances inherited their operations from prior generations of family members. Their daily interactions with the resources on their property and the generational knowledge passed down to them from family instilled a deep connection to and knowledge of their land. This unique relationship between landowner and land has facilitated a sense of responsibility to care for the resources that they manage. This sense of responsibility has imparted a stewardship ethic in many of these landowners. A large portion of respondents discussed their role as stewards and how they consider stewardship to be ingrained in this livelihood. Landowner 6 spoke to this when he said, “I think the ranchers and the farmers are the
ones who originated this conservation thing.” Landowner 6 goes on to describe his reasoning for this belief:

But for the most part, the ranchers and the farmers are the best conservationists that I know. Because they live off the land. The land is their—if it’s not right, it’s not paying off. It could be pasture, hay ground, wintering ground for their livestock or whatever. For the most part, they take darn good care of it. They have to.

Other landowners also discussed their role in caring for the land as stewards (Table 3), although the term environmentalist was used by some to convey the same characteristics as a land steward.

<table>
<thead>
<tr>
<th>Table 3. Selected quotes on landowners self-identification as stewards.</th>
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</thead>
<tbody>
<tr>
<td>“Once again, my livelihood is to raise cattle, and in order to raise cattle, I have to take care of the land and the resources that I have to make it sustainable from one year to the next.” – Landowner 3</td>
</tr>
<tr>
<td>“…Along with that, it’s takin’ care of the property within the watershed, from weeds to how we manage our game animals to keep the populations at a controllable level for that environment.”- Landowner 3</td>
</tr>
<tr>
<td>“I mean, I’m an environmentalist if you want to call me one, I’m an environmentalist of these 160 acres, and I care what goes on here, and I care about the water that’s going down the ditch.” – Landowner 5</td>
</tr>
<tr>
<td>“I think that most farmers and ranchers are exceptionally good environmentalists”- Landowner 7</td>
</tr>
</tbody>
</table>

Landowners self-identification as a stewards appeared to be widely accepted among agency/NGO personnel as well. Agency/NGO personnel acknowledged a stewardship-centered identity among landowners as well landowners’ self-identity as stewards (Table 4). Agency/NGO 1 makes the same connections that landowners have regarding the symbiotic
relationship between living off of the land and caring for it when he said, “I think that landowners consider themselves stewards, at least folks who are in traditional agriculture. They make their living off of their land, and if they treat it well, then they make money, and if they don’t, they don’t survive.” Identifying and acknowledging the role of a stewardship ethic in landowners is one of the few themes that landowners and NGOs and agencies commonly understood.

<table>
<thead>
<tr>
<th>Table 4. Selected quotes on agency/NGO personnel referencing landowners as stewards.</th>
</tr>
</thead>
<tbody>
<tr>
<td>“…I do think that overall and in general the landowners in this area do look at themselves as stewards of the land and responsible for the health of the land, especially agriculturally.” – NGO/Agency 2</td>
</tr>
<tr>
<td>“I’ve heard a lot of landowners say over the years that they are just the stewards of the land, they are just taking care of the land for the next generation, and they want to leave it in better condition than when they received it.” – NGO/Agency 3</td>
</tr>
<tr>
<td>“I’ve noticed that some private landowners are really good about conservation and making sure that they’re doing things in a conservation-minded way. – NGO/Agency 4</td>
</tr>
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</table>

Watershed Health & Communal Management

When respondents were asked to define what a healthy watershed looks like the majority of respondents shared an ecological perspective as seen in Table 5. For example, Landowner 5 described a healthy watershed as, “frogs and tadpoles, fish and the wildlife in your water, the ducks, the geese. It’s got a lot to do with the wildlife. They play a big part of it.” Like Landowner 5, most landowners specifically mentioned the importance of wildlife and fish populations as well as an abundance of vegetation, suggesting these individuals consider watersheds as part of a
larger holistic ecosystem.

It was also common for landowners to elaborate on how best management practices and sustainably managing their land is an important contribution to watershed health. Notably, of the landowners who referenced best management practices for maintaining watershed health majority focused on terrestrial management practices rather than aquatic. The terrestrial topics that these landowners focused on included, weed and livestock management including population and grazing management.

Table 5. Selected quotes on landowners defining watershed health.

<table>
<thead>
<tr>
<th>Quote</th>
<th>Landowner</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A healthy watershed would be one where the people and the wildlife that depend on it are both thriving and it has the potential to function in that way for years to come.”</td>
<td>Landowner 2</td>
</tr>
<tr>
<td>“I think a healthy watershed is a watershed that is sustainable for all of the ecosystem that’s in it. Along with that, it’s takin’ care of the property within the watershed, from weeds to how we manage our game animals to keep the populations at a controllable level for that environment...The watersheds should be healthy, the land should be healthy, but in any situation, if you overpopulate that, then nothing is healthy. You continually have to look at the number of animals that you’re running in certain areas and what that’s doing to your rangeland. The rangeland is a huge part in your watershed, in how healthy it is, and also in the water resources.”</td>
<td>Landowner 3</td>
</tr>
<tr>
<td>“A variety of plants and animals, flourishing and doing good.”</td>
<td>Landowner 7</td>
</tr>
<tr>
<td>“Just a lot of water. Plenty water. Overabundance of water. And again, controlling it. Some people prostitute it. They take advantage of it. They water more than they should and they—you see, if you look around, you see these pivots and mainlines, they go 24 hours a day.”</td>
<td>Landowner 8</td>
</tr>
<tr>
<td>“It’s about biodiversity is what it is. It’s the whole thing the trees the brush, the grass and the water when it comes out of there it’s clean.”</td>
<td>Landowner 10</td>
</tr>
</tbody>
</table>
When agency/NGO personnel were asked to define what a healthy watershed is, a large portion of this group also discussed the biophysical features of a watershed. However this respondent group expanded on the biophysical aspect of their definitions by including social and economic perspectives as well (Table 6). The combination of biophysical, social and economic dimensions of watershed health demonstrated holistic conservation values held by this group of respondents. Agency/NGO 3 exemplified this perspective when he defined a healthy watershed as:

A place where if somebody wanted to get into the ag. business, they can, and they could make a living off the land in a sustainable manner. Or if they wanted to get into the recreational business, they can, be it fishing or hunting or whatever or other sources of recreation. You’ve got businesses like that, you’ve individuals like that, who can come in and thrive.

<table>
<thead>
<tr>
<th>Table 6. Selected quotes on agency/NGO personnel defining watershed health.</th>
</tr>
</thead>
<tbody>
<tr>
<td>“What it looks like, healthy vegetation, healthy trout population. It’s good for industry and fishing and recreation.” - Agency/NGO 2</td>
</tr>
<tr>
<td>“My definition of a healthy Clark Fork would be one where everybody gets what they want but gives a little bit, too, and that we have healthy streams in terms of abundant fisheries, alongside healthy agriculture as well that’s operating efficiently using modern equipment that is appropriate for the location.” - Agency/NGO 5</td>
</tr>
<tr>
<td>“I would say “healthy” means that there’s a land use and economy in place that allow the waterways to maintain as high a quality as possible. To me, that’s what healthy is. The main things that affect water quality and quantity are land use and economy. If our land use and economy are supportive of high-quality waterways, high water quality, adequate flows, we’re on track towards a healthy watershed” - Agency/NGO 6</td>
</tr>
</tbody>
</table>
Although landowners and agency/NGO personnel have varying definitions of what defines a healthy watershed, both groups of respondents largely agreed that “everybody” should be responsible to ensure sustainable watershed health, as seen in Table 7. Both respondent groups have similar responses, although agency/NGO personnel most commonly replied that everybody should have this responsibility, while the frequency of that response among landowners was slightly less.

A smaller percentage of landowner respondents see themselves as the primary party responsible for keeping watersheds healthy. One respondent replied, “the landowner is responsible for what deeded ground and leased ground that he has. But in general—well, I mean, it all reflects back to the landowner, in theory.” - Landowner 5. While another landowner shared a similar response: “Somebody needs to be responsible, and again, I think the ranchers are…” - Landowner 6.

<table>
<thead>
<tr>
<th>Table 7. Selected quotes on landowners and agency/NGO personnel identifying “everyone” as responsible for managing healthy water resources.</th>
</tr>
</thead>
<tbody>
<tr>
<td>“So if I’m answering your question, yeah, as a community, everybody’s got a part.”- Landowner 3</td>
</tr>
<tr>
<td>“Everybody. But we’ve got to come up with a definition of what’s healthy.”- Landowner 7</td>
</tr>
<tr>
<td>“All of us. Everybody. It’s not that farmer or rancher out there, it’s everybody. Everybody who uses water, so that means everybody.”- Agency/NGO 3</td>
</tr>
<tr>
<td>“Everyone. I think we all have some sort of a stake in it, absolutely. Even if you don’t ever set foot near a river or on a river, you still benefit from having them, healthy rivers. We all are.”- Agency/NGO 4</td>
</tr>
<tr>
<td>“I think it really is up to everybody, from government officials who makes the laws to society to put a value on it.”- Agency/NGO 7</td>
</tr>
<tr>
<td>“Everybody. Everybody, I think.”- Landowner 10</td>
</tr>
</tbody>
</table>
Water Conservation Projects on Private Land

As discussed in the prior section, the majority of the landowners interviewed in this study run ranching and agricultural operations. This requires these individuals to irrigate sections of their property in order to maintain sustainable, productive operations. Irrigating large tracks of land demands the use of large quantities of water, which makes irrigation the largest utilization of a landowner’s water right. Results indicate that altering irrigation methods is the most common avenue for implementing water conservation projects on these properties. Second to irrigation, livestock and range management also provide numerous opportunities for implementing water conservation initiatives. Additionally, results showed a disconnect between the conservation ideologies of landowners and agency/NGO personnel. This will provide a foundation for understanding why certain constraints exist and how they may be overcome.

Defining water conservation

When asked to define water conservation, landowner’s responses were somewhat varied. Each definition included topics directed towards water availability/quantity, water quality, or the efficient use of this resource. This helps to identify which areas these landowners view as most important when working with water resources, as well as, provide insight into priority areas regarding conservation initiatives. Additionally, each landowner’s definition of conservation reveals information about the types of water conservation initiatives they are taking on their property, if any.
When speaking about water quantity landowners repeatedly discussed two topics: water storage and water availability. Given the semi-arid climate in the Upper Clark Fork Valley drought is extremely common and occurs in some tributaries of the Clark Fork River on a yearly basis. Landowners who experienced the effects of drought stressed the importance of water storage in their responses. Water storage gives landowners access to water resources in times when it might not otherwise be available to them, and allows them to continue to run their agricultural operations successfully year round. For some landowners access to stored water resources greatly affects their productivity during times of drought. The value that landowners place on water storage is why this topic is included in their definitions of water conservation. One landowner validated the importance of water storage when he defined water conservation as, “building a lake or a pond and flowing water back to use when you need it and not let it go by in the months that you don’t.”-Landowner 5.

Not all landowners experience water shortages on their property. Historically, the Clark Fork River flows all year, which is why property owners with a water right on the Clark Fork River are not as concerned with storing water for later use. Results found that an abundance of water resources influences a landowner’s definition of water conservation and their perspectives on the importance of water conservation initiatives. Landowner 6 said, “I think the water conservation thing is that if you have too little water you have to conserve it. If you have plenty of water, it’s not a problem, it’s not something that I’m really concerned about.”

A third landowner also included water quantity as part of his definition of water conservation. However, his response focused more on a big picture perspective regarding the impact of water resource conservation on the entire ecosystem. He responded, “That would be using the water resources so that we have enough available in any specific drainage for the use in
Another topic that is often synonymous with water conservation is water quality. Despite this, there was only one landowner that discussed water quality while defining water conservation. This landowner focused on the chemical pollution of water resources. More specifically, he mentioned the result of runoff from pesticides, fertilizers and herbicides. He defined water conservation as, “to put it to really good use and not change it as far as too much fertilizer, too much pesticides, too much herbicides.”- [Sic] Landowner 7. This reveals that this population of respondents generally may not value water quality as highly as more frequently mentioned topics, such as water quantity or efficient use of water resources. This result also provides insight into which areas of water conservation landowners are least concerned with. Although much of the study area is a designated Superfund site, only one landowner expressed concern regarding poor water quality due to chemical contamination when defining water conservation.

Across a majority of the responses, there were several words frequently used when defining what conservation of this resource is: “wise use,” “over use,” and “not wasting”. A commonality across all of these responses is the application of the term conservation to the direct utilization of this resource. Additionally, using these terms and the context in which they are used shows that landowners were concerned with the inefficient use of water.

When landowners mentioned “wise use,” they were specifically referring to irrigation practices. Landowners consider some methods of irrigation more wasteful than others because more water is utilized than what is required to produce a certain crop. For example, it is harder to control the application of water to a designated area through flood irrigation than it is with pivot systems. In pivot irrigation systems, a landowner controls the amount of water applied to a crop,
therefore, reducing the potential for the application of excess water. Landowner 1 defined water conservation by describing how overuse of water resources results in wasting this resource, “it’s using it wisely, not just wasting it. Don’t put it on ground that doesn’t need it or more than you need.” Similarly, some irrigation methods are more cost efficient than others. For example, the use of electric pumping systems can lead to high electric bills. Others feel that time is as valuable as money, and argue that the amount of time that it takes them to flood irrigate a field is more expensive than utilizing an electric system. Landowner 4 considered these economics when he defined water conservation as, “only using what you really need and what’s economically feasible.”

Preventing the overuse of water resources was another important topic in landowners’ definitions of conservation. In this case, when landowners refer to wasting water they mean keeping a portion of their water right in a river or stream. Many landowners share this ideology, which stems from the fear of the “lose it or use it” mindset instilled by the prior appropriation doctrine. This commonly occurs for the purposes of maintaining streamflow rather than using their entire legal water right. Landowner 9 described what it means to him to waste water when he said, “This __________ outfit, they want to put all that water in the river. It’s just going to go to the ocean, and the ocean can’t use any more water. They’re already complaining about the ocean rising a tenth of an inch every 10 years or some darn thing.” Using water efficiently allows landowners to receive a maximum value from this resource. Responses that resonated with this belief were also common, as seen in Table 8.

<table>
<thead>
<tr>
<th>Table 8. Selected quotes on identifying the overuse of water resources in landowner’s definition of water conservation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Water conservation is making a conscious effort of the way you utilize your water resources and to make an effort to not overuse when it’s not necessary.” - Landowner 2</td>
</tr>
</tbody>
</table>
“I think it’s a waste of water to have a whole bunch run right straight to the ocean. It makes way more sense to me to turn it out.” - Landowner 7

“Well, as I understand the term “conservation,” it’s the individuals thinking about how much water they’re using and how much water they’re wasting.” - Landowner 8.

“Maybe saving water, or using it more efficiently and don't waste it, I guess.” - Landowner 9

“I guess to me it means using it properly, I mean, keeping it clean and using it to its beneficial use to the best of your ability…” - Landowner 10

### How Groundwater Influences Water Resource Conservation

When landowners discussed water resource conservation, the topic of groundwater occurred in more than half of the responses. Landowners mention groundwater when detailing the hydrologic functions and movement of water on their properties. Their daily irrigation routines familiarize landowners on this topic. This results in the frequent consideration of how their irrigation systems are impacting groundwater storage, and ultimately, how they can practice water conservation through irrigation methods.

These landowners are primarily concerned with issues of groundwater recharge and storage. They have observed that without proper groundwater storage, their water sources become scarcer during times of the year when drought persists. One landowner identifies how flood irrigation is beneficial for groundwater storage and water availability later in the year: “when you’re flooding, getting that water on the ground, it spreads out and recharges groundwater and ends back up in the water system in the fall, when it really needs it.” - Landowner 2. Another landowner shared this belief which was evident when he said, “I think we’re depleting our groundwater source of water by not flooding. And even this time of year, I should have all that
water out in the ground up above so it’ll come up later.” - Landowner 9. Similarly, as one rancher recalled how water availability on his property has changed over time, he also mentioned how changes in irrigation across the valley affect groundwater. He stated, “and then the sprinklers came along, and it’s done away with a lot of these springs, a lot of the recharge of the aquifer in the springs.” He continued, “the sprinklers, the cement ditch, all of those things to conserve water, thinking they were conserving water by not letting any of it seep into the ground. And they sure might have done that, but then there’s no recharge.” - Landowner 7.

This group of landowners does not consider flood irrigation the most efficient method of irrigation. However, they feel strongly about this method’s ability to conserve water through groundwater storage. They believe that they are doing themselves and their neighbors a favor by using this method of irrigation. One ranch manager installed an alternative irrigation method despite some of her neighbors concerns. Her neighbors were most worried about the reduction of ground saturation once the new pivots were functioning, due to the lack of groundwater recharge. Landowner 2 describes how her neighbor has influenced her concerns about changing irrigation methods: “I did, and they mostly came from several other landowners who spoke up about their concerns over pivots and how it affects your neighbor’s property and the creek and the river. Their concerns were for groundwater storage and for keeping water in a certain region.”- Landowner 2.

Similarly, other landowners who have had personal experience with government agencies or conservation NGOs express their disagreement with the irrigation methods that these groups advocate for. “Another potential problem that we’ve seen in the last years is that the government has a lot of programs to convert everybody over to sprinkler irrigation, and the sprinkler irrigation, once again, doesn’t saturate the grounds so you get the crops, but you don’t get the sustainable water flows later in the year.”- Landowner 3. Another landowner describes how he feels as though
two NGO employees likely have made false assumptions about the irrigation methods he chooses to utilize: “I’m not picking on ________ and ________, but they probably think I’m wasting water because I just put out lots of water and it just soaks into the ground and some of it doesn’t do me any good. But I’m thinking that I’m replenishing the groundwater.”- Landowner 9. Similarly, other landowners also struggle to weigh the costs and benefits of pivot irrigation systems. Landowner 10 praised the efficiency of these systems. However, he also acknowledged the amount of water that is lost through evaporation and as a result diminishes the amount of water able recharge the groundwater system. To gain a broader perspective on this topic Landowner 2 was asked whether sprinkler irrigation is more efficient than flood irrigation. She replied:

I’ve prodded at that question. Is it really more sustainable? Does it really conserve more water in the long run? With these pivots, we’re putting out the minimum amount of water that the plants need to grow. We’re not adding anything to the system. I can’t speak to whether evaporation is a factor in the sprinkler system. I haven’t been able to get an answer. It’s unclear. I don’t think that we really know the long-term effects of pivot irrigation.

*Irrigation as a method for conservation*

Landowners identified several types of irrigation methods they implement on a daily basis (during spring, summer and fall months): flood, pivot, and hand and wheel lines. Most landowners utilize a combination of methods, however, flood irrigation was the primary method utilized across this group followed by hand and wheel lines, as seen in the landowner’s responses in Table 9.

<table>
<thead>
<tr>
<th>Table 9. Selected quotes on landowners’ irrigation systems.</th>
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“As of last year, we completely flood irrigated all of our haying ground, but we switched over to a sprinkler system on part of our property last year. We’re still partially flooding, and we now have a sprinkler system.” - Landowner 2

“Flood irrigation.” - Landowner 3

“This place has all been flood-irrigated.” - Landowner 5

“The little system I have, I have to drag around black hoses, and I hook my little hand line up and just keep moving it around the area that I’m hanging.” - Landowner 6

“Flood irrigation, which is just ditches and a canvas dam. We have a couple of pivots and we have some wheel lines, and very little hand line any more.” - Landowner 7

“We do a little bit of everything. We got some flood, we got some pump sprinklers, a little bit of gravity pipe, but not much…” - Landowner 10

As evident in the prior section, a large portion of respondents utilize flood irrigation as a conservation measure for purposes of groundwater storage and recharge. Only one landowner strictly utilizes pivots for conservation purposes, as he pointed out during his interview, “I try to get away from the flooding and get into the mechanical, the pivots and wheel lines and hand lines. That’s what we’re doing, trying to conserve, ‘cause it seems like with that flood, you use a lot more water.” - Landowner 1. He goes on to describe his understanding of how pivots conserve water:

“You use a little less water, and where you set it is where you get the water. With flooding, sometimes you don’t get the high spots. You try to push it with more water, and you’ve got a lot of—you’re running it through ditches, where you have a lot of seepage. You put X amount of water at the headgate, and by the time you get to the end of it, you have, like, half sometimes. You’re losing some water. It’s going into the ground, but it’s not—you’re not efficiently using it. It’s a big water loss.”

Best Management Practices for Managing Livestock along Riparian Areas
All but two of the landowners interviewed have livestock, which provides additional opportunities for employing water conservation initiatives on their property. Utilizing best management practices for managing livestock in and around riparian areas gives landowners other opportunities to implement conservation projects on their land. The most common conservation initiative among participants was riparian fencing projects. The goal of these projects is to strictly control access to the land that abuts the waterways on their property. Approximately half of respondents with livestock abide by these management practices. All of these landowners understand the damage that livestock can cause to waterways and riparian areas if they have unrestricted access to streambeds and streambanks. These include streambank erosion, increased sedimentation, and a lack of riparian vegetation growth. One landowner mentioned these consequences as he described how he manages the cattle on his land: “I have riparian fences on both sides of the river that parallel the river. The one on the west side I put in maybe 30 years ago because...I didn’t want the cows trampling the riverbanks and stuff, either, and causing problems.”- Landowner 4. Landowner 2 also believes that riparian fencing is beneficial to water quality and riparian health. When asked how she manages the livestock on her property she said,

“We’ve had our cattle completely fenced off of the Clark Fork River. We had one watering gap, but they were never free-ranging along the river, which was a conscious decision, to try to preserve the vegetation along the stream banks and not add any more sediment to the river. We’ve also taken that approach in the last couple years on ________ Creek, that flows through the ranch. We’ve built permanent electric fences. So we now have I guess you’d call them controlled pastures, where we can control when cattle do or do not have access to the creek.”

Completely restricting livestock access to rivers or streams is not uncommon, and more evidence supporting this method is found in Table 10.

| Table 10. Selected quotes on the utilization of riparian fencing as a conservation measure. |
“I’ve almost got fences running down both sides of the crick, for three-quarters of a mile, so the livestock can’t get to the crick. There’s one or two spots they can actually get to the crick and drink, but I’ve been trying to keep them off of the crick bottom. After this spring, I should be pretty close to having that done.” – Landowner 5

“All our cattle are up above from the river, which is approximately a quarter mile down from where our pasture land is.”- Landowner 8.

Although not all landowners regulate their livestock’s access to water resources, it does not mean that those individuals are not making other efforts to protect the water resources on their property. One landowner who practices rotational grazing, also mentioned his effort to make his livestock’s access to water resources sustainable:

“One of the frustrating things about running cattle as well as any other species, whether it be buffalo or anything else, is that cattle and other species congregate around the water area and eat the grass from the water area out. One of the things that I try to concentrate on is to try to spread those watering areas so you don’t get such a heavy concentration in one place.”- Landowner 3.

In addition to riparian fencing, one landowner also brought up the topic of grazing and the prevention of overgrazing is an important conservation measure he implements on his property. He said:

I don’t overgraze and I make sure that I have water gaps and stuff for them so they don’t tear the whole bank out. I have spaces that’s fenced off so they’re not tearing out the whole bank. We try to keep them out of the banks when the willows are growing, the high-grow peaks we take the cows off. We manage that way.- Landowner 1.

Another landowner who practices rotational grazing across his pastures also indirectly mentioned being cognizant of overgrazing. When asked how he manages livestock on his property he replied:

The way that I manage my cattle on this property is that from October 1st until about probably May 15th they’re here on this property, and the remaining time during the summer
they’re on our mountain pasture. In the mountain pasture we have streams, we have developed springs for watering, things like that. That’s where they get their grass during the summer, and then that makes this property available for growing hay crops until the fall, when I bring the cows back. - Landowner 3.

Fertilizer Application and Weed Management Techniques

Although this group of landowners utilizes specific methods of irrigation and riparian fencing for water conservation, some respondents discussed two other areas in which they implement conservation initiatives: the type of fertilizers and techniques used to control invasive weeds. Although these initiatives are not specifically water resource conservation methods, they help to reduce the amount of chemical runoff entering the waterways on their property, therefore, protecting water resources indirectly.

During interviews, landowners discussed runoff management on their property. Most of the respondents interpreted this as sediment runoff due to flash flooding, a common occurrence in the study area. Due to the nature of this natural event, many landowners were unable to offer preventative methods to this issue. The landowners who did not discuss sedimentation resulting from flooding discussed their use of fertilizers and herbicidal weed control. Some landowners chose to eliminate the use of commercial chemicals from their operations, as Landowner 7 mentions, “I try not to use commercial fertilizer and I try not to use any chemicals, to tell you the truth.” Other landowners use natural fertilizers as opposed to chemical as Landowner 8 describes:

We utilize the manure quite a bit. We use it for fertilizer. We leave it on the land. We drag the land, and it does put the potassium and other items back into the field. We do not use any artificial sprays of any nature. Sometimes we do to kill weeds, but I have no fear of runoff. We want all the water we can get, natural water, all we can get.

Another landowner discusses his use of natural fertilizers for the purposes of promoting vegetative growth to promote bank stabilization, not necessarily for crop productivity. He described the method he utilizes: “One thing that we’ve been doing is takin’ cow manure and wood chips and
making mulch and mixing it in with the sandy ground and trying to build the ground up that way and the grass grows a little bit better.” - Landowner 5.

These same landowners were also cognizant of chemical runoff from weed management and have implemented alternative measures or adapted their application techniques with water quality in mind. For example, Landowners 5 and 10 uses sheep and goats to fight noxious weeds on their properties.

**Agency and NGO Personnel Attitudes Toward Conserving Water Resources on Private Land**

The holistic perspective that Agency/NGO personnel had regarding their definition of watershed health remained present when they discussed water resource conservation. This suggests that this group of respondents has a positive attitude towards water conservation on private property. This holistic perspective broadens the spectrum of topics these respondents value when considering conservation. Many of these values align with the values of landowner respondents. These topics include livelihood dependency on water resources and a shared value of the importance of water resources for healthy ecosystems and communities.

**Defining Water Conservation**

Each of the agency/NGO respondents work for organizations that implement conservation projects on private property. The types of projects these individuals implement will be further discussed in the next section of results. Approximately half of the respondents in this group are employees of state or federal conservation agencies while the remainder of respondents work for conservation nonprofits or own their own business. This information is relevant because the type of conservation organization that respondents work for influences these individual’s attitudes regarding conservation on private land. This claim first became evident
during the analysis of how respondents define water conservation. When defining this term respondents replied in two different ways: by either describing the ecological features that they feel supports overall watershed health, or identifying behaviors that individuals can implement to conserve water resources on an individual basis.

The majority of respondents focused their definition on the human dimensions of water conservation, and included topics such as collaboration in conserving natural resources and being cognizant of how much water individuals use. Agency/NGO 4 described the importance of collaboration in resource conservation, while also demonstrating a high value for conservation oriented partnerships. She said:

In this day and age, it’s very complex. To define it, the best way is something that we all need to work on, all different stakeholders… Defining water conservation is all about defining how we can do it together, because there’s no way that one single person or organization or stakeholder will be able to conserve if we don’t all get on the same page. There’s so many different ways we use water, for recreation, to drink, to feed our cattle, to water our fields. If all those people don’t get on the same page, I don’t have a lot of hope, to be honest. We need to do that. It’s a highly used resource and very diverse.

Water conservation definitions that focused on behaviors shared similar characteristics as the landowner respondents and included similar terms like, “wise use”, “not wasting” and efficiently using or “optimizing use” of this resource. Agency/NGO 3 demonstrated this in his definition; “it’s the wise use of the water resource. Using what’s needed and depending on the particular situation, not overusing. That’s a tough one. The wise use of the water resource so that it’s not wasted, so to speak.” Additional examples of this type of response can be found in Table 11.
“I think in these terms, water conservation can start in your home, where you’re conserving water, irrigating properly, at the right hours, more deeply than more often. And that extends to ranch practices, it can be the same sort of thing, where less—flood irrigating is considered more wasteful, it doesn’t cover an extensive area like a pivot or something like that. But anything that we can do that helps put water in the river and not waste it would be conservation.” - Agency/NGO 2

“When I hear water conservation, what comes to mind for me immediately is conserving flows and maintaining flows in streams that are adequate for the fishery and other aquatic life… For me, water conservation is looking for ways to optimize our use of a scarce and limited resource.” - Agency/NGO 6

“I define conservation always as “wise use of.” It’s the wise use of the resource, I guess is how I would see it.” - Agency/NGO 9

Alternatively, a smaller percentage of respondents included characteristics of the components that make up a healthy watershed in their definition. In these responses, topics of water quality and quantity were most commonly mentioned. Agency/NGO 7 discussed these topics when he defined water conservation as:

Removing contamination from the flood plain to improve water quality in the river. And it’s not just water quality, it’s also water quantity, improving riparian habitats improves cover over the river improves habitat and in turn improves water quality and quantity in the river.

Another common topic included in definitions with an ecological perspective was how healthy water resource contribute to healthy fisheries. Agency/NGO 8 acknowledges that he doesn’t necessarily value fish, but understands their role in indicating the quality of water resources. He said:

With water conservation, water quality, water quantity, stream temperature, even weeds, bank erosion all play such a part. I’m not a lover of fish, but fish are the best indicator that I know, and they’re free. They tell you if the stream is heavily impaired or if it’s in pretty good shape.
Agency/NGO 5 also referred to fisheries, however, his response focused on the need for returning water resources back to tributaries during the times of year when drought is most likely to occur because that is when it is when water quantity has the greatest impact on a fishery.

These definitions also largely include topics that are directly tied to the types of projects respondents implement through their profession. For example, Agency/NGO 7 works closely with the Superfund remediation project and Agency/NGO 5 is involved in many projects related to in-stream flow. Of the three respondents that defined water conservation in this way, two of them are agency employees.

*Importance of Water Resource Conservation*

Two themes arose from questions regarding the importance of water conservation; these same two themes were also present in landowner interviews. First, the livelihoods of agency/NGO personnel also largely rely on water conservation, and second, identifying the connection between successful water conservation programs and the success of the agricultural community. Additionally, many respondents had varied responses which included perspectives that address ecological and social dimensions influencing their reasoning for believing that water conservation is important.

The majority of respondents provided varied responses which expressed values in both the social and ecological dimensions of water conservation. For example, Agency/NGO 8 emphasizes how proper ranch management contributes to healthy watersheds. He said: “I think the healthier the streams are, the healthier the whole ranch is. If you have weed problems, overgrazing problems, it all shows up in your water. The stream banks erode. I don’t know if it’s conservation as much as just good water management.” Some respondents also provided ecological perspectives signifying the importance of water resources by discussing topics such
as, how water conservation improves the overall environmental health of the community and
watershed, and water resource availability. Agency/NGO 7 provides this holistic perspective
when he describes why the conservation of water resources is important to him, specifically
focusing on habitat improvement and human utilization of water resources.: “…And probably
most important, it’s important to me because it improves the quality of our riparian habitat and
our rivers and the places we like to live and play.” Table 12 provides further examples of varied
dual perspectives.

<table>
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<th>Table 12. Selected quotes on the importance of water conservation to agency/NGO personnel.</th>
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| “It is important to me. It probably would be, say, more important if I was in an area where we
didn’t have extensive water resources. In this area we’re lucky that we have extensive
groundwater resources, so even our drinking water in town here is tied to a groundwater
resource which isn’t threatened or isn’t a limited resource, it’s not very limited, I should say.”- Agency/ NGO 2 |
| “It’s very important. I think it should be very important to everybody. It’s a renewable
resource, but still, that doesn’t mean that’s a resource that should be wasted and treated as if
there’s a limitless supply. It’s a resource that is important to everybody. It’s important to have
clean water and keep it clean for everybody to be healthy and to thrive.”- Agency/NGO 3 |
| “I think that’s the next big issue that people don’t recognize yet. People are starting to see it,
but water conservation, water quality and quantity and availability, is going to be— But I
think it is the defining issue for the West in the future. And it’s become—it’s going become
bigger, because climate change is going impact what we have… Personally that’s what I think.
But it is going be the defining—water’s the defining issue.”- Agency/NGO 9 |

Each interviewee within this group works either to directly conserve water resources in
capacities such as improving in-stream flow or water quality, or indirectly, through projects such
as fish passage or riparian restoration projects. Regardless, each of these projects depends on
abundant and healthy water resources for them to succeed. For this reason, approximately one third of respondents identified this reason for feeling that water conservation supports their Livelihoods. Agency/NGO 7 started, “For one, it’s important to me because it’s my job and I get paid to do it. Secondly, it’s important to me because it’s a job that I feel good about doing.” In addition to feeling good about contributing to this topic, as Agency/NGO 7 mentioned, others feel that they have dedicated a large portion of their career to this field, justifying its importance to them. Agency/NGO 1 reinforced this when he replied, “Personally, it is at this point my life work. So it’s hugely important.”

In addition to supporting conservation because it supports many of the livelihoods within the Deer Lodge community, several respondents also value water conservation because it supports local agriculture and the local economy. Paralleling the landowner respondents’ replies, several respondents draw the connection between the dependencies of local agriculturalists and water resources. Agency/NGO 1 continued his response by elaborating on these connections when he said:

To our communities it’s essentially, to the communities we work with to agriculture it’s everything. You can’t run an agriculture operation unless you have water right and are able to utilize water resources. From our community drinking water to the agriculture that our economy’s based on in a large part in the state, the aquatic resources that a lot of the rest of our economy depends on, everything centers around those water resources that we have… The question was how important is it to me? It underlies most folks’ lives, whether they realize it or not.

Some respondents were less detailed in their reply and included a variety of topics in their answer, and simply mentioned the importance of local agriculture to them. Agency/NGO 4 said, “I also want to support local agriculture.” The support of Agency/NGO personnel for local agriculturalists and ranchers is a significant underlying theme throughout these interviews and will be further analyzed in research question five.
Impact of Water Resources on Watershed Communities

Additional analysis of how agency/NGO personnel define watershed health also supports this group’s positive attitudes towards resource conservation. Many of the perspectives that agency/NGO personnel provide when discussing watershed health provide evidence that this group of respondents views landowners as well as the larger community as an integral part of the watershed. This perspective reinforces agency/NGO personnel’s holistic perspective further supporting why social and economic topics are included in their responses. Agency/NGO 6 demonstrates overlap between ecological and social dimensions of watershed health:

If we’re going to focus on the watershed, what goes on in that watershed has everything to do with the conservation of the water itself. I would say “healthy” means that there’s a land use and economy in place that allow the waterways to maintain as high a quality as possible. To me, that’s what healthy is.

Further evidence of this mutually inclusive viewpoint was provided by Agency/NGO 4. She includes both ecological and social parameters within her definition, as well as provided suggestions for achieving her definition of a healthy watershed. She responded:

I think first about working together cooperatively. There are conflicting uses, there always will be. I do think that in the future a health perspective would be for everyone to be able to use the river the way they want, while keeping the interests of others and other types of uses in mind… So cooperation, trying to think outside the box and not shutting down new ideas, that would all be a healthy ecosystem, a healthy river, one that 15 years from now will still be a great fisheries, a great place for people to enjoy recreating on the water, will be good for wildlife, all of those things. If we acknowledge that everybody has their own use but that these uses can coexist. I think they can. It’s a matter of recognizing it, keeping our minds open, and keeping communication going. Those are the three things I think are most important.

Agency/NGO 5 also acknowledges the connectivity between human use of water resources and achieving watershed health specifically by citing the importance of balancing the demands of water resources while considering the benefits of healthy watersheds. He replied:
“My definition of a healthy Clark Fork would be one where everybody gets what they want but gives a little bit, too, and that we have healthy streams in terms of abundant fisheries, alongside healthy agriculture as well that’s operating efficiently using modern equipment that is appropriate for the location. Balancing the needs and the resource.”

In expressing a perspective that includes multiple dimensions of watershed health, the agency/NGO personnel convey an understanding of the role water that resource conservation plays in achieving the objectives discussed in their definitions. Identifying methods to achieve watershed health supports the claim that this group values for water conservation. These values are strong enough that this group can readily identify behaviors to support their value of this resource. As a result of a high level of dependency on aquatic and terrestrial resources, these respondents realize that in order to achieve their vision of healthy watersheds social factors must also be considered. One respondent describes the importance and necessity of considering multiple dimensions when thinking about watershed health when he said:

A healthy watershed is a place where if somebody wanted to get into the ag business, they can, and they could make a living off the land in a sustainable manner. Or if they wanted to get into the recreational business, they can, be it fishing or hunting or whatever or other sources of recreation. You’ve got businesses like that, you’ve individuals like that, who can come in and thrive. You’ve got communities in the watershed that are benefiting from healthy resources in the watershed. As part of that, a person wants to see a healthy stream site along the Clark Fork River and a lot of the tributaries that come into it. But it’s so much more than that. What is a healthy watershed? That’s all well and good, you can visualize, you can see that in your mind, most people can. You’ve got a nice riparian corridor along the river, everything’s doing well. But it’s so much more than that in terms of the social aspect of it. You also have to have your communities of people living in the watershed healthy and thriving and working these resources in a sustainable and responsible manner. Everybody’s happy. [laughs] Utopia. - Agency/NGO 3

Improving Watershed Health in the Upper Clark Fork Basin

Asking this group of respondents which types of projects are most needed to improve watershed health also provides responses that suggest a positive attitude towards water resource
conservation on private property. Although responses were varied and there was little overlap in the types of projects suggested, one overarching theme was that all responses focus on the conservation of water resources. Many respondents suggested a broad spectrum of specific projects ranging from “riparian area restoration and stream bank restoration”- Agency/NGO9 to “irrigation diversions” and fish passage projects- Agency/NGO 8 and “bank stabilization projects”—Agency/NGO 4. While these projects convey value for watershed health they do not necessarily suggest that implementation of these projects would require partnership with landowners.

Two agency/NGO personnel did specifically reference working with landowners on their property and as a result, specifically discussed the need for landowner participation in identifying how water resources could be improved. Agency/NGO 6 answered this question by saying, “everything’s a custom situation. There’s no overarching, “This is what people need, this is what people want.”—you’d have to ask the landowners what they want.” Agency/NGO 5 shares a similar perspective as evident in his response: “It’s kind of a tough one, because it depends on each individual property and how they operate their property and where they’re located in the watershed and stuff like that. I don’t think there’s a one-size-fits-all option for anybody.” Citing landowner participating while identifying potential projects emphasizes a positive attitude for water resource conservation specifically on private property.

Another common response from agency/NGO personnel included educating landowners about the importance of implementing water resources in a sustainable way. These responses share the ideology that with proper education conservation practices can become more ingrained in daily land management decision making. Agency/NGO 7 shared his feelings about the role that education plays in long-term resource conservation:
I think one of the biggest things that is needed is education, from my perspective in terms of contamination, education of how they can implement conservation practices and minimally or not monetarily change the way they do things. There’s education in terms of, “Maybe in the long run I would actually come out ahead if it didn’t overgraze this field, maybe not this year, but if I looked at this from a five- or 10-year perspective, I would be ahead not doing these things.” That’s the biggest thing. I really do think it comes down to education.

Education is also highly valued by Agency/NGO 3. This respondent feels responsible for educating landowners in the agricultural community, as evident by his response: “Education is probably one of the biggest keys to all of it. If you’re going to do something, the person should be learning as much as they can about how to do that and how to do it right.”

Behaviors that Agencies/NGOs Advocate for on Private Land

Current Conservation Projects Land

In order to identify the types of water conservation projects that agencies and NGOs are currently implementing on private property this group of respondents were asked to describe the types of projects that they work on with rural landowners. Their responses will assist in determining areas of priority and concern relating to water conservation. Chart 1 illustrates the types of projects that agency/NGO personnel identified as currently being implemented in the study area. Additionally, this information will be beneficial in finding areas of overlap with landowner’s natural resource priorities, potentially creating opportunities for furthering public-private collaboration on water protection and conservation projects. Furthermore, learning more about the types of projects that are currently occurring on private land will provide insight into agencies and NGO’s motivations for advocating for specific conservation practices. Results in this section will be from the perspective of the agencies/NGOs and specifically focus on the types of projects they are involved in the study area.
Agency/NGO personnel are involved in a variety of projects many of which provided multiple opportunities to connect their work to water conservation and protection efforts. Most of the respondents identified multiple projects that they are currently active in implementing. For example, several respondents who identified primary goals in water quantity and instream flow also have separate projects focused on irrigation. To further clarify this point, respondents work with landowners in more than one project area when describing their current projects.

Nearly half of the respondents reported irrigation projects as the most common collaborations with landowners. Primarily, these projects provide financial support for upgrading irrigation structures to more efficient water utilization methods. A small portion of the respondents commented on implementing projects in each of the following topics: instream flow, education, Superfund remediation, and water quality. Even fewer respondents reported implementing projects related to riparian health improvement, recreation, regulation, and fish passage/habitat, as seen in Chart 1. Given similarities in the project goals of many of the organizations that these respondents work for, collaboration between agencies and NGOs in the aforementioned project areas is very common.

Chart 1
Irrigation Methods

Irrigation is one of the largest and most important uses of water resources within this study area. The number of irrigation projects that conservation organizations are currently implementing on private property (Chart 1) also implies that this topic is an area of high priority among this group of respondents. There are a variety of irrigation techniques landowners implement based on their operations, property, and finances. These factors also contribute to difficulties agency/NGO personnel face in identifying the best irrigation techniques for water resource conservation. Many respondents recognize that choosing an irrigation system is “site specific” and that there isn’t a “cookie cutter approach” that can be applied to every property. Agency/NGO 8 identifies some of the criteria for selecting which irrigation methods should be utilized as well as his perspective on recommending irrigation techniques to landowners:

It’s site-specific. An easy out for me. Because there’s some times flood is great, sometimes pivots, sometimes hand lines, sometimes wheel lines. It just—it is really site-specific. That’s why there are so many different types out there. You just need to have whatever works best for your operation. It depends on water supply, water quantity.
The majority of respondents in this sample could not draw a conclusion as to which irrigation technique should be recommended to landowners in terms of efficiency. Agency/NGO personnel recognize that each property parcel is varied and therefore, recommendations should occur on a case by case basis. Agency/NGO 3 demonstrates this when he was asked which irrigation method he would recommend landowner utilize by saying, “It’s site-specific.” This feeling was shared with other respondents as well. Agency/NGO 3 responded to the same question stating: “…it depends on the situation as well.” As a result, many respondents initially hesitated in identifying one specific irrigation method that they would hope landowners would utilize. Once this hesitation was expressed, respondents then voiced their opinion of which techniques that they hope landowners utilize. This initial hesitation is documented in Table 13.

<table>
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<th>Table 13. Selected quotes on the variability of agency/NGO personnel irrigation advocacy.</th>
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<tbody>
<tr>
<td>“To answer your question, I don’t think there is any one system that would work best.” … “I would not say that there’s a cookie-cutter approach.”- Agency/NGO 1</td>
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<tr>
<td>“…but very site-specific. I don’t think either one is a good thing in a blanket statement.”- Agency/NGO 5</td>
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<tr>
<td>“ Because every solution needs to be customized. In terms of technology, there’s a lot of technology out there, and a lot of it is very well-known in terms of irrigation technology.”- Agency/NGO 6</td>
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Although respondents were reluctant to recommend a one-size-fits-all approach to the irrigation systems that they recommend, respondents did describe irrigation systems that most efficiently utilize water resources. “Pivot” or “pressurized irrigation systems” were the most commonly mentioned methods. Agency/NGO 4 advocated that having the ability to control the
quantity and precise location of water application is a beneficial result of this type of irrigation technology (Table 14). Another agency/NGO personnel considered the social and economic benefits to these types of systems when he said:

Pivots swept through this area when they became economical enough because people found that they could manage their ranches with way less personnel and lack of labor is one of the big constraints for effective ranching. There’s just not the people out there to help you do the work at an economical price.-Agency/NGO 6.

Using pivot irrigation also reduces the amount of water that is being removed from rivers and tributaries (Table 14), which is why Agency/NGO 1 feels that this method is best suited as a conservation measure. Table 14 includes responses from several other respondents that felt similarly about the benefits of pivot irrigation systems.

<table>
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<tr>
<th>Table 14. Selected quotes on agency/NGO personnel pivot irrigation advocacy.</th>
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<tr>
<td>“In some cases it’s switching from flood to pivot, and installing sprinkler irrigation has some advantages, but every system’s a little bit different…. But it definitely reduces the amount of water you take off of streams.”- Agency/NGO 1</td>
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<tr>
<td>“It seems to be that the trend right now is to push towards pivot irrigation. If you can also utilize a groundwater source for that pivot, if you can drill a well, that seems to be the best form of irrigation as far as conservation with the river resource in mind.”- Agency/NGO 2</td>
</tr>
<tr>
<td>“Generally, in terms of efficiency, how we measure efficiency is, the center pivot systems are probably the most efficient in today’s world.”- Agency/NGO 3</td>
</tr>
<tr>
<td>“There needs to be more of a push towards a pressurized system so that we can keep some sort of control over the amount of water and try to use it responsibly.”- Agency/NGO 4</td>
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Respondents also frequently mentioned flood irrigation when discussing water-wise irrigation methods for landowners. Respondents compared the benefits of flood irrigation to those of pivot irrigation systems, as seen in Table 13. Respondents made these comparisons
primarily because they had a difficult time delineating a superior method, which reinforced their belief that not one method is best suited for all landowners. The result of this comparison often ended with the conclusion that there are merits and shortcomings to any type of irrigation method. One example of this comparison was when Agency/NGO 1 discussed the differences between the benefits of flood and pivot irrigation:

I don’t think there is any one system that would work best. What I’ve seen out there is that in some cases changing the irrigation technology is a good approach. In other places, if we can allow for upstream fish passage when those fish are migrating and potentially keep them from going down the ditch, the flood irrigation that’s going on out there now in some places has very little impact on the fishery. In some places it may even benefit late-season flow. You give that up once you see those channel-forming flows in the spring.

Another respondent was slightly more skeptical of the environmental benefits often associated with pivot irrigation. He concluded that there needs to be more comprehensive research on groundwater storage before he feels comfortable making any recommendations to landowners. His concern is that by reducing flood irrigation in the Valley the amount of groundwater availability and distribution will also change significantly. He further explains his concern with pivot irrigation systems stating:

What happens is, you put the pivot systems in and they put more acres in. A lot of times there’s wells being drilled or they’re using more water to sprinkle more acres, because we’ve made it more effective. We didn’t reduce the amount of water. And then not having groundwater storage, we’ve laid it out there in the sprinkler and increased the evapotranspiration and the groundwater recharge is lessened. And in some drainages, eliminating the flood irrigation is an issue. I think you need a more in-depth look at that issue before you just say sprinkler is the case. - Agency/NGO 9
Table 15. Selected quotes on agency/NGO personnel comparing the benefits between flood and pivot irrigation systems.

“There’s a huge debate on if sprinklers are a good thing. I’m sure you’ll hear that from a lot of people. They’re good and bad. They’re not good everywhere. Sometimes flood irrigating can have some beneficial return flow impacts, but very site-specific. I don’t think either one is a good thing in a blanket statement. If you flood irrigate everywhere but have no water in your creek, is that the good thing? If you have sprinklers everywhere and you don’t have any return flows in the fall, maybe that’s a critical time for fish, that’s not necessarily a good thing. There’s a healthy mix of the two. In certain places sprinklers are a pretty good thing, and in certain places maybe flood irrigation has some aquifer storage properties.” – Agency/NGO 5

“If you look at old photos, you’ll see lots of pivot irrigation sprinklers coming into Deer Lodge Valley over a period of a couple decades to change the way people are irrigating. It’s changed the way water is distributed on the landscape a lot. Some people in the ag community particularly, but anybody like myself who’s interested in water has to recognize that some of the changes with pivot sprinklers are kind of scary. We’ve been flood irrigating for so long that we have established patterns of recharge to aquifers and return flows to streams that are critical to people now, because that’s the reality. That’s what we’ve established. It’s not the natural system, but it’s what the agricultural practices of the past decades established.” – Agency/NGO 6

Livestock Management Techniques

Although a small portion of respondents reported implementing projects related to livestock management, the hesitation regarding irrigation recommendations was significantly less common regarding the discussion of livestock management techniques. Based on the techniques that respondents identified, it is apparent that the greatest concern of conservation organizations regarding livestock is ensuring that they are “managed in a responsible manner” so that “resources are not degraded.” Approximately seven out of ten respondents identified keeping livestock out of waterways and adjacent riparian areas as the best way to conserve the quality of water resources (Table 16).
Within those responses several management techniques were recommended for implementing this conservation measure. One way to improve the quality of water resources is to make riparian health a priority within range and pasture management. Limiting livestock access to waterways and riparian areas significantly reduces the amount of ecological damage that livestock can cause, such as “bank trampling, changing stream dimensions, overwidening, and reduction of shade,” as Agency/NGO 1 identified. Agency/NGO 1 further describes how those factors impact stream health when he says, “All those things increase water temperature, soil erosion, sedimentation…” Several respondents identified riparian fencing as a mode to limit livestock access to riparian areas. Although fencing is typically the most common method for managing livestock in riparian areas Agency/NGO 8 identified some of the limiting factors that prevent this measure from being a sustainable solution when he said:

But then you’re fencing riparian or you’re fencing the stream away, and there is an expense to that. There’s maintenance issues. Most of these projects that we help people with, like if fences are a required part of the project, they have to maintain the fence for 15 or 20 years.

Having proper management plans in place can help minimize implementing projects that are costly and require additional maintenance, as Agency/NGO8 reinforces.

Livestock are given access to riparian areas and waterways primarily as a means for providing access to drinking water. Therefore, respondents also suggested that ranchers utilize management practices that “…keep them (cattle) off the crick”, as Agency/NGO 8 emphasizes. Water gaps or off-site watering sources are ways to control and limit the area where livestock have direct access to stream and riverbeds. Similarly to fencing, Agency/NGO 9 feels that off-site water should also be included in rancher’s management plans. This was evident as he described best management practices for livestock on private property: “What we’d hope is that we could convince them that riparian area management needed to be part of the plan and that we
had to take a look at either water gaps or off-stream water… That’s what we’re always pushing.” – Agency/NGO personnel 9. When asked the same question, other respondents were more definitive in their response and feel as though offsite watering is the best method for keeping cattle out of waterways. Agency/NGO personnel 2 replied, “Definitely an offsite water source, keep the animals out of the water as much as possible, keep them out of the river, out of the streams, try to develop some sort of offsite watering.” Minimizing livestock access to waterways also reduces access that livestock have to riparian areas. Ultimately, this provides solutions to two of the biggest concerns that this group of respondents has regarding livestock management.

### Table 16. Selected quotes on agency/NGO personnel livestock stream exclusion advocacy.

<table>
<thead>
<tr>
<th>Quote</th>
<th>Agency/NGO</th>
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<tbody>
<tr>
<td>“But in general, what we’re looking to do is keep the cattle out of streams and habitats adjacent to streams for at least as much as we can.”</td>
<td>1</td>
</tr>
<tr>
<td>“Keep the animals out of the water as much as possible, keep ‘em out of the river, out of the streams.”</td>
<td>2</td>
</tr>
<tr>
<td>“We need to do our best to keep them out of waterways. That’s an obvious reality.”</td>
<td>4</td>
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**Managing Runoff**

Keeping runoff from agricultural fields and livestock feed lots, is one conservation measure that all of the respondents, who discussed this topic, agree is important and “needs to be managed as much as possible.” The majority of respondents who discussed this topic focused on agricultural runoff, while only a small portion of respondents mentioned issues related to livestock runoff. Several respondents identify that over irrigation of agricultural fields is the most
problematic source of runoff. Agency/NGO 6 described the efficiencies of irrigation within the study area by stating, “One of the biggest issues in irrigated crop production in Montana is uneven irrigation, too much some places, too little other places in the same crop field, causing very erratic and generally lower overall production.” This feeling was shared with other respondents and expanded on by Agency/NGO 3 when he reinforced the outcome of overwatering by saying, “If they’re over applying, you’re going to get runoff.” He continued to speak to this concern by referencing the water management strategy that his department put in place to address this topic with landowners. He cites “education” as the primary tool utilized to inform landowners of the consequences of over application.

Sedimentation caused by agricultural runoff is another concern for respondents. The approaches to managing this also vary. Agency/NGO 9 describes an approach that is designed to slow down the velocity of runoff and reduce the amount of sedimentation. He details how he would implement this approach: “we’re looking at maybe some grass waterways or some field strips or something like that, any way to try to slow down the velocity and the amount and catch some sediment, have some sediment buffers.” Another method to address sedimentation is to create a separate “pick up ditch” that catches and channels runoff into a settling pond before it can reach a waterway, as described by Agency/NGO 8. Even with practices designated to resolve this issue, one respondent simply states, “it’d be easier just not to overwater.”

**Constraints of Implementing Water Conservation Projects on Private Property**

The scope of this study includes an effort to understand the constraints that landowners and agency/NGO personnel encounter during their efforts to conserve water resources on private property. As identified in the *Constraints* section of the Literature Review, individuals typically experience a series of constraints that influence their decision to engage in specific behavior. These
constraints are intrapersonal, interpersonal, and structural. Both groups of respondents identify numerous hurdles, several of which overlap across respondent groups. Agency/NGO personnel primarily described two main issues. The first involved their understanding of the constraints landowners faced. Secondly, they discussed their perceptions of how the ranching/agricultural traditions and subculture impact modern land management decision making, both intrapersonal constraints. Alternatively, landowners identified hurdles involving the struggle to find a balance between conservation and successful livelihoods, which is an intrapersonal constraint. A minority of landowners indicated a complete lack of hurdles in water conservation.

Financial

Both groups of respondents cited finances as a limiting factor. Similarly to landowner attitudes, results strongly indicate a desire by landowners to engage in water resource conservation on their property. Many of these individuals already implement some water conservation initiatives and have expressed an interest in expanding these efforts, however, the majority are unable to do so for financial reasons. Landowner 6 describes how finances limit his ability to have more efficient irrigation system on his property. He said, “Most of it, for me anyway, is a money thing, financially. You do what you can… If I had the money to invest $10,000 into a different system, it’d make it a lot easier.”

Agency/NGO personnel also experience financial burdens when attempting to accomplish conservation projects with private landowners, (Table 17). Some landowners look towards agencies for sources of funding to offset the costs of implementing these projects, however even these agencies have difficulties procuring these resources. Agency/NGO 1 confirmed this when he said:
Finding the resources to accomplish the project we want to accomplish can be a challenge. We are blessed in the Upper Clark Fork to have this settlement fund that can be utilized, but it has side boards around what the state as the trustee has determined what they think the priority is, so in some cases you can use that funding and in some cases you can’t.

Both landowners and agency/NGO personnel recognize that implementing conservation practices is expensive and requires significant time and energy to accomplish. All of these are scarce among ranchers and agriculturalists. One landowner who has switched to a pivot irrigation system largely for water conservation purposes discussed the costs associated with this change. He said, “Some of the hurdles would be finance, cost, changing over to pivots is a big cost… the pivots, to start with, they’re expensive. Maintenance is expensive, too. There’s a lot of financial things.” - Landowner 1.

Aside from the economic costs that are often necessary to install more efficient systems, landowners also consider how changing irrigation methods will impact the profitability of their operation. This can create an internal conflict for landowners as they struggle to find an equilibrium between their value of conservation and their livelihood. One landowner reinforces this finding by saying:

I think that what we run into is what I was talking about before, when you have the best intention to use best management practices that you can to conserve water, but at the end of the day, you’re running a business, being a cattle operation or haying operation or whatever it may be, and sometimes opening the riparian gates, you have to sacrifice one or the other. It’s not always easy to make that sacrifice from your business end for water. So reality, how things really work on the ground, can be a hurdle to doing what’s best for a watershed. - Landowner 2.

Other landowners shared this difficulty and also reinforced the restrictions that finances place on the amount and types of conservation projects that landowners can implement. In addition to the economic limitations, one landowner also referenced how time constraints directly impact financial gains, which in his case factor into the hurdles he faces for implementing water conservation projects on his property. He said:
The hurdles are probably the money, the financial end of things. Like I said, if I won’t the lottery, I would do a lot more conservation practices. Right now it takes all of our money to keep the fences up just to keep them in the deal. You don’t go putting in a water trough if there’s a crick and a mile of fence costs you $10,000 and you’re fixing fence every day, versus that cow can go to the crick and drink. I think that’s kind of a no-brainer. I don’t think there’s very many farmers or ranchers who have been in it very long or get to do it themselves who want to damage any of it. - Landowner 7.

Results from earlier sections indicate that landowners and agency/NGO personnel share positive attitudes towards the conservation of water resources and highly value this resource. Regardless of how supportive landowners may be for initiating conservation projects on their property, without the resources to do so, implementing these projects will not occur. The frustrations that some agency/NGO personnel feel became apparent when they identified these financial restrictions as a barrier to working with landowners on conservation projects. Agency/NGO 3 demonstrated this when he described the hurdles he faces:

There’s always that financial aspect that has to be—obviously that producer out there needs to make it work for them. I can go out and talk about pivots and all these grandiose ideas of how they should be doing something, but if they don’t have the financial means to get it done, it won’t get done. That seems to be one of the major ones that comes up a lot.

The majority of landowners are aware of funding opportunities that agencies and some NGO’s offer to offset the costs of conservation projects. Half of the landowner respondents utilized these grants to aid in the implementation of a variety of projects, including riparian fencing, irrigation systems, and livestock management. These programs are intended to make it easier for landowners to achieve their conservation goals through financial assistance. However, two landowners feel as though the reporting and management of these grants is often more trouble than they are worth. This claim is supported by one ranch manager’s thoughts on the arduous process of grant management. She said:

I think we’re lucky because we do have resources to access grants and the people who have the skills to do that sort of thing. If we didn’t have that, I would say that I would be strapped for time to make some of that stuff happen. That would be the biggest hurdle for me. Those
things take a lot of time, and there’s documentation as you move forward as you obtain a grants. Those things are still a hurdle. I have times where I’m like, “This isn’t worth it.” We’re maybe only getting a couple thousand dollars, and I’ve put hours into it, and it’s time out of my day. - Landowner 2.

In addition to the time that it takes to manage these grants, some landowners have to expend additional resources in order to uphold their portion of a grant agreement. Several landowners described the large amount of time required to maintain the projects implemented from grant funding, and the additional out of pocket expenses necessary to complete projects that they receive partial funding for. Landowner 6 described how the grant that he received for a riparian fencing project influenced his choice to forego any future grant assistance when he said:

I had to agree that for 10 years I’d maintain the fence and keep an eye on it. But of course the river washed the fence out in places when the high water come there. It seems like there’s always a catch in the agreements. And there’s people who take money from them all the time and get by just fine. I just don’t care to deal with them to the point where their money’s going to make any difference.

<table>
<thead>
<tr>
<th>Table 17. Selected quotes on financial constraints to private land water conservation by agency/NGO personnel.</th>
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</thead>
<tbody>
<tr>
<td>“…it does come down to money. These ranches, it’s—the expenses that they have are ungodly. I couldn’t even imagine that. I own a house that I think is ungodly. But the expenses they have, there’s a real hesitation of trying something new because it could mean next year’s income to them.” Agency/NGO 7</td>
</tr>
<tr>
<td>“Always money.”- Agency/NGO 8</td>
</tr>
<tr>
<td>“Let me see if I can list them in priority… number four would be money.”- Agency/NGO 9</td>
</tr>
</tbody>
</table>
Distrust and Resistance to Outside Influence

Collaboration between stakeholders is often necessary to accomplish goals in water conservation. Whether an agency/NGO utilizes private property to implement projects or landowners work with conservation organizations to secure funding for their own projects, working together is a key aspect. Both groups of respondents also identified working collaboratively as a limitation. Each group’s perspectives towards one another largely facilitates levels of willingness towards collaboration.

A small percentage of landowners perceive the regulations that agencies and other “outside” organizations impose interfere too much with their water rights. The contention surrounding water rights has been building for decades. Some landowners fear that agencies will take away their water rights through this regulation. Landowner 3 illustrates, “We’ve seen all kinds of rights taken away from us that our forefathers fought and died for and shed blood for, and the system today I think overlooks that.” The April 2015 passage of the Confederated Salish and Kootenai Tribes water compact compounds this fear. Landowner 3 discusses how he views this issue as an obstacle in his ability to conserve water resources:

The biggest obstacles I have to deal with on a regular basis are government regulations and government interaction with trying to get the water, similar to the CSKT Compact which just passed, the government trying to take water away from the useful resource that we have here and other operations.

Further encouraging this fear is a distrust of outsiders, specifically state or federal conservation agencies. This creates conflict because these agencies/NGO’s are suggesting solutions to problems that don’t fully understand. Landowner 3 reinforced this theory as he continued to describe his constraints. He said,

…and the government agencies and their personnel not understanding truly how the water works in different areas, because it is different for every ranch. They try to fit everything
into a one-size-fits-all scenario, and that’s not the way things work. That is probably the biggest obstacle I have to work with.

Landowner 6 identified similar feelings about agency/NGO personnel making recommendations on how to improve the efficiency of water resources on private property. Landowners have a deeply rooted knowledge of their property and strong intentions to care for the resources they depend on for their livelihood. From a landowner perspective, it can be perceived that when outside agencies/NGO’s propose conservation projects on private property that they are suggesting that the landowner is managing their resources irresponsibly. This leads to the perception that agency/NGO personnel consider themselves better stewards than the property owner. One landowner identified this frustration when he said, “We’re getting a lot of help from people who don’t know what they’re talking about… They’re trying to tell us how we should operate, how we should take care of our land, and we do. We all do. That’s our livelihood.” – Landowner 6.

Agency/NGO personnel also have preconceptions of landowners, which further contributes to the “misinformation”, as one respondent phrases it. This increases the hindrances of private-public relationships. Nearly half of this group reference a landowner’s distrust, or unwillingness to work with agencies as a major constraint inhibiting conservation on private land. One agency/NGO respondent summarizes her understanding of how landowners feel about the agency that she works for. Her summary is an excellent example of the biases that landowners place on agencies. She says:

The biggest hurdle to get over is, “I’m not here to ruin you. I’m here to help. Our agency can help you. It’s not us coming in and demanding you do it a certain way, but we can work together to come up with a solution.” So that very first interaction that you have with people, if they even allow for that, is a hurdle. Just getting over the fact that, “I work where I work. You know where you work, and there’s this idea that we don’t talk to each other and we don’t get along. - Agency/NGO 4
Evidence suggests that each group feels biases towards one another, further fueling underlying tensions that lead to an unwillingness to work collaboratively. The inability of each group to speak candidly reinforces a sense of distrust that these respondents harbor towards one another. These feelings are acknowledged by agency/NGO personnel, and are also seen as constraints. Agency/NGO 5 describes, “Some of the hurdles are gaining trust from landowners, being able to talk openly about different ideas.” In addition to a lack of trust, resistance to outside influence also contributes to a lack of productivity on conservation related goals.

Respondents identified two different perspectives on where this resistance from landowners stems from. Agency/NGO 1 cites cultural influence. He describes, “There’s a culture of independence, which is great, but landowners are resistant to outside influence of anybody, me, the government, their neighbors. As a hurdle, overcoming bias is probably a big one…” Although Agency/NGO 9’s perspective doesn’t directly cite cultural influence, one of the hurdles that he identifies could also be influenced by rural culture. He said, “there is a whole population out there who don’t want to get tied up with the federal government.”

*Changing Tradition*

Results also indicate that agency/NGO personnel feel that “tradition” or changes to a landowner’s operation largely hinders their ability to successfully implement water conservation projects on private land (Table 18). Individuals who inherit these operations are groomed for this livelihood by their elders. This leads to the exchange of information, specific methods and attitudes across multi-generations. Agency/NGO personnel perceive that the “generations and generations of doing it a certain way…” have ingrained “an attitude in this valley that this is the way it’s been done for generations, and that’s the way we do it.” (Agency/NGO 7). Other agency/NGO personnel
share this perception and identify that the difficulty in overcoming this challenge. Primarily, it is difficult to change people’s behaviors, as Agency/NGO 3 stated.

Changing the way that landowners manage their natural resources can be extremely risky for them. Altering this behavior can impact productivity of entire operations leading to the potential for economic loss. As a result, many landowners would rather continue implementing practices that they are familiar with so as not to increase their chances for failure. Exploring these risks with landowners was also identified as a constraint associated in making changes to traditional methods. Agency/NGO 6 describes his perception of why landowners feel this apprehension in the face of change:

> It’s all about people’s willingness to consider changes, and that’s a tough topic. People in agriculture have survived because they haven’t gone out on a limb and done crazy things that don’t make sense in the long term, and that’s why they’re still operating farms and ranches, because they made the conservative decision to not take too much risk on that wasn’t good for their family or their operation. That’s another tension in the work we do, exploring change with people who have a lot to lose from changing.

Evidence supports landowners’ unwillingness to change, and this impacts the work of agency/NGO personnel working on private property. However one respondent is also concerned that an unwillingness to change traditional practices will jeopardize landowners’ ability to maintain this way of life. According to Agency/NGO 3, many of the methods that have been passed down from generation to generation are outdated in terms of cultural, social, and technological aspects. Some landowners embrace change more willingly than others, and as a result, have adapted their operation in ways that are more modern culturally, socially and technologically. “Keeping up with the times” as Agency/NGO 3 phrases it, has kept these individuals from becoming obsolete. Strictly maintaining traditional practices not only inhibits conservation initiatives but also puts this group at risk of “not lasting very long” (agency/NGO 3) in the modern age of agriculture and ranching.
Table 18. Selected quotes on the constraint of tradition to private land water conservation by agency/NGO personnel.

<table>
<thead>
<tr>
<th>Quote</th>
<th>Agency/NGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Landowners tend to want to keep the same practices that they’ve had. Change isn’t always met with happiness. That’s a big part of not just water conservation, but also best land management practices in general…”</td>
<td>2</td>
</tr>
<tr>
<td>“Another one would be, like I mentioned previously, tradition. “This is the way my dad and my grandpa did it. I don’t see any reason to do it any differently myself.” That one pops its head up still once in a while. That’s a tough one to get over, too. [laughs] For some folks.”</td>
<td>3</td>
</tr>
<tr>
<td>“Let me see if I can list them in priority… three would be change in your operation.”</td>
<td>9</td>
</tr>
</tbody>
</table>

Perceived Negative Attitudes Toward non Agricultural Use

Agency/NGO personnel discussed perceptions of water utilization as a limitation for implementing water conservation on private property. This theme was less prevalent than previously discussed themes, but is significant to include as a constraint. The context of this topic was identified during discussions of water rights, specifically their interpretation of landowner’s attitudes towards water rights. Landowners fear losing their water rights, and this creates negative perceptions. Agency/NGO 9 described his perception:

…fear over losing water rights by allowing us to do anything different, like in-stream flow or leasing. Some of the laws have protected that, but that’s still a concern. The fear of losing it and the fear or having it all go away before the next generation, that over time it just slips away from them. So the whole attitude about water rights, number one, is a big deal.

Landowners not fully understanding the intentions of agency/NGO personnel when approached to collaborate on water conservation projects resonated with Agency/NGO 5 as well. According to Agency/NGO 5, this misunderstanding makes landowners feel threatened by project
managers and their work because landowners aren’t sure of the extent that conservation projects will interfere with their water right. This uncertainty stems from the landowners’ unfamiliarity of the projects being proposed. The landowners who practice agriculture understand the resource needs necessary to maintain a successful operation. Therefore, projects outside of that scope have been interpreted as less important, as described by Agency/NGO 9. This instills a sense of dislike for “water being used for other uses other than agriculture.” According to Agency/NGO 5.

**Negotiating Constraints**

Both groups of participants were asked to identify ways in which they might overcome the hurdles that they identified. Landowners indicated they faced financial constraints, and offered external, improbable solutions to address this constraint. Alternatively, agency/NGO respondent’s almost exclusively focused their solutions to the constraints regarding improving landowner relationships. Both groups of respondents consistently mentioned the topic of education during interviews. While there were no interview questions specifically asked regarding education or outreach, a portion of respondents chose to discuss this topic. The analysis of this topic provided insight as to how improving current education and outreach efforts could address many of the constraints identified by both groups of respondents. Each of these solutions is explored in detail below.

**Addressing Financial Constraints**

Approximately half of landowner respondents cited financial constraints as a factor contributing to the inability to implement water conservation projects on their property. The solutions that this group proposed to alleviate this limitation were varied with responses ranging
from proactive solutions, such as applying for financial assistance, to less tangible suggestions, i.e. “having more money” or “winning the lottery.”

Two individuals referenced financial assistance, but approached this topic from differing viewpoints. It should be noted that each of these respondents received grant funding previously, and were familiar with receiving and reporting on grants. One landowner used his response to discuss a specific federal grant program that he is pursuing to meet his conservation goals. This landowner was particularly knowledgeable about financial assistance offered by agencies and NGO’s. His prior experience in securing federal funding and receiving support from a local NGO proved to be a positive experience for him.

Landowner 2, however, had less positive experiences with federal grant programs. Her dissatisfaction was evident in the comments she made referencing the amount of work associated with reporting on grant activities and meeting specific project requirements within grant guidelines. As a result, her response to this question included a reference about the difficulty of relying on grant programs as a funding source: “…I don’t think there’s many programs where people will just give you money and trust that you’re going do what you say you’ll do with it. I don’t know the answer to that question.”

The remainder of respondents who discussed finances had less quantifiable solutions to this constraint. These types of responses were more matter-of-fact like “…make more money or have more money or whatever.” (Landowner 7) or “most of it, for me anyway, is a money thing, financially.” (Landowner 6).

These individuals share the common plight of many ranchers and farmers, limited financial resources. Based on their chosen livelihood, this group is familiar with insufficient
finances for additional projects, lack of technological upgrades, and sometimes overwhelming amounts of maintenance on existing projects. This likely served as a long-standing constraint to implementing conservation projects to the extent that individuals are interested in. Discussion of other opportunities to alleviate financial constraints were consistent throughout a number of interviews. However, those opportunities were intentionally mentioned to reinforce the limitations in overcoming this barrier. An example of this is Landowner 7’s repeated reference of “winning the lottery” as a catch-all solution, “But if I had my druthers and if I had plenty of money, if I won the lottery tomorrow, I would build all-new fences…”

*Enhancing Public-Private Relationships*

The majority of agency/NGO personnel’s responses contained discussions on the topic of trust. During the analysis of this topic, two sub-themes emerged 1) Respondents identified actions that would help them establish relationships and build trust with landowners 2) respondents demonstrated an understanding of the importance of maintaining trust by fostering existing relationships with landowners.

Several words reoccurred within sub-theme 1 including, “relationship” and “listening.” In discussing relationships, some respondents described the factors that contribute to “long-term,” “good,” and “personal” relationships with landowners. Agency/NGO 9 described how active listening contributed to establishing trust when he said, “Lots of one-on-one, lots of trust-building, lots of taking the time to listen and sit down with them.” Agency/NGO 1 also details specific communication techniques that he viewed as important in building trust and establishing relationships. He said:

Part of it’s establishing trust and part of it’s engaging personally, establishing personal relationships. I wouldn’t necessarily say that they’re friendships, but being friendly, being
able to look people in the eye and engage in small talk, go to the meetings and hang around and be there.

Agency/NGO 6 described the importance of listening to landowners:

We have to put as much focus as we can on good listening. We have to listen to what people say in detail with tremendous patience and attentiveness, because they know their valley. They know their history. They know the land. They know how things work. This perspective reinforces the significance of using listening as an opportunity for not only educating landowners about conservation practices, but to learn from landowners as well.

Other respondents that talked about listening and relationships focused more on the benefits associated with achieving positive relationships with landowners. Agency/NGO 3 identifies the benefits of having candid conservations that provide opportunities to educate landowners on conservation topics once a long-term relationship has been established. He said,

With those folks, you hope you’ve established a long-term relationship so you still can discuss and visit and talk with them about various things and continue to try to increase their knowledge till at some point you maybe, for lack of a better term, wear them down, [laughs] so that they start looking at, at least considering and thinking about some of the things you may have been talking about with them. It’s a longer process.

Working for a multi-departmental agency can make establishing trust with landowners especially difficult. Numerous people from different departments attempt to collaborate with the same landowner on a variety of issues, and this leads to breakdown in communication. When multiple contacts are attempting to establish relationships with a single landowner, it is difficult to build a meaningful relationship. Agency/NGO 4 remarks that in her experience a “good relationship” is established between one landowner and one agency representative. Once a baseline of trust has been established, it makes it easier for employees in other departments to work with that landowner on other issues. The concept of maintaining existing public-private relationships was also discussed amongst several agency/NGO personnel. The amount of time Agency/NGO personnel invest in building these relationships demonstrates how strongly they
value relationship building. Agency/NGO 4 references “constant contact” as a successful means of fostering the development of landowner relationships. She said,

We’re not just going to come in and suggest things and you’ll never see us again.” It’s the constant contact. When that breaks, which is does sometimes, trying to fix it, trying to fix that relationship. Because we have that going on right now. And it’s working. The relationships are being repaired, slowly but surely.

Other respondents identify the role that communication has on encouraging long-lasting relationships by keeping “open lines of communication.” Agency/NGO 5 discusses the importance of both parties “continuing to touch base and talk informally,” to create a mutual level of comfort between individuals. He continues by explaining that “being present” and open with landowners about the work that he does provides for a greater opportunity for landowners to approach him with ideas since landowners “know what you do and what you’re about.”

Agency/NGO 1 discussed identifying communication strategies specific to agency/NGO personnel; “Living by your word, honoring what you say, and sticking around when there’s problems so that you can tend to them,” are all necessary for establishing trust. Helping landowners solve problems resonated with Agency/NGO 4 as well. She described her experiences with landowners once they have adopted a management technique that her agency suggested. She said, “They will say that they’ll continue to do it this way and then—so monitoring is important, and setting that up with the landowner ahead of time so that they know that they’ll see us again. If they have more problems, we’ll try to help.” This group of respondents all focus on trust and relationships, however, it is evident that there are differing viewpoints on the best methods for achieving this.
Improving Conservation Education

Typically, respondents referenced education in two ways. First, when agency/NGO personnel referred to education, they most commonly discussed how their agencies or organizations use education as a tool for conveying their objectives to landowners. Alternatively, when landowners brought up education, they gave feedback as to whether or not the educational methods that conservation groups utilize are considered successful. It is important to include this theme in the solutions section because identification of strategies to improve landowner education and outreach will aid in improvement of public-private communication. A benefit further contributing to the establishment of trust and increasing the opportunity for conservation goals to be met on private property.

The utilization of education as an outreach tool is common among the agency/NGO personnel group. This group of respondents reported several specific methods in which they use to convey a specific message to landowners. The methods include: meetings or tours intended to inform landowners of successful public-private conservation projects, newsletters, and an annual seminar or workshop. These methods inform landowners about financial assistance for conservation related projects, and serve as outlets to inform the public about the types of projects that conservation organizations hope to partner with landowner on. Several individuals from each group discussed the importance and benefits of education as a communication tool. This allows both groups to be informed about the work each is doing. For example, Agency/NGO 5 discusses how education can be used effectively by landowners and conservation organizations to identify overlapping conservation goals. He said, “You need outlets and avenues for people to know that those sort of things are happening… I think hearing about projects, especially
testimonials from landowners on projects that do work, can be beneficial.” Landowner 3 shared a similar perspective and provided a landowner’s point of view on the topic of collective learning:

I think education is the biggest and most important thing, whether you’re talking to the ranchers or people outside of the industry. A lot of what happens is based on the ignorance towards whatever the subject is. If people don’t know, if they don’t know the facts, and they don’t really know what goes on, yet they feel like they need to make the decision that creates a lot of problems along the way. You’ve got to inform people of how things work, because it’s like any business.

As evident from earlier sections, agency/NGO personnel are aware of the level of difficulty in attempting to change landowner behavior. As a result, several agency personnel identify the role they feel they have as educators. Agency/NGO 3 described his agency’s educational objectives: “An education process, in showing those landowners that they can still be productive and produce what they need with using a lesser amount of water, just doing it in a more efficient manner.” Another agency employee agrees that it is important for landowners to understand how their productivity could be impacted by agreeing to participate in a conservation project, however he feels as though this goes beyond showcasing successful projects. He said:

If somebody comes on, whether it’s from _____ or ______, and says, “I want to go on your property and do this next to the river,” and they say, “OK, well, why the hell would you want to do that? We’ve never done that before. What’s that going do?” explaining the benefits would go a long way in terms of conservation.- Agency/NGO 7

In addition to showcasing successful projects and explaining to landowners how they could benefit from conservation projects, one landowner shares views as to the educational role that agencies/NGO’s should have. “The agency should be there to offer perspective and help on things and help resolve problems.”- Landowner 3.

In order for agencies to achieve any of the aforementioned roles or objectives it is necessary that landowners are aware of the educational opportunities available. Without that knowledge, the educational efforts of agencies/NGOs are ineffective and in some circumstances
detrimental to their goals. When landowners were asked whether they utilize any government programs, several respondents were completely unaware that any of their local agencies provided any type of assistance for water conservation projects. One landowner’s neighbor recently received funding to assist with the costs of the installation of a pivot system which he described, then asked: “I guess my question is, when _____ can get three pivots put in for what they got those pivots put in for, is that money there readily available for somebody like me if I was smart enough to get on the computer and find it?”- Landowner 5. Furthermore, this landowner was also unaware of which agency would be the most appropriate to seek funding sources from for water related conservation projects. He was also unsure of what type of projects might improve the efficiency of his agricultural operation. Similarly, although Landowner 8 is aware of the government programs that provide assistance to landowners, he did not know that those agencies offer any kind of assistance for water related projects. He said, “There are government programs available. I don’t see what would be available through the government to conserve water. I know they have programs, but I’m not familiar with them.”

Other landowners expressed a dissatisfaction with the methods that agencies/NGO’s utilize to educate landowners. Much of their concern focused on the amount of time that is required to attend the tours, workshops, and meetings that agencies heavily rely on as an informational tool. When specifically asked whether or not Landowner 2 felt as though agencies/NGO’s were successful at making their educational programs known to landowners she responded:

I think they’re doing a really bad job. For example, our local _______ who’s in charge of doing all the financial stuff and creating projects, she has, like, two annual meetings. It’s a time where people who have _____ issues or an interest in _____ go to the meetings and she’s there and you can discuss opportunities or programs available. I have never heard of anything like that being done for local agencies where maybe they have a roundtable
thing or a night where they can put up some visuals for water awareness or Q&A for what landowner concerns are regarding resources and if they have certain projects in mind, what are their options. And it’s not that they for sure don’t exist. I’ve just never been invited, and I’m involved in most of the agencies, and I’ve never heard of them. They’re voluntary, so you go to them when you want something. But it’s another time thing. It would be nice maybe if there was an evening or two during the year where they made an effort to make projects known or funding.

Landowner 3 also shared his frustration with the amount of time required for him to learn about the available resources, issues pertaining to water conservation, and conservation projects. He said, “I don’t have time to run to meetings and run over to the Capitol building.” He continued by expressing the value that he sees in these educational opportunities by concluding “but you’ve got to make as much time as you can and do those things.”

Agency/NGO 5 recognized that landowners’ time is limited, however it hasn’t changed how his organization approaches their educational offerings. His organization relies heavily on project tours although he acknowledges that “sometimes tours can be too big of a time commitment, too, for people to go wandering around someone’s property for the day.” Another component to these tours is for landowners to provide testimonials about the success of the project that was implemented on their property. This method however, also has shortcomings, as identified by Agency/NGO5:

I think hearing about projects, especially testimonials from landowners on projects that do work, can be beneficial. Sometimes landowners also don’t—it works for them, but they may not be the type of personality who feels comfortable going out and advertising what they did because they might perceive that as being too sympathetic to your cause… Maybe an individual project worked out for them, but each project’s different, so it’s hard to say that you support everything the organization does.

A different agency utilizes a quarterly newsletter to educate landowners about various topics throughout the year. In discussing its inefficiencies, Agency/NGO 8 said, “We put out a newsletter that has something in it every time that would potentially benefit. I don’t know that that many people read it and take it to heart.” As a follow up question he was asked whether or
not he thinks that landowners are aware of the educational offerings that his agency hosts. His reply was, “Probably not. There’s a certain amount who are… Pretty much everybody gets our newsletter, so if they read it, they are aware.” Once again, despite identifying the shortfalls of the educational tools utilized by this organization, there was no discussion of improving these methods or utilizing more effective methods. An evaluation of the effectiveness of agency/NGO led educational offerings is necessary in order to improve communication of projects goals and maximize success. This evaluation will advertise the resources that are available to landowners that will assist them in achieving their conservation goals.

THEORETICAL IMPLICATIONS

This study contributes to a broader understanding of the connection between attitudes and expressed behaviors within the cognitive hierarchy proposed by Vaske and Donnelly (1999). A significant amount of research exploring the human dimensions of natural resource management utilizes the cognitive hierarchy model to demonstrate that value orientations toward natural resources influence an individual’s attitudes, norms and behavioral intentions (Bruskotter & Fulton 2007; Fulton et al. 1996, Manfredo et al. 1997; Vaske & Donnelly 1999). More specifically, it addresses the need for additional analysis on the role of attitudes in predicting behavior in natural resource management (Vaske & Donnelly, 1999). This study examines the relationships between rural landowners’ environmental attitudes and behavioral intentions to implement water resource conservation projects on private property. Furthermore, through the use of a novel constraints theory, landowner’s attitudes towards water resources are mediated by landowner constraints when considering participating in water conservation partnerships on their property.

There are three major themes that emerged and influence landowners’ positive environmental attitudes towards water conservation including; 1) Livelihood dependency on water
resources, 2) Self-identification as stewards of the land, and 3) Communal responsibility in managing water resources.

Building upon the hierarchical relationship, this study further supports a strong connection between attitudes and the practice of water conservation behavior. All of the landowners who discussed livelihood dependency on water resources also identified multiple water conservation behaviors in which they are currently implementing on their property. For example, several landowners expressed the importance of water resources in supporting the success of their livelihood. As a result, these landowners were strongly driven to participate in conservation related practices because these behaviors also support their livelihood and way of life. Demonstrating this connection, some Landowners used pivot irrigation systems. These very same Landowners also utilize best management practices for managing their cattle along waterways, such as riparian fencing, utilizing sustainable grazing management, and watergaps or water tanks.

Additionally, some landowners choose to use non-commercial fertilizer to avoid chemical runoff on their property. One landowner also utilized livestock, such as sheep, to minimize noxious weeds as an alternative to chemical application. This same landowner also utilized riparian fencing to reduce his livestock’s access to riparian areas. Some landowners practiced rotational grazing and implement measures to keep their livestock off of the streambed. Results from this study demonstrate the role that attitudes have in predicting behaviors related to natural resource management decision making. Further confirming the role of attitudes in predicting conservation related behavior.

A variety of barriers confront natural resource managers and landowners when implementing water conservation projects on private land and can hinder private-public conservation partnerships. Similar to Crawford, Jackson, & Godbey’s (1999) leisure constraint
model, agency/NGO personnel and landowners are faced with intrapersonal, interpersonal, and structural constraints that guide their participation in collaborative water resource conservation initiatives on private property. Slight modifications were made to the leisure constraint model to understand how constraints mediate the attitude-behavior relationship in water conservation practices. Once an attitude has been established, it is believed that landowners continue to navigate the same hierarchical constraints that leisure participants encounter when determining participation. As a result, the model introduced in this study creates opportunities for application of a hierarchical constraint theory in a broader context than its applications in recreational studies.

According to the model proposed in this study, intrapersonal constraints largely influence an individual’s attitude toward water conservation. Similar to Crawford, Jackson, & Godbey’s leisure constraints model, intrapersonal constraints are influenced by human psychological states, and include preferences formulated by personal values. Therefore, once a landowner has established a positive attitude toward an object, there is a high likelihood that intrapersonal constraints that an individual may encounter may easily be overcome. However, our findings suggest that these intrapersonal constraints may be difficult to overcome.

Findings indicate that landowners and agency/NGO personnel have positive attitudes regarding water resource conservation. However, results suggest that each group experienced intrapersonal constraints while navigating their attitude toward water conservation. Agency/NGO personnel experienced two specific intrapersonal constraints: their understanding of the constraints landowners faced, and their perceptions of how the ranching/agricultural traditions impact modern land management decision making. The only evidence supporting intrapersonal constraints of landowners is the difficulty to find a balance between livelihood success and conservation. Several landowners expressed their desire to implement or expand water resource conservation initiatives
on their property, supporting their role as a land steward. However, many of these landowners are unable to implement conservation initiatives because majority of their resources are used to support the success of their ranching or agriculture businesses. Therefore, these individuals are left feeling conflicted regarding their role as a steward and business owner.

Positive attitudes towards water conservation persisted within both groups of respondents despite these intrapersonal barriers. This signifies that this constraint was not influential enough to negatively affect attitudes, or it had already been overcome before the implementation of this study. As a result, neither group of respondents provided solutions for overcoming this barrier. Therefore, additional analysis focused on the interpersonal and structural constraints faced by these individuals.

Interpersonal constraints introduce variables that influence behavior resulting from interpersonal relationships, or in this case, collaborative partnerships. In order to foster conservation oriented collaboration between these groups of respondents, it is important to understand the variables that limit each project partner’s decision to collaborate on conservation related projects. Conservation agencies and NGO’s both identified trust as one of the greatest barriers to working with private landowners on natural resource issues. This finding is consistent with other literature that has identified trust as being a key reason for the failure of projects or collaborations (Hendee, 1984; Metcalf et al., 2015; Olsen & Shindler 2010; Lachapelle et. al 2003; Davenport et al. 2007). Although there is limited empirical research on the prevalence of distrust and poor interpersonal relationships specific to water resource conservation, there is significant research in other natural resource contexts conducted (e.g. fire, climate, and natural resource management). Findings from this study indicate that poor communication and non-active listening by both agency/NGO personnel and landowners are underlying factors contributing to trust
constraints. Data indicates that these factors contribute to the interpersonal constraints that landowners encounter, and can make it difficult for this group to move past this constraint altogether. This results in poor interpersonal compatibility and coordination between landowners and agency/NGO personnel.

In addition to trust as an interpersonal barrier, a large portion of landowners also identified resistance to outside influence as a constraint in implementing water conservation projects on their properties. Several landowners mentioned two specific instances where they had negatively associated experiences with outside influence such as, state and federal regulation over water resources and when agency/NGO personnel offer unsolicited recommendations on improving conservation initiatives on private property. For some landowners these interpersonal constraints were powerful enough to dismiss their willingness to collaborate with agencies or NGO’s on projects directly related to water conservation altogether, although both of these landowners still participate in water conservation initiatives on their own.

For other landowners, interpersonal constraints are less influential in determining participation in conservation related practices, therefore creating a higher likelihood for successful interpersonal compatibility and coordination with agency/NGO personnel. For example, many landowners in this study identified interest in partnering with conservation agencies for the purposes of receiving financial assistance from them. The financial resources available to complete specific conservation initiatives outweighs other factors that might otherwise prevent these landowners from engaging in public-private partnerships. The strong desire and motivation to complete a conservation project is represented in the majority of landowners within this study that have overcome interpersonal constraints. As demonstrated in this study, landowners who can overcome interpersonal barriers are more willing to collaborate with agencies/NGO’s on
conservation related projects. This concept aligns with Crawford, Godbey, and Jackson’s findings which conclude that only when interpersonal constraints are overcome can an individual advance their negotiation of structural constraints (1999).

A large majority of individuals from both groups of respondents reported that the most common structural constraint they face is a lack of financial resources to engage in implementing conservation related projects. When confronted with structural constraints, landowners identified two underlying constraints: a lack of knowledge about financial assistance available through collaboration with conservation agencies/NGO’s, and how financial factors influence the scope of conservation practices they implement on their property. Several landowners acknowledged that financial constraints have greatly influenced their inability to participate in water conservation projects. A lack of tangible solutions to this landowner specific structural constraint further contributes to nonparticipation in water resource conservation projects on private property. Other landowners expressed that with a better understanding of financial aid, they would likely consider utilizing their property for collaborative conservation projects.

Agency/NGO personnel also identified finances as a constraint, primarily in the context of expressing acknowledgement of the financial limitations that landowners experience. Agency/NGO also described the challenges of finding and securing sources of financial assistance for landowners to utilize through organizations. Although both groups of respondents identified financial constraints, results indicate that this constraint is more likely to be navigated by landowners rather than agency/NGO personnel. However, agency/NGO personnel are better positioned to help landowners alleviate the financial limitations that they experience by effectively communicating and understanding conservation goals of landowners. This type of communication
can aid agency/NGO personnel in identifying sources of financial aid that best fits landowner’s project and financial needs.

Modification of Crawford, Jackson, and Godbey’s leisure constraint theory has proven to be successful in its application of understanding the role of attitudes in determining participation in water conservation projects on private property. However, there are weakness in the application of this model in the context of water resource conservation. Utilizing this model of constraints draws the assumptions that partnerships are required to implement conservation related practices on private property. As seen in this study, this assumption is false, as some landowners chose to implement certain conservation-related initiatives without assistance from agencies or NGOs. This consideration completely eliminates the need for landowners to navigate interpersonal constraints. Therefore demonstrating that although constraints can influence participation in water conservation projects, overcoming all levels of constraints is not necessary in determining participation in water conservation behaviors.

Landowners and agency/NGO personnel share positive attitudes towards water resource conservation on private property in the Deer Lodge Valley. Through in-depth interviews and analysis, this study contributes to the understanding of complex social processes in the scope of natural resource management. The attitudinal assessment within this study provides additional information supporting evidence claiming that attitudes serve as a preliminary predictor of conservation related decision making and behavior. Furthermore, application of constraint theory to natural resource management has contributed to an understanding of what influences project partners ability to overcome constraints impeding water conservation on private land. Use of this constraint theory has also informed natural resource managers of the complications likely to arise when implementing collaborative partnerships in rural communities. Addressing complex social
processes within the scope of natural resource management is an unavoidable consequence of working across diverse groups of stakeholders.

DISCUSSION OF MANAGEMENT IMPLICATIONS

Findings from this study help natural resource personnel understand the factors contributing to landowner constraints in implementing water resource conservation projects on private property. It is evident that the majority of agency/NGO personnel can identify at least one domain of constraints that landowners experience when determining participation in water conservation projects on private property. However, as apparent in this study, many landowners experience a multitude of complex constraints which influence their participation in the collaboration and implementation of water related conservation projects. Therefore, understanding each of these dimensions provides agency/NGO personnel with the potential to improve interactions between stakeholders, ultimately assisting in overcoming some of the interpersonal constraints impeding collaborative partnerships.

Given the collaborative nature of many of the water resource conservation projects that agency/NGO personnel hope to implement within the study area, constraints between landowners and agency/NGO personnel warrants further discussion. Consistent with previous literature, many landowners in this study self-identify as stewards of the land. Some individuals even argued that ranchers and agriculturalists are the best land stewards as a result of their deeply rooted knowledge of their property and their livelihood dependency on natural resources. However, many of the landowner participants in this study also own and operate ranching or agricultural businesses, requiring them to utilize water resources (albeit responsibly) on a daily basis. As a result of this natural resource issues continue to persist on private property. Many of the agencies and NGO’s included in this study exist to address the need to ensure the health and
protection of natural resources, primarily by reducing water use by landowners. This implies that there is a gap between the way in which landowners perceive themselves as stewards and their actual behaviors of best management practices on the land. Additionally, the juxtaposition of how landowners and agency/NGO personnel view implementation of the conservation of water resources creates a direct competition between stakeholders. As a result, this contributes to an underlying tension between agency/NGO personnel and landowners. The difference between landowner’s self-identification as stewards and the practices that they implement creates a need for agencies and NGOs to fill this gap. This has generated the perception that landowners may not be the best environmental stewards further fueling tension between agencies/NGO’s and landowners.

Many of the agency/NGO participants in this study discussed taking an individualized approach to making conservation related management recommendations regarding natural resources on private property. I recommend that agency/NGO personnel take the same approach when interacting with landowners. Results from this study highlight a multitude of factors that motivate individuals to implement water resource conservation projects on their property. Therefore, utilizing a blanket approach for communicating with landowners and building relationships within a population that has diverse conservation goals is predisposed for failure. Implementing a new model for building interpersonal relationships focused foremost on listening to the needs of landowners would provide agency/NGO personnel the opportunity to improve their relationships with landowners and build trust. Additionally, this would also allow for more collaborative decision making regarding the management of natural resources.

Changing attitudes and behaviors requires a large time commitment from all potential conservation partners. Therefore, in order for multi-partner conservation initiatives on private
property to be successful, agency/NGO personnel must work slowly to implement measures that require behavioral change. Listening to landowner’s perspectives regarding the resource concerns they encounter on their property could aid agency/NGO personnel in better understanding the ecological goals of agricultural and ranching landowners. This perspective is often embedded within larger economic goals and therefore can be difficult to tease out. This peer-to-peer learning strategy also increases the potential to generate a greater number and higher quality of collaborative conservation partnerships. As previously identified, landowner respondents from this study have ecological, social, and economic ties to their land, which further complicates the decision making process that determines participation in conservation behavior.

In order for conversations with landowners regarding conservation initiatives on their property to be successful, I also recommend that agency/NGO personnel approach these discussions with an ability to dismiss their own ecological goals. This study found that both groups of respondents have ecological goals, but approach them from differing perspectives. Therefore, it is important for agency/NGO personnel to take the time to listen to landowner’s perspectives regarding the resources on their property before starting a conversation about their organization’s ecological goals. This approach may better equip agency/NGO personnel with the ability to identify areas of compromise and mutually beneficial ecological goals. A strategy that is beneficial for building trust as well as productive interpersonal relationships.

By continuing to utilize ineffective methods of communication with landowners, agencies/NGO’s miss the opportunity to overcome social barriers that create inaccurate biases regarding natural resource managers and agencies. The longer that inaccurate biases exist, the
more normative these perceptions become, thus making it more difficult to overcome these false perceptions.

Many agencies/NGO’s have limited time and resources available to expand the scope of their workplans. Despite this fact, dedicating time for building relationships and understanding the social complexities of trust would be beneficial for meeting project management objectives. If resource managers could improve their relationships with project partners, fewer barriers may arise throughout the implementation phases of these projects. Relationship building would also potentially increase landowner participation and “buy-in.”

Although many natural resource professionals understand the importance of building trust and positive relationships, many of them have limited backgrounds in human dimensions. Further training or professional development focused on this dimension of natural resource management would contribute to a broader understanding of this subject, broaden the methods and strategies necessary for building trust, and improve efficiency in project implementation. Devoting a set amount of time to this task would shift natural resource manager’s priorities, integrating trust and relationship building into the daily operations of these agencies and NGO’s.

Dedicating time to address the social barriers impacting the effectiveness of private-public conservation efforts would improve the quality of relationships between landowners and agency/NGO personnel and has the potential to increase participation in these projects. Improving communication and education methods as well as prioritizing this implication of natural resource management would largely contribute to diminishing this barrier.
FUTURE RESEARCH

Findings from this study help conservation partners involved in water resource conservation projects to understand the factors that shape landowner and agency/NGO personnel’s attitudes towards this topic. Furthermore, results provide insight into the constraints that stakeholders navigate as they make decisions about participating in water conservation initiatives. This study contributes to existing knowledge in the field of human dimensions of natural resource management. However, there is a need to expand upon some of the theoretical implications within this study.

In Vaske and Donnelly’s 1991 study, the researchers request additional information regarding a better understanding of the role of attitudes in predicting behavior, as well as, the role that values and value orientations have in determining attitudes, behavioral intentions and behaviors. Further exploration of the value orientations of natural resource agency/NGO personnel and rural landowners would provide a more comprehensive and scientifically sound understanding for how project partner’s attitudes are influenced and ultimately influence water conservation behaviors. Results from this study provide preliminary glimpse into personal values amongst stakeholders, such as trust and honesty, however, this finding is weak and needs further research. Utilizing similarities between stakeholder values could contribute to improving trust and reducing communication barriers between these groups of respondents. Another opportunity for identifying additional commonalities between stakeholder’s values is to further analyze the role of value orientations within rural landowners. Respondents from this study are all part of rural culture, and as a result, should share similar basic beliefs embedded within this culture. However, this study found only touched on differences in value orientations between respondent groups, especially during the application of value orientations associated with natural resources on an
anthropocentric-biocentric continuum. Thus, future analysis examining how personal values influence value orientations in the scope of natural resource management is needed. Additionally, further tests should examine the validity of an anthropocentric-biocentric continuum when applied to project partners engaged in water resource conservation.

With an adaptation specific to water resource conservation, initial application of Crawford, Godbey, and Jackson’s leisure constraints model to a discipline outside of the recreation field has proven useful. Additional research analyzing natural resource decision making is needed to understand the benefit and potential success of future applications of this model. Crawford, Godbey, and Jackson propose that utilizing a hierarchical model to determine participation requires sequential navigation through each constraint (1999). Therefore, research establishing a better understanding of how intrapersonal constraints influence attitudes towards water resource conservation is warranted. Although this study provided a foundation for understanding solutions to address the interpersonal constraints associated with multi-partner water conservation projects, additional research on this subject is needed. Results from this study found that many rural landowners are unable to overcome interpersonal constraints. In order to improve collaborative participation in water conservation related projects a better understanding of this constraint and how to overcome it is necessary.

CONCLUSION

In the context of water conservation on private land, public-private partnerships face a variety of issues limiting the productivity of water conservation in the Deer Lodge Valley. The inadequate understanding of stakeholders’ attitudes regarding water conservation on private land contributes to a lack of trust for and resistance to conservation agencies and NGO’s. This leads to difficulties in implementing water conservation initiatives on private property. Additionally, poor
execution of educational methods and communication strategies targeted towards landowners about the resources that are available to assist them in meeting their conservation goals also diminishes the productivity of landowner-agency/NGO collaboration.

Despite landowner’s self-identification as stewards of the land and their best intentions to conserve natural resources, water conservation often comes secondary to ensuring the financial success of their operations. The risk associated with making changes in how ranchers and agriculturalists utilize natural resources on their property presents a major constraint to collaboration. Furthermore, financial restrictions prohibits implementation of these projects. Water resource conservation agencies and NGO’s are equipped with resources to address the interpersonal hurdles that stakeholders face, as well as provide low-risk solutions to intrapersonal and structural constraints associated with initiating conservation projects. Assessment and improvement of education and outreach methods utilized by conservation agencies/NGO’s is a necessary implication for addressing the barriers of conservation on private land identified in this study.

As Superfund remediation in the Upper Clark Fork basin progresses, communities are presented with new opportunities afforded by watershed health. However, these benefits are only sustainable if the watershed health is maintained. Although the health of water resources are improving drastically as a result of Superfund remediation, climatic conditions remain variable resulting in the limited availability of water resources. Project partners need to overcome personal biases and integrate a broader understanding of the social dimensions of multi-stakeholder partnerships. Until this is achieved, conservation on private land will perpetuate unnecessary conflict regarding seemingly different attitudes, goals, and vision for watershed health.


APPENDIX I

Agency Interview Guide:

Thank you for your interest in our study about environmental attitudes and water resource conservation within the Deer Lodge Valley. We are quite pleased to have the opportunity to hear your perspectives on these topics. Our questions will take about one hour to answer.

We want to audio record the interview. The audio recording is to help us later analyze general themes and trends in the data. In order to protect your identity, we will not use actual names in any subsequent publications; only a pseudonym will be used.

The interview will be transcribed by a professional within two months of the interview. All of the audio recordings will be destroyed once the transcription is complete, approximately three months after the transcription. Is it okay if we record this interview?

This study is voluntary and confidential. You can choose NOT to answer any question and/or stop the interview at any time.

1. Tell me about your experience with water conservation on private land.

   Probe: How would you define water conservation?

   Probe: How important is water conservation to you? Why?

2. What kinds water conservation practices do you work with rural landowners on?
Probe: How do you hope that landowners utilize their land?

Probe: What type of irrigation system should landowners use?

Probe: How should landowners manage their cattle along the waterways on their property?

Probe: How do you think runoff from fields should be managed?

Probe: What types of projects/work are most needed?

3. What are some of the hurdles practicing water conservation with landowners?

Probe: Do you have any ideas of how you might overcome these hurdles?

Probe: Do you offer any programs that could help landowners conserve water resources on their property?

4. What do you think a healthy Clark Fork Watershed looks like?

Probe: How do healthy resources affect families in the Deer Lodge Valley?

Probe: How do healthy water resources affect communities in the Deer Lodge Valley?

5. Who do you see as responsible for keep water resources healthy?

Probe: How does your organization work to keep watersheds healthy?

Is there anyone you’d recommend that we talk to?

Can I say that you recommended that I contact them?

If there’s anything you think of later, please feel free to give me a call.
Landowner Interview Guide:

Thank you for your interest in our study about environmental attitudes and water resource conservation within the Deer Lodge Valley. We are quite pleased to have the opportunity to hear your perspectives on these topics. Our questions will take about one hour to answer.

We want to audio record the interview. The audio recording is to help us later analyze general themes and trends in the data. In order to protect your identity, we will not use actual names in any subsequent publications; only a pseudonym will be used.

The interview will be transcribed by a professional within two months of the interview. All of the audio recordings will be destroyed once the transcription is complete, approximately three months after the transcription. Is it okay if we record this interview?

This study is voluntary and confidential. You can choose NOT to answer any question and/or stop the interview at any time.

1. Tell me about your experience with water conservation on your land.

   Probe: How would you define water conservation?

   Probe: How important is water conservation to you? Why?

2. What water conservation practices do you currently use on your property?

   Probe: How do you utilize your land?

   Probe: How do water rights affect how you utilize water on your property?

   Probe: What type of irrigation system do you use?

   Probe: How do you manage your cattle along the waterways on your property?
Probe: How do you manage runoff from your fields?

3. What are some of the hurdles practicing water conservation in your property?

   Probe: Do you have any ideas of how you might overcome these hurdles?

   Probe: Do you utilize any government programs to help you conserve water resources?

4. Can you tell me how you would describe a healthy watershed.

   Probe: How do healthy resources affect you and your family?

   Probe: How do healthy water resources affect your community?

5. Who do you see as responsible for keep water resources healthy?

   Probe: On your private land?

   Probe: In your community?

Is there anyone you’d recommend that we talk to?

Can I say that you recommended that I contact them?

If there’s anything you think of later, please feel free to give me a call.