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Ruffled Feathers: Shared narratives in the sage-grouse management conflict in Sublette County, Wyoming

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RUFFLED FEATHERS: SHARED NARRATIVES IN THE SAGE-GROUSE MANAGEMENT CONFLICT IN SUBLETTE COUNTY, WYOMING

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ABSTRACT

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The tense conflict over sage grouse management in the West, where livelihoods have been pitted against the possibility of an endangered species listing, has been ongoing for many years and has been described as being as tense as the spotted owl conflict in the Northwest in the 1990s. This research is designed to highlight the different frames or narratives within the sage grouse debate in Sublette County, Wyoming while exploring a resurging research methodology. Q methodology, a method intended to identify distinct viewpoints within a sample was employed to understand the different narratives among these conflict parties. The Q method suggested three distinct viewpoints or knowledge communities existed within the sample: ultra locals, classic biologists and harmonizers. Ultra locals largely consisted of ranchers (75%) and others dependent on the land for their livelihood and showed a strong preference for local county management that included local information. The narratives of the classic biologists, a group consisting solely of biologists working for agencies, consulting firms and conservation organizations, preferred that science and research point the way to a solution. Finally, agency biologists and energy industry employees made up the final group identified, the harmonizers. This group favored working with all stakeholders to work together to build a solution. A number of areas of agreement including the lack of support for an ESA listing, and disagreement such as the role of predators on sage grouse populations were highlighted. To move forward on the conflict, this research suggests that instead of pursuing issues that may only serve to increase the conflict, such as issues of predators or sources of knowledge, a path forward may be found in merging the livelihood interests of ranchers with the preservation interests of biologists. Results also show that the Q method was helpful in pinpointing distinct viewpoints on sage grouse management in Sublette County; however, without the use of an in-depth interview, the Q method results may have been difficult to clearly and meaningfully interpret.

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Introduction

Wyoming is currently in the midst of an environmental conflict. Some have compared it to the spotted owl conflict in the Pacific Northwest in the 1990s (Wilkinson 2004) where fears over the loss of livelihood were pitted against the preservation of a small, charismatic bird. Described as a conflict of jobs versus the environment, echoes of this well-known environmental conflict can be heard in Wyoming's issue with greater sage-grouse (*Centrocercus urophasianus*) management. In fact, it can be imagined as the spotted owl v2.0. Concerns over the loss of livelihood are seen to be in opposition with environmental and species conservation. Like the Pacific Northwest, the conflict over sage-grouse management in Wyoming ignites fears over the loss of livelihood, from ranching to natural gas development setting them against concerns over the loss of a charismatic bird and its habitat.

Throughout Wyoming, those reliant upon the land for their livelihood, both ranchers and energy company employees as well as residents relying upon the economic stimulus resulting from the increase in gas development are seemingly at odds with specific environmental groups advocating for federal Endangered Species Act (ESA) protections to the sage-grouse. The oil and gas industry is quickly constructing new wells on private and public lands to extract energy resources, bringing new jobs and wealth to the area. Ranchers with oil or gas leases on their land are now receiving new royalty checks and residents of Southwestern Wyoming are benefiting by way of increased state, city and county wealth from energy development severance taxes. New schools, parks and community centers have recently been opened across Western Wyoming (Stitchfield et al. *in press*). However, this development has other consequences. Biologists have documented negative impacts of energy development on the natural landscape and its wildlife inhabitants such as limits on survivorship and negative impacts to habitat (Dohorty 2008, Walker 2008, Walker et al. 2007, Naugle et al. 2006, Holloran 2005).

Some environmental groups argue this impact is so severe that the sage-grouse should receive federal Endangered Species Act (ESA) protections. As of today, nine petitions have been filed with the US Fish and Wildlife Service (USFWS) arguing for federal ESA

protections by at least 30 organizations and six individuals (Kritz 2007). None of the petitions have resulted in federal protection for sage-grouse populations; however, actions are still pending in the federal courts.

Those opposed to listing the sage-grouse, for example, those in the energy industry as well as some ranchers, are wary of federal government control, because of the loss of development opportunities and infringement on private property rights. Furthermore, some believe that a listing action will severely threaten their livelihood by closing the natural gas fields and eliminating grazing on public lands. If the small game bird were to be designated as endangered there may be serious consequences for the oil and gas industry and its local employees. Drilling operations may be limited or halted and many could lose their jobs and private royalty checks would no longer be available to ranchers with energy development on their land. Some ranchers believe that if the bird receives federal protections they will no longer be able to access their US Bureau of Land Management (BLM) or Forest Service (USFS) allotments to raise their cattle. Without these allotments ranchers may not be able to continue ranching as they will not have enough land to both raise their cattle and their feed. This may lead them to sell their property and leave the ranching way of life.

Unfortunately, there is a dearth of research exploring the social and political dimensions of environmental conflicts in the West and specifically the conflict over sage-grouse management in Wyoming. Because of the recent expansion of energy development in the area and the biological data on the ecosystem and the species, a project to explore the knowledge and frames within the issue of sage-grouse management is aptly timed. This research investigates how actors in the conflict surrounding sage-grouse management in Sublette County, Wyoming prioritize knowledge and ideas to build frames within the debate. It will then seek to understand how, if at all, these different ways of prioritizing knowledge contribute to the conflict.

To understand the different frames among these parties, this study employs Q methodology. First, because Q methodology is intended to identify distinct viewpoints within a given sample, and second, as it has only recently emerged in human dimensions

of natural resource conflict research, the research question provided an appropriate opportunity to explore the utility of Q method as research tool in this context. Specifically, this research is designed to evaluate how useful Q method is in measuring and capturing the various viewpoints within a complicated multiparty conflict and to evaluate whether Q method is a useful way of identifying and understanding how residents frame the sage-grouse debate within Sublette County.

Outline of thesis

The remainder of the thesis contains four chapters. It begins by describing and summarizing relevant literature including a more detailed summary of the sage-grouse management debate, the nature of conflict, and social science concepts that have been used to help explore social conflicts (specifically the concepts of social construction and framing). Next, the methods section introduces the methodology to be evaluated as a research tool, Q methodology. The following chapter presents results from the data analysis coupled with the discussion to enrich the understanding of the research findings. The final chapter presents conclusions related both to the sage-grouse management debate (what are the knowledge communities, how do the frames/viewpoints they hold differ, and what does that mean with regard to an opportunity to resolve the underlying conflict) and to the question about the utility of Q-method as an approach for studying this type of resource conflict.

Literature Review

The Sage-grouse Conflict

The conflict over sage-grouse management is a premier example of natural resource conflict in the West. It involves long-time ranching families, federal and state management agencies and new westerners all living in mostly rural areas of the Intermountain West. Many of these individuals purport to value conservation, yet despite this seemingly shared value, conflict over conservation abounds.

The Intermountain West is home to vast areas of sagebrush (Knick 1999). This sagebrush ecosystem is one of the largest ecosystems in the US with historic measurements of over 100 million hectares (West 1999). In the past decade much of this area has seen tremendous change, including increased energy development. Vast areas of sagebrush sit above rich energy resources of natural gas and due to new technological advances in accessing and harvesting natural gas deposits they are now able to be developed. This recent energy development has significantly impacted the sagebrush landscape (Copeland et al. 2009). Although the specific estimates of this impact could not be found, overall 25% of the sagebrush ecosystem has been lost (West 1999). As a result, some consider the ecosystem to be endangered (Thompson 2007, Knick 1999).

Due to this significant decline, researchers have sought to identify appropriate umbrella species, whose management is intended to protect the unique biodiversity of sagebrush ecosystems and communities as opposed to a single species (Fleishman 2000, Rowland et al. 2006). Fleishman defines an umbrella species as a "shortcut for conservation planning" and a "species whose conservation confers a protective umbrella to numerous co-occurring species" (569, 2000). The sage-grouse has been proposed as a possible umbrella species for various scales of sagebrush ecosystems as it is a sagebrush obligate species (Rowland et al. 2006, Rich et al. 2005, Connelly et al. 2004, Rich and Altman 2001).

Historically, sage-grouse were found in 15 Western states from North Dakota to California; however, sage-grouse populations mirror declines in the sagebrush ecosystem (Connelly and Braun 1997). Long-term records show that in nine of eleven states where sage-grouse occur sage-grouse populations have decreased by an average of 33% (Connelly and Braun 1997). Furthermore, five of the same eleven states showed a 25% average production decrease. Negative responses to energy development were found in seven out of seven peer reviewed studies (Dohorty 2008) including coal-bed methane in Eastern Wyoming (Walker et al. 2007) and natural gas development in Sublette County (Lyon and Anderson 2003). More specifically, one study concluded that if development were to continue in the Pinedale Anticline, a substantial natural gas energy field in Sublette County, Wyoming, local populations of sage-grouse would be extinct within 19 years (Holloran 2005). Future projections of the effects of energy development in the West predict a 7-19% decrease in sage-grouse populations over the coming years (Copeland et al. 2009). Other negative impacts to sage-grouse populations include, West Nile Virus (Naugle et al. 2000), drought (Connelly et al. 2000) and predators (particularly non-native species such as red foxes) (Connelly et al. 2000). Both positive and negative population effects have been measured from grazing (Beck and Mitchell 2000, Crawford et al. 2004), and measured effects from hunting on sage-grouse populations are low (Reese and Connelly in-press).

Sage-grouse and the Endangered Species Act

As a result of these and other similar studies nine petitions were filed with the US Fish and Wildlife Service (USFWS) arguing for federal ESA protections by at least 30 organizations and six individuals (Kritz 2007). To date none of the petitions have resulted in federal protection for sage-grouse populations. However, actions and decisions are still pending in court.

Before outlining the many stages of the conflict in the federal system, it is important to understand why an ESA designation might affect current activities across the sage-grouse's range. When a species is listed under the ESA, the Secretary of the Interior,

usually through the USFWS, has up to one year to designate critical habitat for the newly protected species (16 UC 1533 (6)(c)(ii)). By its definition, critical habitat is public or private land designated to aid in recovery of the protected species (16 USC 1532 (5)(A)). The ESA requires all federal agencies proposing actions where threatened or endangered species occur to consult with the Secretary of the Interior before beginning construction. This consultation is intended to ensure the "continued existence of any [protected] species" and prevent "destruction or adverse modification of critical habitat" (16 USC 1536 (a)(4)). Therefore, if the species were to be listed the designation of critical habitat could potentially alter plans for devolvement on public lands and on private lands where large projects, such as energy development, are proposed.

To gain a better understanding of the degree to which the sage-grouse issue has been addressed in the legal and federal government systems, a history of the petitions, reports and court cases will be valuable. Between 2003 and the end of 2004 three separate petitions were filed with the USFWS to list the sage-grouse under the ESA. After a status review of the best available science, as required by the ESA (16 USC 1533 4 (a) 3 (b)), the USFWS published their decision that the listing was not warranted (70 FR 2243). As a result of this finding, a complaint was filed in federal district court by Western Watersheds Project (WWP) under the Administrative Procedures Act (APA) accusing the USFWS of making an arbitrary and capricious listing decision.

In December 2007, more than a year later the district court of Idaho ruled in favor of WWP in light of a DOI Inspector General Report revealing political tampering with scientific information in the USFWS's sage-grouse decision (Western Watersheds Project v. United States Forest Service) by Julie MacDonald, a high-ranking political appointee (Department of Interior 2007). Specifically, the report documented how MacDonald, who lacked any formal training in the sciences, "'ignored good science' related to the Endangered Species Program" (Department of Interior 2007, 4) and bullied employees to produce documents that supported her political viewpoints not to list the species (Department of Interior 2007).

The December 2007 court ruling remanded the listing decision back to the USFWS to reconsider. After much anticipation, the USFWS issued their most recent decision on the management status of sage-grouse. Based on the evidence they reviewed, they announced that the listing the species was warranted, but due to a number of factors, including the number of species in more danger of extinction, the listing was precluded (75 FR 13909). Since this announcement one complaint has been filed in federal court in Idaho (WWP v USFWS) and one notice of intent to sue delivered to the DOI and USFWS (Belenky 2010) by WWP and the Center for Biological Diversity, respectively.

The matter of sage-grouse management has not been resolved and is clearly political. However, as this thesis will show, the conflict over sage-grouse management is more complicated than litigation can fully reveal or address. The conflict is woven into the fabric of the details of some Western resident's lives, including values, livelihoods and frames. This conflict will undoubtedly continue beyond this research. Despite this, the following discussion provides additional evidence of the intensity of the conflict at hand.

The Nature of Resource Conflicts

Conflict has been studied across a number of disciplines including communication, political science and other social science disciplines. Consequently it has been described in a number of different ways. Wilmont and Hocker (2005) defined conflict as an expressed struggle between parties with perceived incompatible goals, scarce resources and interference from others in achieving their goals. Pinkly (1990) defined conflict as a decision making process whereby participants partake in a sort of filtering process determining how conflict parties interpret and define a conflict. Parties accept or ignore information about the conflict, in turn engendering the conflict and its shape as they encounter new information on the conflict. Duane (1997) characterized different types of conflict including cognitive, relationship, interest and value conflict.

Identifying the nature or type of conflict can be helpful in identifying the most appropriate pathway toward resolution. For example when a conflict is exclusively

cognitive, or comprised of a different understanding of the facts, the path to resolution becomes clear - one must simply determine and agree on the facts of the issue. Interestingly, this could be the rationale behind many scientists' focus on education and attempting to increase people's understanding of noteworthy scientific knowledge when attempting to solve social problems related to natural resource management (Patterson et al. 2000). For instance, grizzly bear managers often focus solely on public education over grizzly bear management in hopes of solving the problem by showing the public their scientific evidence. This approach, although coordinated with the best intentions, does not address the complexities of the conflict including specific cultural values, goals and interests that influence an individual's frame and consequently how they view the issue, nor does it recognize that an educational approach is a political act serving to privilege scientific knowledge.

Furthermore, while Duane's (1997) categories are helpful in conceptualizing social conflict they are not mutually exclusive or exhaustive. Scholars have described many other types of conflict from various types of interpersonal conflict, from relationship conflicts, to task or goal related conflicts and conflict about process (see Jehn 1997, Jehn and Mannix 2001). Some conflicts display the characteristics of many types of conflict. For example, a conflict over use and extraction of minerals under a wilderness area may show elements of interest conflict as well as cognitive conflict. However, when conflicts are constituted of different elements, part identity conflict, part value conflict, for example, the path to a resolution is much more complicated (Creighton 1981).

The above example over the use and extraction of minerals in a wilderness can be described as a wicked conflict as can many natural resource conflicts (Nie 2003, Larch et al. 2005). Wicked conflicts are ill-defined and rely upon political judgments for their solutions (Rittel and Webber 1973). They are context specific, depending on the specific facts and situations (social, economic and so on) of the conflict at hand. These specifics make the conflict unique. Instead of having a solution that can be objectively deemed by all as either true or false, as in mathematics or physics, the solutions proposed for a wicked problem are seen as "better," "worse" or "satisfying" depending on the

perspectives those participants involved in the conflict. Therefore, solutions to wicked problems are anything but simple. As Rittel and Webber (1973) explain,"[w]e use the term 'wicked' in a meaning akin to that of 'malignant' (in contrast to benign) or 'vicious' (like a circle) or 'tricky' (like a leprechaun) or 'aggressive' (like a lion in contrast to the docility of a lamb)" (160).

Wicked conflicts surrounding natural resources use and management are increasing. In particular, these wicked problems have surfaced in the Rocky Mountain West. Look no further than water use and distribution, wilderness designation, old growth timber and timber harvesting jobs, spotted owls, wolf and elk populations, and sage-grouse and energy development. Evidence of wicked problems in natural resources, specifically wildlife management, is plentiful.

Conflicts over wildlife management in the West, such as wolves, sage-grouse, spotted-owls and black-footed ferrets serve to demonstrate how wildlife management issues have become wicked, entangled in issues of identity, economics, values and politics with no clear solution (Saterfield 2002). This wicked nature of wildlife conflict has only increased as social context, including the aforementioned urbanization, has shifted the meaning of wildlife from utilitarian (such as the idea of hunting) to emotional (such as wolves as a spiritual entity) (Sutherland and Nash 1994). Based on this idea, Patterson et al. (2003) trace the social underpinnings of wildlife, wildlife science, current culture and their link to increased conflict over wildlife policies. They write that,

> "as remaining rural communities feel the pressures of urbanization, wildlife conflicts can become conflicts not just over specific animals, but conflicts over larger sociopolitical concepts such as equity, tradition, private property rights, government control, power, and acceptable forms of knowledge" (172).

Because the above ideas are more complicated than the older, more utilitarian idea, highlighting the root of conflicts over wildlife have become more difficult. As a result, finding amicable solutions to these conflicts has become more difficult.

Sublette County Wyoming may not be experiencing the degree of urbanization seen in other parts of the West; however, the recent changes in the physical and social landscape of the area may have resulted in different ways in which members of the community value and relate to wildlife. Thus rather than merely adopting a definition of conflict as resulting from scarcity of resources and competing goals; or as a decision making process; or merely classifying different types of conflict, an effective way to better understand these conflicts is to better understand differences in how the increasingly diverse population of Sublette County frame the issue of sage-grouse management. In other words, this research agrees with Brummans et al. (2008) that making sense of a conflict is often a matter of understanding the way that stakeholders frame the issue.

Social Construction

Before moving into a complete discussion of framing, it is important to understand the concept of social construction. Social construction is a broader concept under which the concept of framing falls. Broadly speaking social construction deals with how individuals come to view reality. To better understand social construction, it can be compared to the belief that an objective, tangible reality is the sole influence driving what people understand as real (Forsyth 2003).

Water can serve as a useful example for illustrating the difference between the two perspectives. Objective reality defines water as H_20, always definitively composed of a preset combination of hydrogen and oxygen. It is real and undisputable; this is what water is. When ideas of social construction are introduced, the idea of what water is in reality remains unchanged. What is different are the more plastic meanings of water influenced by cultures and societies. For example, water as a source of recreation in a river or lake influenced by a culture valuing recreation. This idea of water may not be as widely shared as the tangible realities of water are. These constructed ideas of water can

change, depending on a number of factors, such as "cultural, social, political and economic context" (Shriver and Peaden 2009, 145).

In other words, something thought of as having set and widely understood meanings, such as water, may in fact mean different things to different people depending on their unique vantage point. This unique vantage point may be defined by livelihood, geography, economics or other cultural features. These differences in meaning provided by various situations and context can be significant. For instance, an elk may be perceived as a nuisance by some. It may forage and thus destroy economically valuable winter feed for a rancher's cattle. Someone in a different context, though, may instead view the elk as a beautiful creature serving a purpose within an ecosystem. These two meanings of elk are clearly different; however, the tangible reality of what an elk is remains unchanged. In the end, things can hold two levels of meaning, one of an undisputable reality and those ideas that are socially constructed based on experiences and societal norms. Collectively, knowledge and perspectives are constructed into discourses reflective of experiences, facts and norms and are powerful in determining how information is perceived.

This discussion is meant to underscore how ideas and interests can be constructed; however, it is not meant to diminish the tangible realities that also influence perspectives and interests. In this research economic interests may play an important role in building interests and ideas of sage grouse management, from ranchers trying to run a cattle operation to biologists working as consultants for oil and gas companies, economic interests may be a powerful force in determining the realities and perspectives of conflict parties.

Framing

One way to construct and define reality is though the process of framing. Frames are important in constructing meanings (Putnamn and Holmer 1992), especially within conflicts. The unique lenses though which people view their world and build knowledge or reality are thought of as frames. As a result, one might say reality is formed through

particular frames and through the process of framing. Frames have been discussed at length in communication literature (see Bateson 1972, Goffman 1974, Pinkley 1990, Putnam and Holmer 1992, Lewicki et al. 2003, Putnam and Shoemaker 2007, Rogan 2007, Brummans et al. 2008) and have more recently been discussed in literature surrounding environmental management conflicts (Harris 2009, Shriver and Peaden 2009, McBeth and Shanahan 2004, Nie 2003). First defined by the work of Goffman (1974), frames are "the basic frameworks of understanding available in our society for making sense out of events" (10) and serve to "locate ourselves with respect to [an experience]" (Gray 2003, 12). Furthermore, "[f]raming refers to the process of constructing and representing our interpretation of the world around us...Frames are used to (1) define issues, (2) shape what action should be taken and by whom, (3) protect oneself, (4) justify a stance we are taking on an issue, and (5) mobilize people to take or refrain from action on issues" (Gray 2003, 12, 15). Moreover, frames serve as a type of map, a way to guide one through a means of interpreting the world around us.

In the context of environmental conflicts, frames serve to define the problem and its associated issues (Pinkley 1990, Gray 2003). In doing so, information is selected that is consistent with their frame and information that is inconsistent with the frame is discarded (Pinkley 1990, Elliot et al. 2003). As information and ideas are collected and selected conflict definitions are formed (Gray 2003, Putnam and Wondolleck 2003). For example, imagine a conflict over water distribution, one increasingly common in the West. A frame within the conflict may underscore the importance of in-stream flows to water quality and maintaining fish habitat. By way of defining the problem of water distribution as one associated with water quality and fish habitat, the scope of acceptable solutions is narrowed. According to this frame, an ideal resolution would ensure water remains in the natural stream channel to provide for fish habitat and assure water quality. Another frame in the issue may underscore the importance of water to irrigation, valuing the (economic) productivity of water to maintaining one's agricultural livelihood. Clearly, these two frames do not support the same problem definition or conflict solution and are therefore mis-matched frames. Mis-matched frames can often result in conflict (Putnam and Holmer 1992).

Frames can also be thought of "as a type of story" (Nie 2003, 321) or narrative. In calling for increased attention on discursive issues in environmental conflicts, Harris (2009) specifically underscores the need for attention to understanding narratives forwarded by conflict parities. Harris describes these narratives as, "stories that are told about environmental issues…ways that enable the reader or listener to come to certain conclusions about the world" (2009, 701,703). The attempt to understand narratives is similar to the examination of frames to better understand conflicts. Both an in-depth look at frames and narratives center on the ways which participants interpret their surroundings and make sense of the world. Indeed, recall that making sense of a conflict is often a matter of framing (Brummans 2008, 26).

Framing is not a linear process. Instead, it regularly grows and expands upon its prior frames, at times resulting in a new frame. This process, reframing, happens when a frame context shifts and changes the interpretation of the situation defined by the frame (Putnam and Holmer 1992, Gray 2003). Reframing can be accomplished by actors subscribing to a given frame or by those external to a given frame story. For example, one can think of two different frames describing wolves: "wolves are killers" or "wolves are important top predators." In a debate about wolves it is possible for one interest group to begin the discussion by seeking to frame "wolves as killers" by highlighting the killing of livestock, elk and domestic dogs by wolves. Alternatively another group of stakeholders may try to reframe the issue as "wolves as important top predators" by underscoring how wolves serve to create a healthier ecosystem by maintaining ideal ungulate populations. Reframing is an ongoing process as conflict parties negotiate conflict meanings among each other, through dialogue, media and other interactions (Putman and Shoemaker 2007). As a result, frames are considered dynamic and shifting.

Recall that "[f]raming refers to the process of constructing and representing our interpretation of the world around us" (Gray 2003, 12). The example above, referring to the framing of wolves, reflects how individuals can select information that is consistent with their conflict frame. This selection is often based on one's position in the world,

from multigenerational Western rancher to Native American Shoshone to middle-class Google employee to prominent public figures. These positions situate and construct the reality of individuals. In other words, one's position in life plays a role in deciphering, interpreting and framing the world. Consequently, frames are often situated and built using information or knowledge that is consistent with that situation or with one's world view (Haraway 1988, Nygren 1999, Turnbull 1997, Tenkasi and Mohrman 1999, Robbins 2000, Elliot et al. 2003, Forsyth 2003, Gray 2003, Birkenholtz 2008, Berkes and Berkes 2009, Moore and Stilgoe 2009). For example, the frame of biodiversity exists within the contexts of ecologists and biologists (Escobar 1998). However, simply because individuals belong to what researchers may label the same stakeholder group does not necessitate that they share the same frames (Brummens et al. 2008). For instance, simply because all participants are ranchers does not mean they will share the same frame. Instead, it is possible, but not inevitable. In other words, these realities may not match with simple cultural labels such as, ranchers, environmentalists, loggers and so on. Instead, they may be more nuanced, representing differentiated groups of individuals and how they view and construct society.

Furthermore, frames can be used strategically (Brummans et al. 2008). Strategic framing is often more prominent in conflict as frames can be used to "win" public opinion (Brummans et al. 2008) creating a common cause or a shared views of problems, solutions, enemies and heroes (Gray 2003). These strategic frames can be launched, or propelled into debates through public meetings, newspapers, organizational literature or other similar media outlets, and as a result can be adopted by conflict parties and the general public (Brummans et al. 2008). Similarly, strategic frames can be contested by the use of other strategic frames through the process of reframing.

The following section aims to explore different knowledge types and how they have been viewed in the literature. More specifically, it serves to highlight tensions arising between these different knowledges and comment on how they may affect conflicts.

Types of knowledge

Frames can also build recognizable knowledges, like science. A shared knowledge often necessitates or builds on a certain world view or reality that may be different from others. These shared knowledges are based on similar frames, realities and world views and occur "across time, cultures and individuals" (Patterson and Williams 2002, 14).

One example of a shared knowledge is science. Science is often seen as fact, rigorous, cumulative (Nygren 1999), universal (Nygren 1999, Hess 2009, Thomas and Twyman 2004), generalizable (Nygren 1999, Hess 2009), objective (Turnbull 1997, Thomas and Twyman 2004), true (Turnbull 1997), testable, verifiable, replicable (Thomas and Twyman 2004) and written (Fischer 2000). Furthermore, science is sometimes described as separate from the culture from which it was produced, or free of context (Fischer 2000).

However, those in the new and developing discipline of science and technology studies (STS), a discipline questioning of the accepted neutrality of science and the role institutions such as governments and universities in shaping how the environment and society are managed (Forsyth 2003), explain that the boundaries of science are "fuzzy" (Hess 2009) and that

> "'science' is no single thing: characteristics attributed to science vary widely depending upon the specific intellectual or professional activity designated 'non-science'…The boundaries of science are ambiguous, flexible, historically changing, contextually variable, internally inconsistent and sometimes disputed" (Gieryn 1983, 792).

These fuzzy boundaries highlight how scientific knowledge is also subject to social construction (Nygren 1999, Turnbull 1997, Forsyth 2003, Patterson et al. 2003). This is not to say that science is not valid. Instead, it is meant to say that "scientific knowledge

production is a *social activity*" (Turnbull 1997, 553, emphasis in original). What is accepted as science and rejected as non-science, for example in various professional, peer-reviewed scientific journals, is often based on changing social norms and standards of science. The negotiation of scientific norms is a social process (Nygren 1999, Forsyth 2003).

Other knowledges can be constructed in a similar fashion, through a process of accepting and rejecting ideas based on social norms, cultural beliefs, or political ideologies. Examples of other types of knowledges are traditional environmental knowledge (TEK), indigenous knowledge and local knowledge. Although these terms are intertwined, their definitions are slightly varied (see Agrawal 1995, Nygren 1999, Berkes and Berkes 2009). This research will focus on the broad category of local knowledge as recent literature conceptualizes local knowledge as inclusive of traditional environmental knowledge and indigenous knowledge (Berkes and Berkes 2009).

Local knowledge is heterogeneous and "emerge[s] out of a multidimensional reality in which diverse cultural, environmental economic and socio-political factors intersect" (Nygren 1999, 282). Local knowledge is collective, experiential knowledge and often passed down through generations (Nygren 1999, Fabricius and Koch 2004). Others note that like science, local knowledge is shifting (Nygren 1999, Fischer 2000) and often contested (Agrawal 1995, Nygren 1999). Furthermore, it is practical, strongly rooted in place (Nygren 1999) and socially situated (Nygren 1999), or intimately tied to the context for which it was meant (Fischer 2000). As a result of this rich contextual nature, testing local knowledge as science, a formerly common practice to test the "validity of local knowledge, is not a relevant exercise" (Fischer 2000, 202). This testing procedure often removes the context from the knowledge, rendering if less meaningful, if not meaningless (Fischer 2000).

There is a clear and obvious tension between local and scientific knowledge (Nygren 1999, Birkenholtz 2008, Moore and Stilgoe 2009) that can be traced back to a time where local and scientific knowledge were historically seen as two opposing discrete realities

(Thomas and Twyman 2004). Where local knowledge and local knowers, such as indigenous groups, were deemed "primitive and pre-scientific" (Nygren 1999) by Westerners. Local knowledge was looked down upon and marginalized resulting in a Western-led scientific response to problems of local knowers (Forsyth 2003). Local knowledge was seen as non-knowledge whereas science was seen as *the* knowledge. Thus, "[t]hanks to the modern commitment to – if not obsession with – the wonders of science and technology, local knowledge has long been ignored" (Fischer 2000, 195).

However, contemporary ideas of knowledge underscore the blended nature of knowledge. That is, local knowledge is not purely local as local people and experts rarely live in complete isolation from ideas of Western science, especially in the era of mass globalization (Thomas and Twyman 2004). Similarly, science is not entirely scientific and can be influenced by local knowledges, such as a farmer's knowledge of favorite watering holes for wildlife on private land. As a result, it would be false to present knowledge as a discrete dichotomy of simply either science or local. Instead, knowledge is "heterogeneously constituted" (Murdoch and Clark 1994, 129) representing the concept of hybrid knowledge (Murdoch and Clark 1994, Agrawal 1995, Nygren 1999, Thomas and Twyman 2004, Birkenholtz 2008). For example, scientific experts often use local knowledge as a place to begin scientific inquiry (Agrawal 1999, Fischer 2000, Birkenholtz 2008) resulting in a blending of local and scientific knowledge (Agrawal 1995, Forsyth 1996, Nygren 1999, Usher 2000, Thomas and Twyman 2004, Berkenholtz 2008).

This blending of local and scientific knowledges can also contribute to tensions and create conflict between knowledges and those subscribing to the knowledge. Often there is a struggle over which knowledge will dominate in shaping such things as public opinions or policies. For example, in the debate over appropriate responses for climate change some parties advocate based on science while others on their own personal experience. Those supporting science may claim that science should point to solutions and shape the public debate, but the parties using their experience may not support this use of science engendering a tension between the parties over the use of science and other

knowledges. This idea of contested knowledge result from an understanding that knowledge holds a degree of power and political sway to inform and make policy decisions affecting people's lives and the environment.

The Politics and Power of Knowledge

Politics and power are inextricably connected to framing, social construction, and the role of knowledge in natural resource conflicts. Recall that frames can be constructed strategically, aiming to influence decision makers and their constituents (Brummans et al. 2008, Hess 2009). For example, in the debate over whether to list a species as endangered or threatened, a frame elevating the value of science and scientific data is often seen as one that can "win" (Doremus 2004). This is mainly due to the statute's privileging of science in making listing decisions (16 USC 1533 4 (a) 3 (b)). In other words, narratives highlighting scientific findings can be viewed has having a political effect, swaying policy decisions. This demonstrates how some knowledges and types of knowledge may be used for political purposes based on their perceived power.

The goals of this study are not necessarily to comment on the appropriateness of science as privileged knowledge, but instead to attempt to better understand how differences in using knowledge to define and outline conflicts over natural resources may contribute to conflicts. This study serves to underscore how those involved in contemporary environmental conflict can work strategically, politically employing their knowledges, to build frames and conflict definitions. Furthermore, it seeks to understand how these definitions serve to further conflict.

Knowledge communities

At this point, it is clear that different types of knowledge and associated frames can become a tool in discursive environmental conflicts. Many scholars studying environmental conflict have used specific terms to describe groups of people who share ideas about conflict definitions, solutions and other ideas about environmental issues. These terms include communities of knowing (Tenkasi and Mohrman 1999), knowledge

communities (Forsyth 2000), clusters (Brummans et al. 2008) and epistemic communities (Böschen 2008). However, these terms all seem to have their roots in Hajer's concept of discourse coalitions (Hajer 1995). Discourse coalitions are

> "unconventional political coalitions [who] …develop and sustain a particular discourse, a particular way of thinking about environmental politics. These coalitions are unconventional in the sense that the actors have not necessarily met, let alone that they follow a carefully laid out and agreed upon strategy. What unites these coalitions and what gives them their political power is the fact that its actors group along specific story-lines that they employ whilst engaging in environmental politics" (Hajer 1995, 13).

These coalitions are not coalitions in the typical sense in that they do not meet to strategize about issues of interest. Instead, because they share the same story of a conflict, they act in similar ways to support it (Hajer 1995). Similar to the idea of discourse coalitions, are knowledge communities (Forsyth 2000). Many scholars underscore the importance of social situations, for example, livelihoods, careers and positions of power in defining environmental knowledge communities. Forsyth (2000) notes that these communities are "socially, materially and epistemologically aligned" (141). Both Hajer (1995) and Forsyth (2000) note that these groups can form political alliances that sometimes vying among each other to define and frame issues and solutions and to gain power in the conflict (Forsyth 2000).

Although the terms knowledge communities and discourse coalitions are similar, it is unclear at what scales either would operate. For example, are discourse coalitions formed at larger scales due to the importance of media (Hajer 1995)? By using the word community has Forsyth implied that knowledge communities form at smaller scales? Importantly, the concept of community in conservation has been ill defined (Agrawal and Gibson 1999). The notion of communities in conservation has been reified as existing only at the local scale with individuals with shared norms and social structures. Others

suggest that communities are heterogeneous and differentiated, occur at multiple scales and are composed of divergent politics and ideas (Agrawal and Gibson 1999).

This thesis adopts this more contemporary look at communities, as proposed by Agrawal and Gibson (1999), their knowledge and associated politics and power. This concept of communities is aligned with Forsyth (2000), Hajer (1995) and Agrawal and Gibson (1999), responding to calls for an increased look at discursive issues within environmental conflicts (Hajer 1995, Brumans et al. 2008, Harris 2009). Knowledge communities will be thought of as heterogeneous (Agrawal and Gibson 1999) groups, in this case within the geographic boundaries of Sublette County, Wyoming. Although the groups may or may not interact, they share politically aligned narratives or frames on the issue of sage grouse management. These shared narratives are what bind them together and justify their consideration as distinct descriptive groups.

Methods

The Q method is an appropriate method to explore the issues of knowledge and the use of frames in the debate over sage-grouse management in Sublette County, Wyoming. However, to gain a richer understanding of the perspectives of participants, in-depth, semi-structured interviews of each participant were also conducted. The following outlines both the Q sort and interview methods employed.

Q methodology

Q methodology was first developed in 1935 by William Stephenson, a student of Charles Spearman, as a sort of discourse analysis integrating both qualitative and quantitative research methods with the aim of studying human subjectivity (Brown 1980, Robbins 2000, Tueler et al. 2005), or as Mckeown and Thomas (1988) said, "a person's communication of his or her point of view…anchored in self-reference" (12). In other words, the Q method is designed to identify and describe distinct groups, opinions or viewpoints within a given issue of study, providing a method to model and represent different points of view (Brown 1980, Tuler et al. 2005).

This method asks participants to sort a Q set, or a series of statements, photos or ideas, on a continuum most representative of their opinion from most to least agree. The results, completed Q sorts, are then factor analyzed in search of clusters of distinct viewpoints. As a result, participants are put into groups according to their completed Q sorts with each group representing a unique opinion or shared viewpoint.

Tuler et al. (2005) uses a cooking metaphor that is helpful in describing what Q method is intended to accomplish. Imagine a study seeking to understand the categories of culinary dishes that exist within a culture. Researchers might provide a kitchen full of ingredients to a small but diverse group of individuals from that culture. Participants are invited to cook their favorite meal, specifically with their culture in mind, with the provided ingredients. Participants are free to vary the amount and order of the ingredients as they

see fit based on their different cooking styles. Because the small group of cooks selected is diverse it is likely that the resulting dishes will vary. However, these dishes may easily be separated into distinct categories by analyzing the patterns of ingredient usage: soups, desserts and appetizers. These three groups have unique definitions, setting them apart from each other in important ways.

Because Q method separates people with similar views into groups it is distinct from many other research methods. Many standard quantitative research methods are referred to as R studies, named after Pearson's r correlation coefficient and are intended to compare the relationship among measured traits using factor analysis (Brown 1980, McKeown and Thomas 1988). Likewise, social science uses R studies to compare relationships among traits. The Likert scale is one such model in the category of R studies commonly used among social scientists.

To better describe the difference between Q and R studies, it is helpful to understand the idea that within a Q sort, each measured trait is to be centered on a single measuring unit (Brown 1980). In the case of a Q study, the common measurement scale in Q sort is a participant's subjective meaning or opinion. In other words, participants are asked to arrange a set of statements in an order that makes sense to them. This common scale allows for correlation among people and their Q sorts. In this way, Q studies correlate people and their opinions instead of correlating traits as an R does (Brown 1980, McKeown and Thomas 1988).

The sample in a Q study is the number of statements, ideas or photos each participant is asked to arrange. The population is all the possible statements on the topic of interest (Cross 2005, Tuler et al. 2005), and the variables are each of the completed Q sorts (Tuler et al. 2005) (See Table 1). In the aforementioned cooking metaphor, the ingredients serve as the sample which is taken from the population of all possible cooking ingredients. The variables are the different combinations of ingredients comprising the meal and the results are the different categories of dishes (Tuler et al. 2005). For example, in this research the sample consisted of the statements used in the Q set taken from the population of possible statements to be made on sage-grouse management in

Sublette County, Wyoming. The variables are the Q sorts completed by each participant and the data analysis reflects the different ways participants view the debate over sage-grouse management in the County.

Population	Sample	Variables
All possible statements on the topic of interest (Tuler et al. 2005).	Items to be sorted in the Q sort (Cross 2005, Tuler et al. 2005).	Participant's completed Q sorts (Tuler et al. 2005).

Table 1: Summary of Q method components.

After each respondent has completed their Q sort, a follow-up interview is recommended (Brown 1980, Excel 2005). First, because Q method is designed specifically to highlight clusters of distinct viewpoints, it may not adequately address other research questions. As a result, conducting an in-depth or semi-structured interview may be helpful. Second, the interview provides the researcher with an opportunity to ask participants any questions about their completed Q sort and to gain clarity and depth of the participant's views.

Once both the interview and quantitative data is collected, data analysis can proceed. Qualitative data can be analyzed both idiographically and nomothetically (Patterson and Williams 2002) while quantitative data can be analyzed using standardized statistical software, such as SPSS or with programs designed especially to handle Q sort data, such as PQMethod.

Justifying the use of Q methodology

Since the birth of Q methodology it has grown to be used in many research fields from psychology to public health to strategic planning (Donner 2001, Cross 2005). However, Q methodology has only recently gained more widespread popularity within political and

social sciences as well as in environmental studies (Webler et al. 2001, Byrd 2002, Tuler et al. 2005, Mattson et al. 2006, Robbins2006). For example, Webler et al. (2001) used a Q sort to determine how individuals involved in a public participation process over management of Northeastern forests conceived of a good public participation process. Their analysis identified five distinct viewpoints regarding what a public involvement process should look like within forest planning. Q method was selected for use in this study in part for its ability to identify these prevailing viewpoints or frames within the conflict over sage-grouse management. Notably, Brummans et al. (2008) and Tenkasi and Mohrman (1999) state that within one conflict there may be "clusters" or "subcommunities," of frames or discourse about the conflict despite a shared experiences among the parties. Putnam and Holmer describe how differences in framing between these groups lead to mismatched frames engendering a conflict (1992). Q method was chosen as an appropriate measurement tool to fulfill the research objectives for two reasons. First, because it is intended to identify distinct viewpoints within a given sample, and second, as it has only recently emerged in human dimensions of natural resource conflict research (by far R studies have dominated quantitative approaches in this field), the research question provided an appropriate opportunity to explore the utility of Q method as research tool in this context.

Preparing a Q sort

Q sorts are designed to integrate both quantitative surveys and qualitative interview methods. As a result, preparing a Q sort resembles a bit of both research logics. However, preparing the Q sort is more similar to preparing a survey, whereas, analyzing all the data from both the Q sort and the subsequent interviews more closely resembles qualitative data analysis. There are many steps to preparing a Q sort. The following section aims to outline the process as well as provide an overview of how Q sort was used in this study.

A Q sort is made up of items, in sum called the Q set, intended for a participant to sort according to their subjective opinion (Cross 2005). These items are sorted based on a

condition of instruction, also sometimes called a domain of subjectivity or umbrella question (Brown 1980, McKeown and Thomas 1988, Robbins and Krueger 2000, Donner 2001, Tuler et al. 2005). The condition of instruction is specifically designed to "focus the attention of respondents" (Robbins and Kruger 2000, 638) and provide a context in which the participants will sort the Q set (Tuler et al. 2005). Most importantly, the condition of instruction must explain to the participant how they are to sort the items (e.g. from most to least agree, from most agree to most disagree).

The condition of instruction can be in the form of a question or a fill-in-the-blank statement. -These instructions can also describe a particular situation and ask participants to complete the sorting activity as if they were in that situation. A combination of these ideas is also acceptable. Some examples are:

1. How would you most like to see sage-grouse managed in Sublette County, Wyoming? Arrange the items from which you most agree to least agree.

2. If you could decide the fate of sage-grouse in Sublette Country, you would _____. Sort the statements according to your opinion, from the outcomes you would most like to see to those you would least like to see.

3. Imagine you are a federal Bureau of Land Management biologist talking to someone from the Northeastern part of the US attempting to help them understand what is happening to the sage-grouse in Sublette County. What would you say to them? Organize the items that would include in the conversation from most likely to least likely.

Following the condition of instruction is a set of simple sorting instructions on how participants were to complete the Q sorting activity. This was done to ensure each participant had the same instructions to complete the Q sort activity. These sorting instructions directly follow the condition of instruction. For example, the sorting instructions for this study were:

1. *Read through all of the statements carefully, twice.*
2. *Arrange the statements into three groups:*

a. *statements you most agree with,*
b. *statements you most disagree with, and*
c. *statements you feel neutral about. Statements you are not sure about you can also put in this group.*

3. *Arrange each group of statements from most to least agree and place one statement on each square of the pyramid in front of you.*
4. *If you have any questions at any time, please feel free to ask.*

The next step in preparing the Q sort is gathering the items each participant will be asked to sort given the condition of instruction selected. This involves a series of steps beginning with selecting the concourse of statement moving to the subconcourse and ending with the Q set (see Figure 1). First, one must select a concourse of statements (Brown1980, Robbins and Krueger 2001, Webler et al. 2001). The concourse of statements is much larger and more inclusive than the Q set will eventually be and should include statements about the research topic of interest. These items can consist of statements, sentences, photos or images and can be gathered from a variety of sources including, public comments, reports, newspapers, professional or popular literature, media, flyers, focus groups, websites or individual or group interviews. The concourse of statements should be as "wildly inclusive as possible" (Tuler et al. 2005, 251), or should encompass the greater conversation and accordingly should "mirror the range of commentary being voiced" (Brown1980, 260) on the topic of interest. For instance, the final Q-set should include ideas found in all the sources examined (e.g., all newspaper articles, all public comments and the content of all interviews conducted on the subject of interest).

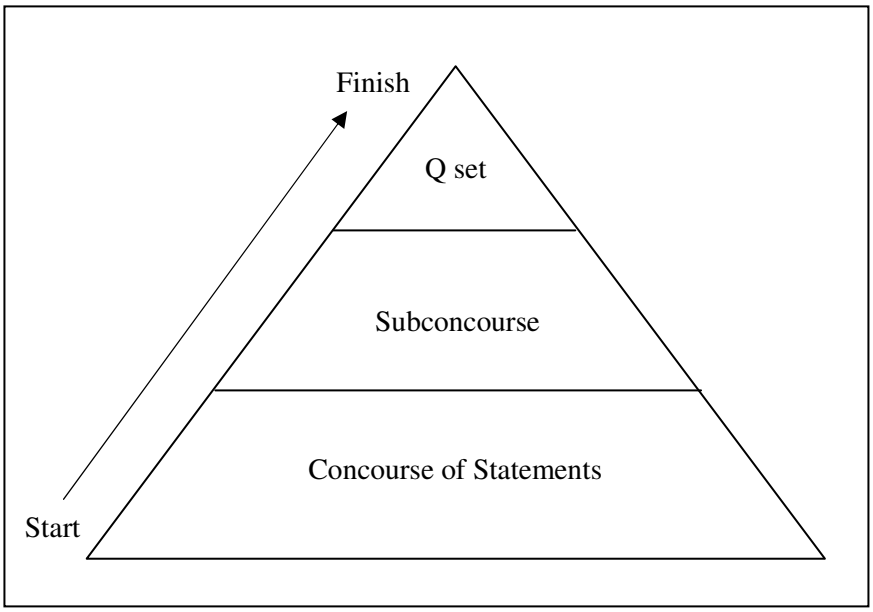

Figure 1: Development of items for a Q sort exercise.

Once a concourse of items has been selected, a subconcourse (Webler et al. 2001) must be identified by narrowing the selection into a set of items that accurately reflect the greater conversation among interested parties for the topic of interest. The difference between the concourse and the subconcourse is then the number of items included and the succinctness of the items included. For example, the concourse of statements is the possible sources for all the items in the Q sort, such as newspaper articles, public testimony and interviews. In contrast, the subconcourse should summarize the ideas most commonly expressed in the concourse. The concourse should be very broad and inclusive; whereas the subconcourse includes a summarized selection of the concourse.

Finally, the subconcourse items are narrowed to the most selective and smallest of the groups of items, the Q set. Ultimately this final set of items should be highly specific, succinct and summarizing. It is the sort of items sorted by each participant in their Q sort. Moving from the subconcourse to the Q set involves categorizing similar items into descriptive groups; a process similar to the qualitative technique of coding, as well as researcher discretion. For example, items about knowledge in one group, items about control in another and so on. Recommendations on the appropriate number of statements to include in the Q set vary from 10 – 100; however, most agree that between 20 and 60

items are appropriate (Robbins and Krueger 2000, Donner 2001, Webler et al. 2001, Thomas and Watson 2002, Clark 2005, Tuler et al. 2005, Robins 2006). "Ideally, the sample of statements must represent all key aspects of perspectives on the issue" (Tuler et al. 2005, 251).

Aside from ensuring that Q set items include a summary of opinions on the topic of interest, a Q set should include opinions that tend to be more contested than agreed upon by the group surveyed. Thus it is best not to include items that are black and white (Staintion 1995, Donner 2001, Robbins and Krueger 2001, Webler et al. 2001, Cross 2005, Tuler et al. 2005). Instead, it is best to focus on the statements characterizing the shades of gray in the research topic. For instance, according to the preliminary interviews from this study there was an agreement among respondents that the population of sage-grouse has declined over the years; however, what was not agreed upon was the reason for the decline. Consequently, no statement about the change in the population was included in the Q set as it would not differentiate participants from one another. Statements about the cause of the decline discussed by participants in the preliminary interviews were included because they would be more characterizing of the viewpoints of the participants.

Lastly, it is important that the phraseology of the Q set items match the condition of instruction to ensure clarity of each comparison made during the sorting exercise. For example, if the condition of instructions asks a respondent to complete a statement following the fill in the blank type of instruction, it would be most clear to participants if each statement clearly completed the sentence instead of simply including statements as they were taken from their original source. The exact phrasing of the condition or Q sort items may be manipulated to ensure a grammatical match thus increasing the clarity of the items and the Q sort.

Once the statements have been selected and have been matched to the condition of instruction, building a board on which participants can complete the sort is recommended. This board serves as a guide for participants as they sort the given Q set items along the chosen continuum selected within the condition of instruction (e.g. most

to least agree). The pattern of this board can be referred to as a forced free distribution (Thomas and McKeown 1988) (see Figure 2), as the researcher often selects a quasi-normal distribution intended to force participants to differentiate among items within the Q set. It is described as forced as there is a preset number of items designated for each rank (from -5 to 5 in the example below); however, respondents are free to deviate from the given pattern on the board if they feel it is the best way to express their opinion (Brown 1980, Thomas and McKeown 1988). The board should include enough spaces so that each item in the Q set will have a place on the board (i.e. one space per item). Importantly, the center of this distribution is always 0, but this should not be interpreted as the mean; instead, it includes the statements that participants either felt neutrally about or felt did not hold substantial meaning or relevance to the stated "debate" in the condition of instruction.

There is some criticism of forced free distribution and its impacts on the statistical analysis. However, there have been many rebuttals to these criticisms. First, the effects of such a change in the placement of items does not adversely affect calculated statistics involved in analyzing the Q sort data into distinct factors or viewpoints (Brown 1980, Thomas and McKeown 1988). In addition, the program used to analyze the Q sort data in this study, PQMethod 2.11, notes that Q sort data that may not match the exact pattern of the quasi-normal distribution does not affect the calculated results (Schmolck 2002).

Next, a data sheet reflecting the distribution and able to record the outcome of each respondent's sort is needed. This can simply be a single piece of paper with the participant's name and the date of the sort along with the distribution as it appears in Figure 2. Other information can also be included such as, age, occupation, sex, income, etc.

Lastly, a follow-up interview is extremely helpful in adding both depth and clarity to the outcome of the Q sort (Brown 1980, Thomas and McKeown 1988, Thomas and Watson 2002, Exel 2005). The interview can act as a source of data while also acting as a point to begin a deeper conversation about the topic at hand (Brown 1980). Researchers can use the interview to ask questions designed to probe deeper into their viewpoints or their

reasoning for sorting the item as they did. In addition, the interview can address issues important to the research that may not be appropriate to use in a Q sort. To make the best use of the interview, an interview guide should be prepared prior to interactions with participants. Recording the interview (as well as the time the participant is actively engaged in the Q sort) is recommended. As a result, a follow-up interview represents an opportunity to enrich the data.

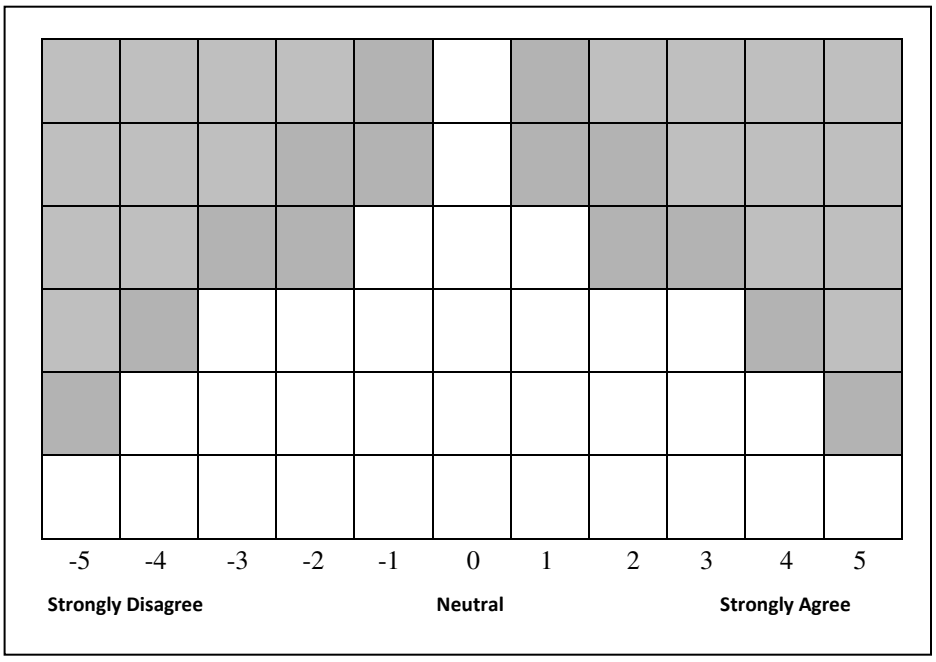

Figure 2: Example of the forced free distribution common to Q sorts.

In conclusion, building a Q sort involves a number of steps were researchers begin with a large, broad set of items and eventually end with a concise summary of the opinions of the topic of interest representing the Q set. These items are then combined with a condition of instruction and a set of sorting instructions to yield a complete Q sort to be completed on a board guiding participants as they sort the items on the chosen continuum.

Measuring perspectives of sage-grouse management with a Q sort

The above ideas and guidelines were helpful in building the Q sort used by participants in this research. Before building the Q set, an interview guide was prepared for a group of preliminary interviews. In fact, these interviews were intended to be the source of the concourse of statements providing the subsequent Q set items.

Preliminary interview participants were selected to represent the range of views (Patterson and Williams 2002) in the area inferred from key informants, print media articles, scientific journals and recent court cases and included ranchers, energy employees, biologists (state, federal and private contractors) and career conservationists all working in Sublette County. Participants were also selected due to their involvement in the issue, and consequently their knowledge about sage-grouse management in the county. A total of13 preliminary interviews were conducted. All but one was recorded. These interviews were considered the concourse for drawing the statements from which the Q set would be selected.

Next, to narrow the concourse of statements to subconcourse and eventually the Q set items, representative themes within and across interviews were noted and exact quotes were taken from interviews to represent these themes. Next, items were coded into similar categories frequently occurring in the interviews including, politics of knowledge, control, experts, reasons for sage-grouse declines, management, the amount of information, science, blame and miscellaneous. Feedback from key informants and thesis committee members (M.P and L.Y.) were instrumental in this coding and selection process. Once the preliminary interviews were completed, extensive notes were taken on each one. These notes represented the concourse of statements from which the Q sort items would be selected.

During the process of selecting the statements for the Q set, the condition of instruction was chosen to ensure statements selected matched the needs of the condition of instruction. When defining the condition of instruction, it was important to underscore

that the intention of the sorting activity was to measure their viewpoints on the sage-grouse issue, not those of their peers or anyone else. As a result, there were no incorrect answers. The condition of instruction used for this project was:

> *"How well do the following statements reflect your views on the debate about sage-grouse management in Sublette County? Please arrange the following statements based on the extent to which you agree or disagree with them."*

Once the Q set was selected it included a total of 32 statements (see appendix 1) all taken from the set of thirteen preliminary interviews. These statements were chosen as to most accurately represent the sum of the preliminary interviews and the opinions within them. As a result, ideas not discussed within the preliminary interviews were not included in the Q set. Once these statements were chosen, the board for which the participants were to use to sort the Q set, a data sheet and a specific sorting instructions were constructed. The board consisted of a large piece of canvas, 2.5feet (length) by 2 feet (height) with 32 squares drawn on it in the shape of a quasi-normal distribution ranging from -5 to 5, from strongly disagree to strongly agree (see Figure 10). The data sheet consisted of the same distribution on a single piece of paper with a blank for the date and name of the participant.

Each participant received a set of instructions including the following text,

1. *Read through all of the statements carefully, twice.*
2. *Arrange the statements into three groups:*
    a. *statements you most agree with,*
    b. *statements you most disagree with, and*
    c. *statements you feel neutral about. Statements you are not sure about you can also put in this group.*
3. *Arrange each group of statements from most to least agree and place one statement on each square of the pyramid in front of you.*
4. *If you have any questions at any time, please feel free to ask.*

In addition, each participant received an explanation regarding their freedom to sort the statements. All participants were first encouraged to sort one statement into each blank space. If this option could not result in a true characterization of their view, they were free to put statements so they would more accurately reflect their view on sage-grouse management. It was important that each participant understood that the goal of the exercise was to measure their opinion on the issue, not to force them into sorting the statement into a preset pattern.

Once the Q set had been selected, an interview guide was prepared to gain clarity and depth in understanding of the participant's views following the completion of the Q sort. Prior to use, the interview guide and an informed consent form were approved for use by the University's Institutional Review Board (IRB). Once in the field and after receiving written consent, the entire interaction with the participants was recorded. In other words, most Q sorts follow-up interviews were audio recorded.

Study area – Sublette County, Wyoming

Much of Sublette County, Wyoming can be described as "rock and ice." That is, it mainly consists of high, rugged mountains retaining snow much of the year. The county contains 80% public lands and 20% private land (Sublette County (no date given)) and most of the public land is managed as either grazing lands or wilderness by the US Bureau of Land Management (BLM) or the US Forest Service. Much of the private land is used for raising cattle and is located at the base of the Wind River Mountain Range in the Green River Valley (Green River Valley Land Trust 2010). The Green River, flowing through cottonwood bottomlands are surrounded by dry, sagebrush species, meanders through the county.

Situated in the least populated state in one of the least populated counties, with a population estimated at about 1,700 people over 5,000 square miles (Sublette County 2009), Sublette County is extremely rural (US Census Bureau 2010). In fact, on average, it contains 1.6 people per square mile (Sublette County 2010). However, since the last

census in 2000, the population of Sublette County has substantially increased (US Census Bureau 2010). In fact, between 2006 and 2007, Sublette County was measured as the fifth fastest growing county in the US (Sublette County 2008). Perhaps this population surge is due in large part to the area's recent energy boom.

In the past decade thousands of deep gas wells have been drilled throughout the county (Sublette County 2008). Two extremely productive gas fields lay just south of the county seat of Pinedale, Wyoming. The Jonah gas field (35,000 acres) has approximately 3,500 wells (BLM 2005). The larger, slightly newer gas field is the Pinedale Anticline Project Area (PAPA) totaling about 198,000 acres with approximately 5,100 wells (BLM 2008). As a result of this development the county has grown tremendously, both in population and in financial resources.

A number of county statistics are useful in demonstrating this wealth of financial resources. For instance, in 2009 Sublette County received $66.4 million in taxes from energy operators. This was nearly 5.86% of the $1.1 billion that was paid to the state of Wyoming through severance and other taxes levied on energy producers in the County (Sublette County 2009). Furthermore, in 2009 the County's valuation (sum of its financial assets) totaled more than 20% of the entire state of Wyoming's valuation, leading it to be the County with the most financial worth to the state at a total of $6.4 billion (Sublette County 2009). Value at this level provided the state with 26% of its K-12 operating budget in 2009 (Sublette County 2009). All of this wealth is accrued with some of the lowest tax rates in the state (Sublette County 2009). This information is useful in underscoring the importance of the wealth generated by the energy development to both the state and to the County.

Sublette County was selected due to its high quality sage-grouse habitat (Holloran 2005, Doherty 2008) and proximity to large-scale gas development which has produced controversies over sage-grouse populations and management, some of this is due to the large revenues produced by the recent gas development. In addition, due to the propensity of public land to be used for ranching, the views of ranchers are also tied to the controversy. These factors, coupled with the tendency for many conservation

organizations to be active in the area, made Sublette County an appropriate location for study of the conflict over sage-grouse management in the West.

Sampling

Participants were selected in much of the same ways preliminary interviewees were selected, mainly through a number of key informants, and represented the same groups working in Sublette County. In addition, some respondents participated in both the preliminary data collection phase as well as the Q sort data collection. Importantly, the sample was not a random sample; instead, it was purposive. Participants were chosen to represent the range of views and cannot be generalized to the greater population of Sublette County residents or to the social or professional groups from which they may belong (rancher, energy employee, etc). As a result, it would be inappropriate to infer that the distribution of opinions within the population mirror the distribution of opinions within the sample. That is if the sample suggests 20% of the participants held a particular view it would be inappropriate to infer that 20% of the population holds that same view. The goal of the research is to identify the viewpoints or frames existing within a population, not to estimate the percentage of the population holding those frames. It is possible that existing frames within the population were not captured in the sample. However, sampling for diversity among frames coupled with the sample size chosen (described below) was intended to decrease the likelihood of this occurring. In total, 13 preliminary interviews were conducted and 30 Q sorts and follow-up interviews were completed. The following sections outline those sampled in the entire study. The numbers of participants within each category include those sampled in the second data collection phase, the Q sort and follow-up interview.

Sample As previously discussed, the sample of participants included ranchers, biologists, energy industry employees and career conservationist/biologists. However, these categories are not discrete, and as a result, it was sometimes difficult to pinpoint the exact category for which each participant would fall. For example, some of the biologists interviewed also worked for conservation organizations. Due to this difficulty, these categories were used as a guide to ensure the sample was varied enough to capture the

range of viewpoints in the area. The categories below are not mutually exclusive for each participant. In other words, participants may fall into more than one of the following descriptive categories.

Ranchers: The sample included 12 ranchers who actively raise cattle. In addition, many cultivate and harvest their own hay feed instead of purchasing it. Consequently, many of the ranchers interviewed moved their cattle to public lands during the growing season in order to raise feed on their private land. Ranchers in this sample tended to be long time land owners many belonging to centennial ranching families (families that have been ranching on their land or at least 100 years). However, some participating ranchers had cattle only part of the year, selling their herd each fall to feed lots or slaughter houses. Because of the extent of the energy resources available in the area, some ranchers had energy developed on the surface of their land (i.e. gas wells). Due to the extended nature of some participant's land tenure many of those individuals also owned the mineral rights to the natural gas.

Biologists: Fifteen biologists were interviewed in this study. Many participants held master's degrees in biology, zoology or wildlife biology while a few had bachelor's degrees in biology. They worked for the state wildlife management agency, Wyoming Game and Fish; for private consulting firms; energy companies and the Bureau of Land Management (BLM). Some were actively participating in sage-grouse research studies while others were primarily managers.

Energy employees: Five energy employees participated in the study. This group of individuals proved extremely difficult to gain access to. Many of those who work in the gas fields are part of a transient population and work long days with few days off, and consequently, they were difficult to contact. Participants in this group were not drilling operators, but were scientists or mid-level managers.

Career conservationist/environmentalists: The terms environmentalists and conservationist are used interchangeablely in this study. These participants (n = 5) worked for non-governmental organizations (NGOs) in the area. Some worked for local

chapters of larger organizations while others worked for small organizations based solely in Sublette County.

Data analysis

The primary focus of data analysis revolved around interpreting the Q sort data. Because this is a complex and multi-stage analysis process, it is described in detail below in conjunction with the actual analyses themselves. However, this analysis could not have been satisfactorily completed without the inclusion of the interview data. This data was initially audio recorded and subsequently partially transcribed (important sections were thoroughly transcribed) based on emerging themes within the Q sort data and analysis.

Results and Discussion

The first step in analyzing the Q sort data was to perform a principal components analysis (PCA) using the PQMethod freeware program version 2.11 PCA is designed to assemble empirically correlated variables (Tabachnick and Fidel 2007), or in this case, groups of participants with similar perceptions based on the result of the Q sorts. One question that must be addressed in analysis of PCA is how many factors exist in the data set. By default, the PQMethod software presents the eight factors with the highest eigenvalues (see Table 2). "Factors" is the generic term used to describe the groupings of participants that represent distinct "underlying perspectives (or discourses) within the larger discourse" (Webler et al. 2001, 437). In this thesis the larger discourse is about sage-grouse management in Sublette County, Wyoming and the underlying perspectives are referred to as "knowledge communities" or groups sharing socially situated narratives on a politically contentious issue, including problem definitions and preferred solutions. Furthermore, due to the political nature of the issue, these narratives can be said to support particular political outcomes of the issue such as listing or not listing the sage-grouse. These narratives serve as a common thread throughout the knowledge community.

Each identified factor or knowledge community, will be characterized by as unique Q sort representing their views relative to other knowledge communities. This unique Q sort also can be described as a model Q sort which is an idealized version of how individuals within the knowledge community sorted the sage-grouse management issues included in the prepared Q set sorting exercise. In this way, one factor represents a number of participant's Q sorts as a discrete viewpoint.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Eigenvalues	9.8255	5.533	2.8166	1.851	1.3436	1.2193	1.0538	.9187
Percent variance explained	33	18	9	6	4	4	4	3

Table 2: Results of principle components analysis showing 7 factors with eigenvalues above one.

Determining the Number of Factors – Explanation of the Analysis Logic

While PQMethod defaults to eight factors, before performing the next step in the analysis, the appropriate number of factors suitable to be ultimately considered in further stages of analysis was selected. It is possible to select all eight factors for analysis. Donner (2001) explains that as the number of factors selected for rotation increases the "cleaner," or more asymmetrically, each participant will load on the selected and rotated factors. This may aid in interpreting the data in the sense that the cleaner the participant loads onto a factor, the easier it is to determine what factor or group each participant belongs in. For example, consider a hypothetical study with participant A and participant B (see Table 3). Note that each participant received a score for each of the identified factors, referred to as their factor loading. Factor loadings are normalized and weighted (Exel 2005) correlations between participants and factors. Factor loadings are "estimates of the scores subjects would receive on each of the factors had they been measured directly" (Tabachnick and Fidell 2007, 650). These factor loadings range from 1 to -1. The former indicates complete agreement with a factor whereas the latter represents the opposite of the specified factor (Donner 2001, Tuler et al. 2005). As a result, the higher the loading each participant receives for each factor, the more closely correlated that participant is to that factor.

Furthermore, notice the difference in factor loading for participant A, particularly the loading for factor 3. Participant A demonstrates a very clean factor loading into factor 3; it correlates relatively highly with factor 3 (0.60) and shows relatively low correlations on the four remaining factors. Contrast this with participant B. The factor loadings of

participant B are low and in many cases quite similar making it more difficult to determine what factor this participant belongs in. It is more likely, then, to see the former case when higher numbers of factors are selected for further analysis. On the other hand, selecting too many factors may increase the likelihood of yielding factors "that are statistically significant but substantially without meaning" (McKeown and Thomas 1988, 51). Those factors without substantial meaning would detract from the goals of a realistic and defensible characterization of viewpoints reflected in the sample of study respondents.

Participant	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
A	.10	.05	.60	.15	.10
B	.20	.25	.30	.20	.5

Table 3: Factor loadings for participant A and participant B.

To achieve an acceptable balance between clear factor loadings and conceptually meaningful factors, five methods were used to determine how many factors would be selected for the next analysis phase. They included analyzing eigenvalues (McKeown and Thomas 1988, Floyd and Widaman 1995, Donner 2001, Tabachnick and Fidel 2007), examining the scree plot (Floyd and Widaman 1995, Tabachnick and Fidel 2007) and analyzing the interpretability of different factor solutions (i.e. different solutions are those with differing numbers of factors) (Donner 2001) and evaluating interview data (Brown 1980, Exel 2005). Each of these approaches to determining the number of factors present in the sample is discussed in more detail below.

In the first approach, factors were selected with eigenvalues greater than one (McKeown and Thomas 1988, Floyd and Widaman 1995, Donner 2001, Tabachnick and Fidel 2007). Although McKeown and Thomas (1988) describe this choice as simply convention, Tabachnick and Fidel explain that there is some empirical justification behind selecting eigenvalues with values exceeding one when they write,

> "Eigenvalues represent variance. Because the variance of each standardized variable contributes to a [PCA] is 1, a component with an eigenvalues less than 1 is not as important, from a variance perspective, as an observed variable." (644, 2007).

In other words, selecting factors with eigenvalues less than one may not result in any different information than would come from selecting any one variable, or participant. Consequently, selecting a factor with an eigenvalues less than one can run counter to the aim of Q method which is to put people into groups characterizing like qualities or viewpoints. Instead, Floyd and Widaman (1995) suggest evidence of a consequential factor can be found when there are three or more variables (participants) associated with each factor. This latter idea is more congruent with the motives of Q method.

The second approach to determining the number of factors was building a scree plot pairing eigenvalues with their respective factors. The scree plot can be a useful tool in understanding how many factors are present (Tabachnick and Fidel 2007). In a process known as the scree test, one can visually assess the scree plot for the "elbow", or where "a [horizontal] line drawn through the points changes the slope" (Tabachnick and Fidel 2007, 644). The point below this elbow represents the factors that do not explain a consequential amount of variance and therefore, the factors below the elbow are not important in carrying to the next phase of analysis (Floyd and Widaman 1995). Rather than looking for the elbow, other authors describe seeking the point in the curve where the slope approaches zero (Floyd and Widaman 1995). Though the specific criterion represented in this approach differs slightly, its rationale is exactly the same as the elbow criterion – beyond the point where the slope approaches zero, additional factors do not contain substantively meaningful information.

While the two criteria described above are commonly used conventions in the interpretation of factors and do reflect some degree of underlying statistical rationale, they are also somewhat arbitrary and can lead to criticism of factor analysis as a data analysis tool. For example, both Tabachnick and Fidell (2007) and Floyd and Widaman (1995) acknowledge the subjectivity of the scree test. One may choose to lengthen or

shorten the x or y axes which can influence the apparent location of the elbow increasing the possibility that the number of factors matches some preset goal. Furthermore, it may be difficult to visually assess where the slope of the line begins to approach zero. The literature discusses a number of other tests that can be used to select the appropriate number of factors, the parallel analysis criterion and the Tucker-Lewis index (Floyd and Widaman 1995). These authors note that these additional tests can be paired with the scree test and "eigenvalue of one" rule when necessary. Instead of performing these tests, Donner's (2001) rule regarding testing the interpretability of different factor solutions was used in this thesis as the third approach to identifying the appropriate number of factors.

The rules associated with eigenvalues and the scree plot might have been sufficient to adequately assess the correct number of factors present in the sample; however, Brown (1980), a fervent proponent of Q sort, points out that one cannot solely rely on statistical tests to determine the number of factors best suited for a data set. Similarly, Donner (2001) suggests selecting a number of different solutions and proceeding through the subsequent analysis phases (in other words, analyzing different solutions with a variety of numbers of factors). In essence, this suggestion encourages researchers to focus on the interpretability or meaningfulness of each factor rather than relying merely on somewhat arbitrary statistical rules. This suggestion stems in part from the fact that the number of factors requested influences the individual factor loadings. In other words, the "groupings" of individuals within factors and the "idealized" model sort representing those individuals will vary depending on the number of factors requested. This approach is based on recognizing the importance of interpretability as an important test of the analysis (Tabachnick and Fidel 2007). As Tabachnick and Fidel (2007, 608) state "a good [factor analysis] 'makes sense'; a bad one does not." In other words, this criterion recognizes that the goal of the analysis is to make a statement about the real world (in this case to group people according to similarities in how they think about the issues underlying the political dialog about sage-grouse). Furthermore, Brown stresses the importance of considering ideas of power and politics embedded within the study in determining the appropriate number of factors within a sample: "the importance of a

factor cannot be determined by the statistical criteria alone, but must take into account the social and political setting to which the factor is originally connected" (Brown 1980 cited in McKeown and Thomas 1988, 51). As a result, it is important to consider the context of the study when analyzing the results.

In a conventional Q sort analysis that adheres to the Donner rule (i.e., the approach of evaluating multiple factor solutions to determine which solution set results in the most conceptually defensible solution), interpretability assessments are made on the basis of rotated factor solutions. As in conventional PCA, factor rotation helps interpretation by "cleaning up" the factor loadings identifying which individuals are associated with each factor (that is by identifying which individuals are associated with each factor). In a Q sort analysis, interpretability is assessed by evaluating the conceptual interpretability or coherence by the "meaningfulness" of the items within the model sort (see Figure 3). In PQMethod, both varimax rotation and manual rotation are presented as options; however, due to an increase in perceived arbitrariness and complexities beyond those of highly skilled statisticians, varimax rotation is recommended (Donner 2001). Varimax is also the most commonly used rotation in conventional PCA (Tabachnick and Fidel 2007).

					19					
					10					
				6	8	32				
		16	5	29	7	23	30	22		
	11	18	31	9	3	17	24	12	15	
13	20	27	28	26	2	25	1	4	21	14
-5	-4	-3	-2	-1	0	1	2	3	4	5
Strongly Disagree					**Neutral**				**Strongly Agree**	

Figure 3: Model Q sort for ultra locals.

The use of "follow up" interviews in this study creates the opportunity to add an important additional "qualitative" stage to the analysis of the conceptual coherence/interpretability of factors in the process of implementing the Donner Rule. Specifically, interview data was also used to evaluate the interpretability and conceptual coherence of each factor solution as evidence to support the retention or dismissal of a given set of factor solutions. For example, if the eigenvalue criterion suggested the possibility of a 6 factor solution and four participants loaded onto one of the factors in this solution, their interview data was inspected for congruencies in opinions. The addition of the interview analysis phase to the assessment of various combinations of factor solutions represents a time consuming and difficult to empirically summarize iterative process that combines the idiographic and nomothetic levels of conventional interview analysis. While the addition of interview analysis to assessment of factor solutions represents an original contribution to this thesis to the Q sort methodological approach, it seems warranted because it both enhances the defensibility of the decision about how many factors to include. Further, it capitalizes on the effort to integrate the normative logics underlying both quantitative research (eigenvalues, factor loadings) and qualitative (interview analysis) approaches that advocates of Q sort promote as such a strength of this research design.

In sum, five ideas were used to determine the appropriate number of factors present in the sample. They were the aforementioned rules associated with:

1. Eigenvalues greater than one;
2. the elbow of the scree plot;
3. analyzing the interpretability of different factor solutions;
4. ensuring at least three participants loaded into a factor; and
5. interview data.

Determining the Number of Factors – Data analysis

Once all the data were entered and checked for errors in the PQMethod software database, a principal component analysis was preformed. Of the eight factors PQMethod defaults to, the PCA revealed that seven of those factors had eigenvalues greater than one (see Figure 4). That is, seven factors explained more variance than could be explained by looking just at single participants. Only eliminating one factor, this criterion suggested seven factors for further consideration. Next, the scree plot pairing eigenvalues with their associated factors was built (see Figure 2). The scree plot showed an elbow at factor three suggesting the selection of three factors for the subsequent step in analysis, factor rotation. Following the Donner rule discussed above, instead of simply selecting a three or seven factor solution based solely on the eigenvalues and scree plot, a number of different solutions, specifically solutions with three to seven factors were analyzed further.

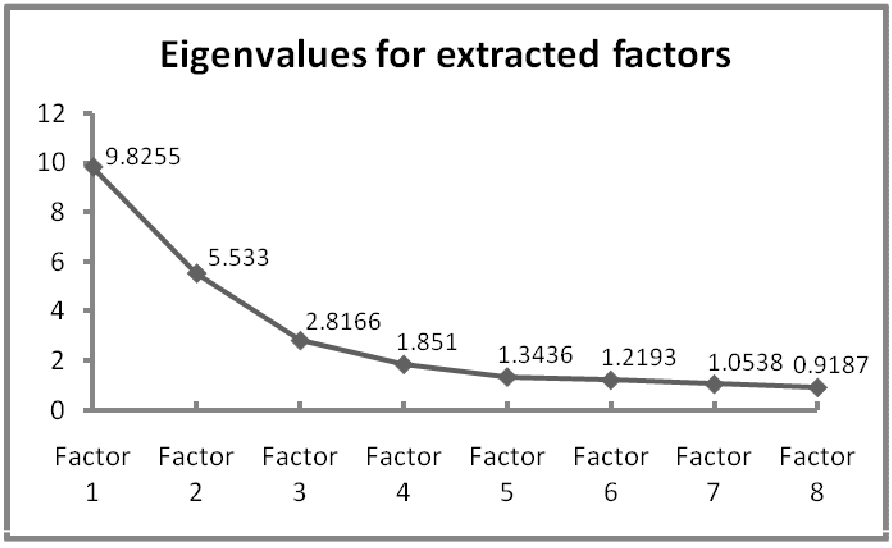

Figure 4: Scree plot of the results of factor analysis.

Based on the analysis approach described above, it was concluded that "solutions" including 4-7 factors were not adequate according to one or more of the four criteria described above. For example, the 7 factor solution included two factors with only one participant loading into them. Based on one of the criteria for selecting factors described

above, there should be at least three participants in a factor. In this case, one may be tempted to simply discard the factors with only one participant and interpret the remaining 5 factors in the solution. However, it is inappropriate to allow for selective analysis of a subset of factors within a given solution. If a factor solution is adopted, all factors defined in the solution must also be adopted because the nature and composition of each individual factor within a set of solutions is dependent the other factors in the particular factor solution. In other words, in the example above highlighting the 7 factor solution removing the two factors consisting of a single participant would be a mistake. If two factors were removed, the remaining factors and their meanings would be affected rendering them inaccurate.

In the sage-grouse data set factor solutions 4-7 all had at least one calculated factor with only one participant. This may have been enough to reject all of these factor solutions, but more information to reject these solutions was also apparent. Upon closer inspection these factor solutions seemed to separate participants with similar views (based on both Q sort data and interview data) into different factors. In other words, the distinctions between factors could not be extrapolated to mean anything applicable to the real world and no meaningful description or summary of the factor could result. These two ideas, the first regarding the number of participants in each factor and the second concerning a lack of a meaningful summary of the factors, coupled with the outcome of building the scree plot and assessing eigenvalues greater than one, provided sufficient evidence to reject factor solutions with 4-7 factors, leaving only the 3 factor solution.

Before simply accepting the three factor solution, close attention was paid to both interview and Q sort data. First, factor loadings within the three factor solution were assessed. One means of assessment was completed by calculating how high a factor loading needed to be to be statistically significant given the sample. Using a formula to derive what is essentially a z-statistic[1] and adopting critical values of $p<.05$ and $p<.01$, it

[1] The formula used to calculate the z-statistics was: (area under both tails of the normalized z-distribution (i.e. .05, .01, etc))*SE. Where SE (standardized error) = $1/\sqrt{N}$ where N is the number of items in the Q set. For example, here the SE = $1/\sqrt{32}$ = .17678. The calculation for the z at the $p<.05$ level: 1.96*(.17678) = .35.

was determined that factor loadings had to be at least .35 and .46 respectively to be statistically significant (for a more complete discussion on calculating z-scores see McKeown and Thomas 1988). This meant that factor loadings in excess of .35 or .46 were statistically significant to the .05 or .01 levels and given no other contradictory information (i.e. interview data), participants were considered significant members of the factors associated with a factor loadings in excess of these calculations.

Upon closer inspection of the factor loadings for the three factor solution, it became apparent that most factor loadings putting participants into factors were far in excess of even the significance .01 level of .46, except for one participant. All other important factor loadings, or those cleanly loaded onto a given factor were at least .58 or significant at .001 level. This indicated a strong relationship between the factors identified in the 3 factor Q sort solution and the individuals within each factor grouping, and therefore viewpoints among participants in these factors. Analysis of the interview data according to the approach described above confirmed these similarities. In other words, the combined analysis of the two data sets, Q sort data and interview data, indicated that the ultimate factors were applicable to the real world and would yield a meaningful description or summary of each the factor.

However, there was one individual with a factor loading that was not significant at the .001 level, but was exactly significant at the .01 level with a factor loading of .47. Because this loading was notably different from the rest of the factor loadings, it and its related data, including interview data from the participant, received increased scrutiny. First, the Q sort data was analyzed in PQMethod including this participant in the factor and the construction of the factor's ideal Q sort. This process was repeated without the participant as part of the factor. Each analysis resulted in unique PQMethod outputs. Next, the two outputs were compared, looking for similarities and differences between them. In addition, interview data from participants more significantly loading into this factor were revisited.

First, the idealized Q sort between the two outputs changed with the addition and subtraction of the participant in question. This alone is not enough to warrant the

exclusion of this individual from the factor. However, when the summary of the two different factor outputs were examined, the summary including the participant with the lower factor loading was not coherent, rendering an interpretation difficult. Based on interview and Q sort data, this meaning shifted enough as to no longer appear to accurately represent the views of other participants in the factor. Consequently, interview and Q sort data supported the exclusion of this individual from this factor. Donner (2001) provides support for decisions such as these where adjustments to data can be made in the cases of close statistical calls or other nuances in the data. As a result of this careful analysis, a more accurate picture of the opinions in the sample will be represented.

The quantitative and qualitative analysis criteria described above provided strong evidence that three factors (knowledge communities) were present in the data (see Table 4). Factor one included the most participants (n=16), and with each subsequent factors identified by the quantitative portion of the analysis including a smaller number of participants (see Table 4). Importantly, two participants did not fit into any of the above factors. One of the participants was described at length above and the other participant did not have a clean loading into any factor and none of the factor loadings were significant at any of the calculated levels (.001, .01 and .05). The three factors are identified and interpreted below. This discussion of factors represents the final analysis phase of the Q sort data, and, as one may recall, the most genuine test of a factor as an empirical statement about reality is its ability to coherently explain a viewpoint that "makes sense" in the context of the study. In other words, do the factors make a meaningful statement about the viewpoints found in the area where the study is conducted.

	Community 1	**Community 2**	**Community 3**	**No factor**	**Total**
Participants	16	7	5	2	30
Percent	53	23	17	10	100

Table 4: Participants per factor after PQMethod analysis.

Characterizing the Knowledge Communities in the Three Factor Solution

Having identified the number of factors to be analyzed, the next challenge is characterizing and differentiating the selected factors so an insightful and empirically defensible summary of the viewpoint represented in each of the three factors (knowledge communities) can be described. In doing so, the output resulting from the Q sort data analysis in PQMethod will be extremely important. The PQMethod software calculates a number of items helpful to the interpretation and understanding of each factor. These include lists of different groups of Q set statements for each factor including, characterizing and distinguishing statements. The former aid in understanding just which statements in the Q set were most important to the factor (knowledge community) at hand, while the latter highlights statements that help distinguish one factor from another. Finally, the software also produces a list of consensus statements that are not helpful in distinguishing one factor from another. The following discussion seeks to define characterizing, distinguishing and consensus statements more thoroughly and to explain their role in providing an empirically defensible analysis of the data (that is the discussion aims to detail the data used to interpret and summarize the viewpoint represented by each factor).

First, z-scores were calculated by PQMethod for each statement (see Table 5 for normalized statement scores for knowledge community one). These z-scores serve two functions. First, they serve the basis for "ranking" the degree of agreement with individual statements within the factor (knowledge community). In other words, these z-scores are used by PQMethod to build model Q sorts, representing the factor's idealized or model Q sort. This model Q sort is organized on the same quasi-normal distribution participants used during their sorting exercise, from 5 to -5 (see Figure 3 for the model Q sort for factor one).

Table 5: Normalized statement scores for knowledge community one, ultra locals.

Statement Number	Statement	z-score
14	We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM. Everyone needs to work together.	1.902
15	Local management of sage-grouse is most appropriate.	1.610
21	The information necessary to make decisions about listing sage-grouse is incomplete.	1.417
4	Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.	1.405
22	There is not enough historical scientific data to clearly understand what has happened to sage-grouse populations over long periods of time.	0.993
12	The primary reason for the decline in sage-grouse populations in Sublette County are predators.	0.916
24	We don't understand enough about the sagebrush ecosystem to know the best ways to create better sage-grouse habitat.	0.838
30	The Endangered Species Act is a tool extreme environmental groups want to use to control development they do not approve of.	0.826
1	The people debating sage-grouse management use scientific data to further their political agendas to list or not to list sage-grouse.	0.797
32	Listing sage-grouse will severely threaten the livelihood of many people here in Sublette County and that is not fair. A bird should not take priority over people's ability to put food on the table.	0.655
17	You can't make gas development go away, so you have to work around it.	0.562
23	People have taken sides on this issue without adequate information to back up their opinions.	0.545

25	The scientific research definitively demonstrates that sage-grouse populations have declined dramatically in Sublette County.	0.329
8	Ranchers know more about sage-grouse than wildlife researchers because their understanding comes from experience developed over a long period of time.	0.198
10	I think there is more expertise on sage-grouse in the local Game and Fish office than at the local BLM office.	0.127
19	Current sage-grouse conservation efforts are primarily a result of the threat of listing. Without this threat there would be little interest in sage-grouse conservation efforts in Sublette County.	0.041
2	I think information provided by ranchers is only used by decision makers if it meets political needs.	-0.065
3	Scientific findings about sage-grouse are not put into practice because of political agendas.	-0.102
7	Biologists working in Sublette County only a few years have not been here long enough to understand trends and influence on local sage-grouse populations.	-0.123
9	People who are in decision making positions are misinterpreting the scientific research that exists on sage-grouse in Sublette County.	-0.177
6	People from large urban areas are using science to try to tell residents of Sublette County what to do.	-0.233
29	The BLM will use whatever information they can to further control the oil and gas operators.	-0.612
26	We need a purely scientific approach to dealing with the issue of sage-grouse. People's private profit (ranching, energy and home development, etc.) should be left out of it.	-0.786
31	The BLM says they are going to collect data and information to help the sage-grouse, but this is all an illusion. They are not really doing anything for them.	-0.898

28	The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.	-0.961
5	Energy companies have the power to develop as they see fit, even if science shows that development is harmful to sage-grouse.	-1.028
16	We need to decide quickly how we are going to conserve these birds or they are going to disappear completely.	-1.043
27	The existing scientific research is sufficient for telling us how to balance energy development with sage-grouse conservation.	-1.068
18	Residents of Sublette County know that development is hurting sage-grouse but there is so much money at stake they are not willing to stop it.	-1.221
20	Unless you get a judge to rule against the BLM's management of energy development and its effects on sage-grouse habitat the BLM will not change.	-1.226
11	The primary reason for the decline in sage-grouse populations in Sublette County is gas development.	-1.581
13	The primary reason for the decline in sage-grouse populations in Sublette County is grazing.	-2.035

Z-scores within these model Q sorts ranged from -2.035 (factor 1, statement 13) to 1.902 (factor 3, statement 14) representing the statements participants most disagreed and agreed with in the Q set. Statements within each model Q sort receiving a z-score in excess of +/- 1 were considered of particular importance. Because these statements are often found in the "tails" of the each model Q sort's quasi-normal distribution, they represent the statements which the knowledge community most strongly agrees or disagrees with. These statements have been defined as characterizing statements in prior Q sort research (Exel 2005) and were used as a guide for the initial characterization of the viewpoints represented by a given knowledge community. Not only were characterizing statements helpful in understanding the viewpoints of each knowledge community, but

distinguishing statements also served a similar purpose. Distinguishing statements were noted by PQMethod based on calculated difference scores (see Table 6 for distinguishing statements for knowledge community one). "The *difference score* is the magnitude of difference between a statement's score on any two factors that is required for the difference in rating to be statistically significant. When a statement's difference in z-scores between two factors exceeds the level necessary to achieve statistical significance, it is called a *distinguishing* (or distinctive) *statement*" (Exel 2005, 9) (for a more in-depth discussion on calculating distinguishing factors see McKeown and Thomas 1988, 53-54). Distinguishing statements therefore help to differentiate knowledge communities in ways that analysis of the characterizing statements alone may not reveal.

Table 6: Distinguishing statements for knowledge community one, ultra locals.

Statement Number	Statement	Rank in sort	z-score
15*	Local management of sage-grouse is most appropriate.	4	1.610
21*	The information necessary to make decisions about listing sage-grouse is incomplete.	3	1.417
4	Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.	3	1.405
22*	There is not enough historical scientific data to clearly understand what has happened to sage-grouse populations over long periods of time.	3	.993
12*	The primary reason for the decline in sage-grouse populations in Sublette County are predators.	3	.916
3*	Scientific findings about sage-grouse are not put into practice	0	-.102

	because of political agendas.		
26*	We need a purely scientific approach to dealing with the issue of sage-grouse. People's private profit (ranching, energy and home development, etc.) should be left out of it.	-1	-.786
28*	The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.	-2	-.961
27*	The existing scientific research is sufficient for telling us how to balance energy development with sage-grouse conservation.	-3	-1.068
20*	Unless you get a judge to rule against the BLM's management of energy development and its effects on sage-grouse habitat the BLM will not change.	-4	-1.226

* indicates significant to the p<.01. Others are significant to the p<.05.

As the software calculated the distinguishing statements it also calculated consensus statements. Consensus, or non-significant statements, are statements that are not helpful in identifying one factor from another and are also based difference scores (see Table 7 for consensus statements for all knowledge communities). Consensus statements may signify either that the statement was not meaningful to participants (i.e. that statement was not important to their viewpoint or was not appropriate for the sort) or that most participants in all knowledge communities agreed on the content of the statement and it is therefore noteworthy. Thus, considering the goal of the study, in some cases consensus statements may reflect important insights – points of commonality despite disagreement on other facets.

Characterizing, consensus and distinguishing statements will prove useful in understanding viewpoints and determining if they have meaning in the context from which they came. For each factor, these three statement types, coupled with the z-scores can be combined into one helpful summary table. This will allow for a more concise

picture of the data. This summary table includes each statement, its rank score according to the model Q sort for a given factor and means of identifying both consensus and distinguishing statements with their associated significance levels, sorted by each statement's z-score (see Table 8, summary table for knowledge community one). In the subsequent analysis, summary tables will be presented *in lieu* of the separate table for distinguishing, consensus and normalized statement tables.

Table 7: Consensus statements for all knowledge communities. All are non-significant at p>.01.

Statement Number	**Statement**	**Comm. 1**		**Comm. 2**		**Comm. 3**	
		Rank in sort	**Z score**	**Rank in sort**	**Z score**	**Rank in sort**	**Z score**
2*	I think information provided by ranchers is only used by decision makers if it meets political needs.	0	-.06	0	-.35	-1	-.21
9*	People who are in decision making positions are misinterpreting the scientific research that exists on sage-grouse in Sublette County.	-1	-.18	-1	-.38	0	-.06
10*	I think there is more expertise on sage-grouse in the local Game and Fish office than at the local BLM office.	0	.12	1	.52	1	.63
14*	We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and	5	1.90	4	1.46	5	1.92

	the BLM. Everyone needs to work together.						
23*	People have taken sides on this issue without adequate information to back up their opinions.	1	.55	1	.28	1	.64
29*	The BLM will use whatever information they can to further control the oil and gas operators.	-1	-.61	-2	-.84	-1	-.43
31*	The BLM says they are going to collect data and information to help the sage-grouse, but this is all an illusion. They are not really doing anything for them.	-2	-.90	-1	-.64	-1	-.31

Table 8: Summary of knowledge community one, ultra locals, arranged by z-score. Items in italics represent consensus statements or those that do not discern one community from another. Bolded items represent significant distinguishing statements.

Statement Number	**Statement**	**Rank Score**	**Compared to other Factors (z- score)***
14	*We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM. Everyone needs to work together.*	*5*	*1.902*

15	**Local management of sage-grouse is most appropriate.**	**4**	**Higher 1.610**
21	**The information necessary to make decisions about listing sage-grouse is incomplete.**	**3**	**Higher 1.417**
4	**Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.**	**4**	**Higher** ** **1.405**
22	**There is not enough historical scientific data to clearly understand what has happened to sage-grouse populations over long periods of time.**	**2**	**Higher .993**
12	**The primary reason for the decline in sage-grouse populations in Sublette County are predators.**	**3**	**Higher .916**
24	We don't understand enough about the sagebrush ecosystem to know the best ways to create better sage-grouse habitat.	1	.838
30	The Endangered Species Act is a tool extreme environmental groups want to use to control development they do not approve of.	2	.826
1	The people debating sage-grouse management use scientific data to further their political agendas to list or not to list sage-grouse.	2	.797
32	Listing sage-grouse will severely threaten the livelihood of many people here in Sublette County and that is not fair. A bird should not take priority	2	.655

	over people's ability to put food on the table.		
17	You can't make gas development go away, so you have to work around it.	1	.562
23	*People have taken sides on this issue without adequate information to back up their opinions.*	*1*	*.545*
25	The scientific research definitively demonstrates that sage-grouse populations have declined dramatically in Sublette County.	0	.329
8	Ranchers know more about sage-grouse than wildlife researchers because their understanding comes from experience developed over a long period of time.	1	.198
10	*I think there is more expertise on sage-grouse in the local Game and Fish office than at the local BLM office.*	*0*	*.127*
19	Current sage-grouse conservation efforts are primarily a result of the threat of listing. Without this threat there would be little interest in sage-grouse conservation efforts in Sublette County.	0	-.041
2	*I think information provided by ranchers is only used by decision makers if it meets political needs.*	*0*	*-.065*
3	**Scientific findings about sage-grouse are not put into practice because of political agendas.**	**0**	**Lower -.102**
7	Biologists working in Sublette County only a few years have not been here long enough to	0	-.123

	understand trends and influence on local sage-grouse populations.		
9	*People who are in decision making positions are misinterpreting the scientific research that exists on sage-grouse in Sublette County.*	*-1*	*-.177*
6	People from large urban areas are using science to try to tell residents of Sublette County what to do.	-1	-.233
29	*The BLM will use whatever information they can to further control the oil and gas operators.*	*-1*	*-.612*
26	**We need a purely scientific approach to dealing with the issue of sage-grouse. People's private profit (ranching, energy and home development, etc.) should be left out of it.**	**-2**	**Middle -.768**
31	*The BLM says they are going to collect data and information to help the sage-grouse, but this is all an illusion. They are not really doing anything for them.*	*-1*	*-.898*
28	**The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.**	**-2**	**Lower -.961**
5	Energy companies have the power to develop as they see fit, even if science shows that development is harmful to sage-grouse.	-3	-1.028
16	We need to decide quickly how we are going to conserve these birds or they are going to disappear completely.	-3	-1.043

27	**The existing scientific research is sufficient for telling us how to balance energy development with sage-grouse conservation.**	**-2**	**Lower -1.068**
18	Residents of Sublette County know that development is hurting sage-grouse but there is so much money at stake they are not willing to stop it.	-3	-1.221
20	**Unless you get a judge to rule against the BLM's management of energy development and its effects on sage-grouse habitat the BLM will not change.**	**-4**	**Lower -1.226**
11	The primary reason for the decline in sage-grouse populations in Sublette County is gas development.	-4	-1.581
13	The primary reason for the decline in sage-grouse populations in Sublette County is grazing.	-5	-2.035

*This column shows statements that ranked significantly higher or lower than those for other communities and are therefore, helpful in distinguishing one community from another.

**Indicates significance at p<05 level. Others in column are significant at p<.01 level.

In addition to the z-scores associated with the model Q sort representing each factor, semi-structured interviews were helpful in characterizing each knowledge community identified in the three factor solution. Detailed notes and relevant quotes were taken from all interviews. Similar themes among and between interviews were coded into like categories through an iterative process. This coded interview data was then used to provide more depth in understanding of each factor. When the interviews do provide additional insights, representative quotes are presented in Tables. Quotes were chosen to

represent the overall sentiments reflected in the factor (knowledge community). Furthermore, quotes were also selected for their concise and succinct nature.

The following sections will outline and discuss the three knowledge community factors identified by the analysis using Q sort and interview data to detail the viewpoints held by those comprising the knowledge community. The discussion begins with a section presenting an analysis of the characterizing statements for each knowledge community separately. It is followed by a section examining differentiating and consensus statements that provide a deeper contrast between the three knowledge communities. When relevant, interview data is incorporated into both sections to help enrich the understanding of each knowledge community. Because the sampling strategy employed in the study was purposive rather than random, the percentage of the sample falling into each knowledge community factor referred to below applies to the distribution of individuals only within the sample and cannot be said to be generalizable to a claim that the same percentage exists in the Sublette County population. Finally, when describing participants in each group based on the interview responses, details about participants are given to the greatest extent possible while protecting identities of small town residents.

Descriptions of knowledge communities – Characterizing statements

Ultra locals This first factor, or first knowledge community was 53 % (n=16) of the sample (see Table 4). Recall that knowledge communities are comprised of individuals, in this case within the geographic boundaries of Sublette County, Wyoming, which the Q sort analysis suggests have politically aligned narratives or frames. About 75 % of the individuals in this knowledge community were ranchers or those in the agricultural businesses (see Appendix I). All active ranchers interviewed for the study loaded into this category. Each rancher ranches for at least five months out of the year and depends on their public land allotments, usually held with the BLM, to remain viable. Those with cattle part of the year practice intensive grazing running strictly grass fed operations; however, the majority run a more traditional, year-around haying operation. The other 25% loading into this factor were a mix of other long time residents of Sublette

County, including some associated with energy development, regulation and conservation. Three individuals had formal biological training.

The term ultra local is meant to refer to individuals whose families have lived in the area, usually for many family generations. In addition, ultra locals are dependent on the land for their livelihood in some form. As a result, ultra locals may have long-term local, experiential knowledge of the area based on their close interaction with the land and its resources over a long period of time. In this case, ultra locals were either a part of families who had originally homesteaded in the county and subsequently operated local cattle ranches for more than 100 years, or depended on the locally prominent extractive industry. Often times, as described below, this tie to the land due to their livelihood resulted in a long-term knowledge of the area.

Analysis of the characterizing statements for this factor suggests several broader themes characterize the viewpoint held by this knowledge community. Thus the discussion of characterizing statements for this (and the other two factors) emphasizes the themes reflected among conceptually related groupings of statements in the tails of the model sort (i.e., as noted above, those statements with a z-score of approximately +/- 1) rather merely literally restating the content of individual statements. This approach is consistent with the manner in which more traditional factor analyses are interpreted in which the specific statements themselves are seen as indicators of larger concepts. This reflects part of the qualitative dimension of Q sort analysis, though readers can assess the merits for the conceptual groupings by examining the specific wording of the grouped statements in relation to the rationale for the grouping reflected in the write up. The first broader theme for ultra locals is one that stresses the importance of valuing local involvement and knowledge in sage-grouse management. Participants in this knowledge group underscored the importance of local management of sage-grouse (statement 15, with the second highest positive z-score (1.610) measured in the knowledge community – seeTable 8). Data further show an emphasis on local by the high value placed on rancher's information (local knowledge) about sage-grouse, equating it with scientific information (statement number 4 with z-score = 1.405). This preference for local management, suggests acceptance and strong support for a multijurisdictional approach

to management (statement number 14 with z-score = 1.902) may largely be due to the inclusion of local, private land owners in the statement about the multijurisdictional approach.

However, based on Q sort data alone, interpreting the meaning of the above statements as all reflecting a focus on the local remains slightly empirically tenuous (especially in the case of statement 14). Here the interview data help support this interpretation. First, in the interviews there was a strong emphasis on the significance of local knowledge. Specifically, as expressed in many of the interviews this knowledge community valued local knowledge arising from long-term, experiential knowledge (see Table 9 T9-1 - T9-5). Whether discussing their long-term knowledge of sage-grouse populations or predators and the related changes in those populations, this community often highlighted their long term local knowledge often based on their connection with the land and their livelihood. Another theme emerging from interviews of ultra locals more explicitly reinforces the interpretation of statement 14 presented above (see Table 9 T9-6 – T9-8). The quotes presented here are typical of these participants' idea of local. Instead of viewing the idea of scale as merely two dimensional, national (as in the federal management of sage-grouse) versus the state of Wyoming (with state representing the local level), they seemed to view local more in the context of Sublette County and its residents. This insight about how local is understood reflects the importance of including interview data in gaining a more complete understanding of the views of participants.

Table 9: Data from interviews from participants in knowledge community one, ultra locals.

Data reference	Participant data
T9-1	"…we have a hundred years of knowledge because of what our parent have told us and what their parents have told them and handed down…based on my history, my dad's told me, the numbers of sage-grouse were incredible at that time." (TSM-

	PRE)
T9-2	"[When I was just a kid] I started haying and would go out there and hay and cut the legs of so many of those chickens, usually 2 a day there were so many." (REM)
T9-3	"When I was younger we had a tremendous sage-grouse population in the 50's and 60's so yea, we've seen a decline in the chicken population." (YKM)
T9-4	"30 yrs. ago we didn't have a raven in the County and very few crows. Now we are inundated with both ravens and crows. And ravens have been identified as some of the most significant nest predators to sage-grouse." (LNM-PRE)
T9-5	"You know it was about 15 years ago when I noticed that the population [of sage-grouse] just went (does a thumbs down motion) and the population has just gone to heck. I think it's the dang predators" (CHJ)
T9-6	"We don't consider Cheyenne as being local. We live here you know. The governor doesn't live here, the county commissioners live here. Local is the county." (DW)
T9-7	"I'm a strong proponent of local decision making. I think local decision making is real important. I don't like the way the Governor is doing the whole grouse thing and its totally government control. And we've seen it so much. I'm not totally against him, he's a good conservative on a lot of things, but he just likes to run everything from Cheyenne. And that just rules out local decision making." (LRM)
T9-8	"I think decisions about sage-grouse listing should be made at the local county level." (TSM-PRE)

T9-9	"If you have lost all of your habitat in Washington state to wheat farms then where are you going to concentrate? Well, let's keep the bird going in *my* back yard. So we get to do the yeoman's work. We get the punishment. We get all the environmentalists up on all the hilltops looking down on us because we have done a good job. Because we haven't destroyed the habitat." (NSM)
T9-10	"You've got groups, these environmental groups like Western Watersheds, where their main agenda is to get cows off public land. They'll do anything behind the scenes to accomplish their objectives. We've run into problems with them. Like the district does a lot of water quality work and what not. Western Watersheds will go wait and they see a bunch of game or cows cross a creek and they will take a sample right quick. If they go out on the range and try to collect data on grass, well they will collect their data on a the track of a road. So their data is not creditable. That's one reason the district is doing this work, so we have the creditable data. We have the creditable data and those people are out of the loop." (TSM-PRE)
T9-11	"The environmentalists blame all the trouble on the cows and want to take all the cows off the public lands and that would put us out of a business." (TSM-PRE)
T9-12	"We didn't have all these stinkin' environmentalists in this county until the [energy companies], then they come in here like flies to crap." (TSM)
T9-13	"You also have to begin to have to fight day by day by day the environmental groups that want to have no trespass, they do concentric circles for activity around the lek. Our leks all overlap so I could get up in the morning and not be able to do

	anything for 4-5 months." (NSM)
T9-14	"I think to a certain degree the environmental community are using sage-grouse for land control." (YKM)
T9-15	"You have a lot of people that want to use the sage chicken situation to shut down the oil companies. To them the sage chickens are a tool to get to the oil companies. Well, the oil companies recognize that so they are willing to spend millions of dollars to counteract it." (JNN)
T9-16	"I think if the sage-grouse was listed life as we know it would cease to exist. I don't think we would be able to turn our cow out [onto the BLM allotment] until they were off their nests. Our cattle go out the first of March. And I think if the grouse was listed, I'm not saying everywhere, but areas where high lek concentration, you wouldn't be able turn out until the chicks were off the nests sometime in the middle of June. So, what would we do? We got to get these cows off the haw meadow to raise the hay. I just don't think we could survive." (YKM)
T9-17	"[If the sage-grouse are listed] it will make life way tougher. They'll be tougher than hell on the grazing." (CHJ)
T9-18	"People are scared of a possible listing because its based on data that is not accurate and will change their ability to generate income. It would mean you could no longer graze the way you had." (LAR)
T9-19	"If they loose those grazing permits [because of a listing], the next thing they do is subdivide their private property and turn it into home sites. Hugely more detrimental to the bird than a bunch of cows. People need an economic reason to be in

	business." (LNM)
T9-20	"You know it was about 15 years ago when I noticed that the population [of sage-grouse] just went (does a thumbs down motion) and the population has just gone to heck. I think it's the dang predators." (CHJ)
T9-21	"There were a lot more people and ranchers out on the range that controlled the predators. That was another major factor. The ranches were smaller. There was more cowboys and sheep herders or whatever and they kept the coyotes and stuff under control. We didn't have the ravens and the foxes which eat the chickens and their eggs. The combination of those factors is the big reason the chickens are having problems." (DMM)
T9-22	"I have noticed when we started getting a lot of fox then the [sage-grouse] chickens disappeared. It was really obvious. In other areas of the county it was more the ravens" (DNM-PRE).
T9-23	"[Wildlife Services] did a study this last spring on some sage-grouse stuff where they done some raven control. And the successful sage-grouse nesting was damn near twice as much. (YKM)
T9-24	"Why don't we use some [mitigation] monies for predator control? Wildlife Services is ready to go." (LMN)

Returning to the Q sort data, a second theme characterizing this knowledge community's views was their belief that the information to guide sage-grouse management is lacking. The ultra local thought community strongly believed that the existing scientific information was insufficient to guide major decisions about sage-grouse management

(statement number 21 with z-score = 1.417; statement number 27 with z-score = -1.043; statement number 22 with z-score = 0.993; statement number 28 with z-score = -0.961). Further, this theme underscoring the shortage of information in the debate of sage-grouse management may have influenced the belief among these respondents that there is no need for fast action to protect sage-grouse (statement number 16 with z-score = -1.043).

A third theme apparent in the Q sort data deals with views about causes of decline. Based on the z-scores, the statement showing the most agreement, and therefore, most strongly characterizing the knowledge community was their view that grazing was not the cause for sage-grouse declines (statement number 13 with z-score = -2.035). Thus, these participants strongly resisted blaming themselves or their peers (fellow ultra locals), for sage-grouse populations declines. In addition, these participants did not believe energy development was detrimental to sage-grouse (statement number 11 with z-score = -1.581). In other words, this knowledge community did not believe that either of the potential reasons for decline that were "livelihood related" were actually primary causes of the decline.

The final theme within this knowledge community flows from their view on energy development impacting sage-grouse populations and comments on their perspective of the on-going energy development in the area. Characterizing statements show that participants in this knowledge community expressed their lack of skepticism of energy development. Specifically, as noted above, these participants did not believe energy development was detrimental to sage-grouse populations. Beyond this, ultra locals did not believe that energy companies had accrued so much power they could develop as they pleased (statement 5 with z-score = -1.028), that the courts should step in and force the BLM to take a hard stand on energy development (statement 20 with z-score = -1.226), or that local residents are ignoring the impacts of energy development because of the money to be made (statement 18 with z-score = -1.221).

The above discussion highlights characterizing statements most defining of the ultra local knowledge community based on the Q sort data. However, the follow-up interviews revealed themes that provide important additional insight into this knowledge

community. First, recall the second broad theme discussed above regarding the perceived lack of adequate information, both historic and current, about sage-grouse. Then, recall the idea that grazing was not viewed as the cause of sage-grouse declines. Coupled together, these beliefs may have had an effect on this knowledge community's perception of environmental groups. For example, some respondents felt that cattle ranching actually protected habitat (compared to, say, farming) and ranchers were therefore responsible the existence of some current sage-grouse (see Table 9 T9-9). Other excerpts show how many of the participants in this knowledge community felt as though environmental groups have an agenda to eliminate grazing and are willing to go as far as to collect fraudulent data to support that goal, causing the ultra locals to distrust environmental groups (see Table 9 T9-9 – T9-12). In particular, interview data show ultra locals believe environmentalists intended to control land use, from grazing to energy development, and private property rights (see Table 9 T9-13 – T9-14). In fact, looking deeper into the idealized Q sort, more toward the center and away from the "tails" (z-scores of +/- 1), it is clear that ultra locals agree that with the view that the ESA is a tool used by extreme environmental groups to control development they do not approve of (statement 30 with z-score = .826) . Thus, the widely shared belief that information is incomplete, the view that grazing has actually benefited sage-grouse habitat rather than been a primary factor in their declines combined with the lack of trust by ultra locals of environmental groups may explain why ultra locals view the ESA as a tool used by extreme environmental groups.

In addition, interview data show that influences of the actions of environmental groups on grazing was of particular concern among ultra locals. Although it did not emerge as a characterizing statement, the Q sort statement number 32 (z-score = .655) reflects a sense of agreement within this knowledge community that livelihoods would be threatened if sage-grouse were to be listed. In the interviews concerns related to livelihood seemed more prominent than the model Q sort ranking suggests. It was often an emotional topic during these conversations (see Table 9 T9-16 – T9-19). Participants expressed fears surrounding a possible sage-grouse listing and their ability to graze cattle. They expressed deep concerns that a listing action would severely limit their cattle operations

to the degree that ranching may no longer be economically viable, and as a result, they may be forced to sell their land as subdivisions. Furthermore, as livelihood concern comments 2 and 5 reiterate, those in this knowledge community believe that the consequences of loss of grazing would actually be detrimental to the sage-grouse.

In sum, characterizing statements showed the ultra locals knowledge community had a preference for "the local," such as the preference for local management and the importance of rancher's information, to inform that management. Ultra locals were not skeptical of energy development and they did not believe there was enough information to render a decision regarding listing the bird. Interview data proved indispensable as it led the way to a deeper understanding of both characterizing statements as well as highlighting other important themes that were not measured to be as important by Q sort data.

Classic biologists Adding to the understanding of the perspectives within the sage-grouse debate in Sublette County, is the second knowledge community, classic biologists; a homogenous group composed solely of biologists (see Appendix I). Specifically, this knowledge community consisted of biological consultants, agency biologists or biologists working for environmental or conservation organizations. Many of these participants were actively engaged in research in Sublette County. Two-thirds of this knowledge community lived in Sublette County. In total, 23% of participants (n=7) loaded into this thought community (see Table 4).

The phrase classic biologist was selected to describe those in this knowledge community for a number of reasons. First, not all biologists within the sample fell into this knowledge community. Limiting the term to simply "biologists" would infer all biologists sampled loaded into this knowledge community when in fact, biologists were dispersed within all three knowledge communities. Second, the predominant views in this knowledge community are typical of biologists and readily associated with them. Traits characteristic of these individuals include privileging science, viewing politics as an impediment to science and implementing scientific findings and a continued hunger

for more information. Together, these views summarize the general perspectives held by many classic biologists.

The first broad theme evident within the Q sort data of the classic biologists was their prioritization of scientific information above rancher's information, which may often be local, experiential information, and preferred by ultra locals. The data show that participants in this knowledge community were driven by their views of the scientific data. In particular, classical biologists felt that science clearly demonstrated a decline in sage-grouse populations (see Table 10, statement number 25 with z-score = 1.657), and as a result, felt a sense of urgency to conserve sage-grouse (statement number 16 with z-score = 1.122).

Table 10: Summary of knowledge community two, classic biologists, arranged by z score. Items in italics represent consensus statements or those that do not discern one community from another. Bolded items represent significant distinguishing statements.

Statement Number	Statement	Rank Score	Compared to other Factors (z-score)*
25	**The scientific research definitively demonstrates that sage-grouse populations have declined dramatically in Sublette County.**	**5**	**Higher 1.657**
19	**Current sage-grouse conservation efforts are primarily a result of the threat of listing. Without this threat there would be little interest in sage-grouse conservation efforts in Sublette County.**	**4**	**Higher 1.613**
14	*We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM.*	*4*	*1.461*

	Everyone needs to work together.		
3	**Scientific findings about sage-grouse are not put into practice because of political agendas.**	**3**	**Higher 1.390**
24	**We don't understand enough about the sagebrush ecosystem to know the best ways to create better sage-grouse habitat.**	**3**	**1.190**
16	**We need to decide quickly how we are going to conserve these birds or they are going to disappear completely.**	**3**	**Higher 1.122**
11	**The primary reason for the decline in sage-grouse populations in Sublette County is gas development.**	**2**	**Higher .926**
18	**Residents of Sublette County know that development is hurting sage-grouse but there is so much money at stake they are not willing to stop it.**	**2**	**Higher .830**
5	**Energy companies have the power to develop as they see fit, even if science shows that development is harmful to sage-grouse.**	**1**	**Higher .745**
17	You can't make gas development go away, so you have to work around it.	2	.702
10	*I think there is more expertise on sage-grouse in the local Game and Fish office than at the local BLM office.*	*1*	*.516*
27	**The existing scientific research is sufficient for**	**1**	**Higher**

	telling us how to balance energy development with sage-grouse conservation.		**.391**
23	*People have taken sides on this issue without adequate information to back up their opinions.*	*1*	*.278*
21	**The information necessary to make decisions about listing sage-grouse is incomplete.**	**0**	**Middle .212**
15	Local management of sage-grouse is most appropriate.	0	**Higher**** .107
20	Unless you get a judge to rule against the BLM's management of energy development and its effects on sage-grouse habitat the BLM will not change.	0	.084
26	**We need a purely scientific approach to dealing with the issue of sage-grouse. People's private profit (ranching, energy and home development, etc.) should be left out of it.**	**0**	**Higher .015**
28	**The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.**	**0**	**Middle -.064**
2	*I think information provided by ranchers is only used by decision makers if it meets political needs.*	*0*	*-.351*
9	*People who are in decision making positions are misinterpreting the scientific research that exists on sage-grouse in Sublette County.*	*-1*	*-.378*

13	**The primary reason for the decline in sage-grouse populations in Sublette County is grazing.**	**-1**	**Lower -.385**
1	**The people debating sage-grouse management use scientific data to further their political agendas to list or not to list sage-grouse.**	**-1**	**Lower -.424**
31	*The BLM says they are going to collect data and information to help the sage-grouse, but this is all an illusion. They are not really doing anything for them.*	*-1*	*-.643*
22	**There is not enough historical scientific data to clearly understand what has happened to sage-grouse populations over long periods of time.**	**-2**	**Lower** ** **-.757**
32	**Listing sage-grouse will severely threaten the livelihood of many people here in Sublette County and that is not fair. A bird should not take priority over people's ability to put food on the table.**	**-2**	**Lower -.812**
29	*The BLM will use whatever information they can to further control the oil and gas operators.*	*-2*	*-.841*
4	**Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.**	**-3**	**Lower -1.058**
7	**Biologists working in Sublette County only a few years have not been here long enough to understand trends and influence on local sage-**	**-3**	**Lower -1.205**

	grouse populations.		
30	**The Endangered Species Act is a tool extreme environmental groups want to use to control development they do not approve of.**	**-3**	**Lower -1.371**
6	**People from large urban areas are using science to try to tell residents of Sublette County what to do.**	**-4**	**Lower -1.396**
8	**Ranchers know more about sage-grouse than wildlife researchers because their understanding comes from experience developed over a long period of time.**	**-4**	**Lower -1.570**
12	**The primary reason for the decline in sage-grouse populations in Sublette County are predators.**	**-5**	**Lower -1.985**

*This column shows statements that ranked significantly higher or lower than those for other communities.

**Indicates significance at p<05 level. Others in column are significant at p<.01 level.

Because classic biologists clearly prioritized the scientific information on sage-grouse, they were distinctively less receptive to other types of information. Particularly, those in this knowledge community did not view rancher's information as valid to make management decisions concerning sage-grouse (statement number 4 with z-score = -1.058). In essence, they did not see this knowledge as science and thought scientific knowledge was more readily transferable from scientist to scientist. Contrast this with the views of ultra locals noting that because scientists in the area often come and go, they cannot understand the long-term trends of sage-grouse populations (statement number 7 with z-score = -1.205; statement number 8 with z-score = -1.570). Interview data provided more insight into why the classic biologists may have rejected the explanation linking predators to sage-grouse declines. As shown in these interview excerpts, chosen

due to their succinctness, rancher's local information cannot be considered science because it is not replicable, lacks discipline and only records clearly observable extremes from usual norms (see Table 11 T11-1 – T11-3).

Table 11: Data from interviews from participants in knowledge community two, biologists.

Data reference	Participant data
T11-1	"What happens with anecdotal knowledge you're remembering something like the weather, you know its real hot today. So you remember extremes that somehow made an impact on us…I think there is some room for that but it has to be weighed very carefully and has to be assessed in some sort of a blind fashion. And I don't know how to use it really…We don't really." (NEM)
T11-2	"Biologists have more understanding of the trend on local sage-grouse populations, sadly, because the rest of its anecdotal and not replicable." (TNM)
T11-3	"I think it's a sad state of affairs when people can believe that anecdotes can be turned into science…I'm very seldom going to doubt the sincerity of the reporter, but it has virtually no value when it comes to doing real measures. It can send us on a path that gets us to go measure something, but to assume observation is measurement is not correct. It has to be with structure. Anecdotal information cannot replace scientific inquiry. I have had this discussion at length. They really want to believe that the things that they have observed but not collected but not structured in their collection, these things somehow become scientific data, but without discipline there is no such thing as real data." (RNE)

T11-4	"I think the ESA is the wrong tool…I think management has to occur on the local scale. No two situations are the same. In terms of the impacts on the landscape and the conditions of the landscape and what needs to be done to fix the landscape, if anything. So, I think that management ultimately needs to be at the local scale, however, the local managers need more of a holistic view – the feds need to manage across the range, at the state level and at the local level. I think you need to start the local level the actual on the ground planning, but the state has to have a concept as to how they want to mange for grouse and the feds need to be able to be sure that the upper Green is where we need to focus, but there are other pockets other places too… The problem with the endangered species act is that it takes the state away. I don't think they necessarily should be listed, but I do think something does have to happen to get the feds. involved. You start talking about the endangered species act and it removes the middle layer, it removes everything below. You start talking about an endangered species and it means the state has very little to say which means the local community has very little to say. The feds com in and tell them what to do." (NEM)
T11-5	"I do think management of the bird is better on a regional scale than on a national scale. It would be more effective, I would say." (YRM)
T11-6	"I have very mixed feelings about [the prospects of a listing]… I think if the species were to be listed I think it would, in some ways, make life a little more difficult because its all federal at that point. Nonetheless, I'm willing to work either way." (RNE)

T11-7	"I think the states should be managing sage-grouse, but that also gives you a scatter gun approach. A species with such a broad range, you can't effectively assess them on a state level, so I think there should be some kind of a blend between the feds and the state level." (NEM)
T11-8	"Preferably, coming up with solutions multijurisdictional and multidisciplinary is going to end up in a program that works better and allows for a site-by-site analysis rather than a prescriptive across the board approach." (RNE)
T11-9	"There is too much variability in the bird's requirements and you see that in SW Wyoming even. You go down to Kemmerer, the birds select habitat somewhat differently in the Upper Green, for example. And how to manage the differences in those habitats is best served by those that are most informed by those habitats and are actively managing those habitats on a day to day basis. I don't think someone from Washington could go into the Upper Green and tell people how to do it effetely, regardless of how effective the regional people are, they are probably more effective than the national people." (TNM)
T11-10	"Sure, we do have some human related activity that effects predation. They finally closed the dump at Pinedale. In addition to that, anywhere we have introduced permanent water, garbage, waste all those sorts of things. We have up-scaled the short-legged predators and raven by our own interference. And to me that is a people problem, not a predator problem." (RNE)
T11-11	"A perfect example is that they used to lace carcasses with 10-80 that would kill everything that ate meat, including ravens and eagles and grouse probably responded positively to that

	because there was nothing out there to eat them. But if you want to start talking about management of an ecosystem and utilizing grouse as the health of an ecosystem, killing all the predators is ludicrous…I think predator control is like putting a band aid on a compound fracture." (TNM)
T11-12	"In my opinion the grouse declines are indicative of far more than just grouse declines. Its indicative of an ecosystem which predominates in Wyoming that is unhealthy and that ecosystem supports our big game. That ecosystem support a lot of neotropical migrants it supports almost every species that lives in Wyoming at some time or another. It supports sage-grouse all the time and it the grouse are declining is that indicative of a system that is unhealthy in breaking, basically. And it that system does break, what does it mean to the rest of the wildlife that depends on that system at least for part of their life." (EWM)
T11-13	"Our initiative is the sagebrush initiative, not the sage-grouse initiative. We are concerned about 191 species of birds and 70 animal species of conservation concern that occur in the core area. It absolutely not just about the sage-grouse, its about a whole ecosystem and the health of the environment. We tend to forget that sagebrush is an important part of a watershed. Sagebrush is not just a plant, we are talking about a multitude of species." (RNE)

Further evidence that scientific knowledge was the driving broad theme among participants in this knowledge community was also apparent in the Q sort data. For

example, the classic biologists believed that the science, showing a drastic decline in sage-grouse populations, should be directing the debate and actions to conserve the bird. Consequently, these participants felt as though invoking the ESA to conserve sage-grouse could be considered an appropriate action based on the scientific conclusions. In other words, these participants did not feel as though it was appropriate to characterize the ESA as a tool within the sage-grouse conflict merely used to control unwanted development (statement number 30 with z-score = -1.371, statement number 19 with z-score = 1.613).

While these respondents do not see the ESA as merely a political tool and feel that it is an important factor in what has been accomplished for the sage-grouse up to this point, interview data show that classic biologists do not whole-heartedly support listing the bird under the ESA (see Table 11 T11-4 – T11-6). These interview statements represent the range in which this perspective was described. Each seems to focus on the ESA as an imperfect management tool that is not well suited to address the problem. Participants seem most concerned with large-scale regulations (referred to as blanket regulations), typical of ESA regulations suggesting that solutions necessarily entail a more local focus. Specifically, they noted that these regulations would not sufficiently address the differences across the landscape of sage-grouse habitats (see Table 11 T11-7 – T11-9). These interview excerpts suggest that the strong agreement for statement 14 (z-score = 1.46) which deals with the need for multijurisdictional management, stems from this concern. In place of an ESA listing and federal management of the bird, these participants supported a multijurisdictional approach to the problem, that may allow for more specific and variable regulations accounting for the unique differences across the sagebrush landscape.

Q sort data also show that in spite of their belief in conclusive nature of sage-grouse science indicating a definitive population decrease, these participants feel as though there is still a need for more scientific information (statement number 24 with z-score = 1.190). This point underscores the continuous inquisitive nature of many scientists.

In addition to the view of classic biologists that sage-grouse populations are declining and that the data are conclusive, the Q sort data show that these participants felt frustrated

that politics were hindering the application of scientific findings on sage-grouse (statement number 3 with z-score = 1.390) even though the science clearly reflected an urgent need for sage-grouse protections. They felt as though politics was muddling the situation and limiting action to resolve a problem clearly highlighted by science (statement number 6 with z-score -1.396).

Furthermore, because these participants were active in the sage-grouse debate, participating in local working groups and state committees addressing sage-grouse declines, they seemed familiar with commonly held perspectives of other knowledge communities within the conflict. This familiarity with the details of the debate may have led classic biologists to recognize the idea stemming from ultra locals regarding the influence of predators on sage-grouse. This idea, coupled with the understanding that classic biologists did not value rancher's local knowledge may have provided sufficient reason for these participants to reject the idea regarding predators and their role in sage-grouse declines (statement number 12 with z-score = -1.985). Moreover, the ideas inherent in the view that predators were responsible for the decline was seen as avoiding the true problem affecting sage-grouse populations (see Table 11 T11-10 – T11-11), and as a result, the idea that predators were culpable was rebuffed.

In conclusion, characterizing data showed that the view of classic biologists was largely motivated by their strong perspective that science clearly demonstrated a decline in sage-grouse populations. As a result of this view, these participants felt as though urgent action was needed to protect the bird. Yet, they saw politics as interfering with the necessary actions needed to conserve concern sage-grouse. In addition, these participants did not find great value in local knowledge and the idea held by ultra locals that the best medicine to recover sage-grouse populations was to initiate predator controls.

Harmonizers This final knowledge community was the smallest measured viewpoint in the Q sort, including 17% of participants (n=5). Like those in the classic biologist knowledge community, the majority of participants (80%) in this factor also have formal training in biological science (see Table A). Sixty percent were government agency biologists at either the state or national level, and the remaining 40% worked in

the energy industry. Evidence from both the interview and Q sort data seems to support the notion that participants in this community provide a sort of balance in perspectives. Participants in this factor were overwhelmingly in favor of working together to make progress on sage-grouse management. This was evident in both their Q sort as well as in interview conversations. Like prior discussions outlining knowledge communities, the following discussion uses characterizing statements as a guide to provide insight into this group. Interview data will also be incorporated when it can add depth to the understanding.

Whereas the driving broad theme identifying classic biologists was their prioritization of scientific knowledge, the most predominant theme among participants in this knowledge community was their drive to work together to address the issue of sage-grouse management. Harmonizers emphasized the need to incorporate all the stakeholders in the debate from private landowners to the land and wildlife managers and energy companies (see Table 12, statement number 14 with z-score = 1.924; statement number 17 with z-score = 1.540). Interview data also show how these participants value incorporating knowledge from all sides of the debate (see Table 13 T13-1). Consequently, these participants did not believe a solution to the problem could be based solely on one viewpoint alone, it must successfully incorporate many views (statement number 26 with z-score = -1.723) from those involved in the sage-grouse conflict.

Table 12: Summary of knowledge community three, harmonizers, arranged by z-score. Items in italics represent consensus statements or those that do not discern one community from another. Bolded items represent significant distinguishing statements.

Statement Number	**Statement**	**Rank Score**	**Compared to other Factors (z- score)***
14	*We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM.*	*5*	*1.924*

	Everyone needs to work together.		
17	**You can't make gas development go away, so you have to work around it.**	**4**	**Higher 1.540**
28	**The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.**	**4**	**Higher 1.456**
27	**The existing scientific research is sufficient for telling us how to balance energy development with sage-grouse conservation.**	**3**	**Higher 1.328**
1	The people debating sage-grouse management use scientific data to further their political agendas to list or not to list sage-grouse.	3	1.070
30	The Endangered Species Act is a tool extreme environmental groups want to use to control development they do not approve of.	3	.913
4	**Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.**	**2**	**Middle** .899**
15	**Local management of sage-grouse is most appropriate.**	**2**	**Middle** .698**
32	Listing sage-grouse will severely threaten the livelihood of many people here in Sublette County and that is not fair. A bird should not take priority over people's ability to put food on the table.	2	.698

23	*People have taken sides on this issue without adequate information to back up their opinions.*	*1*	*.636*
10	*I think there is more expertise on sage-grouse in the local Game and Fish office than at the local BLM office.*	*1*	*.634*
3	**Scientific findings about sage-grouse are not put into practice because of political agendas.**	**1**	**Middle .627**
25	The scientific research definitively demonstrates that sage-grouse populations have declined dramatically in Sublette County.	1	.290
7	Biologists working in Sublette County only a few years have not been here long enough to understand trends and influence on local sage-grouse populations.	0	.219
19	Current sage-grouse conservation efforts are primarily a result of the threat of listing. Without this threat there would be little interest in sage-grouse conservation efforts in Sublette County.	0	.099
6	People from large urban areas are using science to try to tell residents of Sublette County what to do.	0	.074
9	*People who are in decision making positions are misinterpreting the scientific research that exists on sage-grouse in Sublette County.*	*0*	*-.062*
8	Ranchers know more about sage-grouse than wildlife researchers because their understanding comes from experience developed over a long	0	-.117

	period of time.		
22	**There is not enough historical scientific data to clearly understand what has happened to sage-grouse populations over long periods of time.**	**0**	**Middle** **-.196**
2	*I think information provided by ranchers is only used by decision makers if it meets political needs.*	*-1*	*-.209*
20	Unless you get a judge to rule against the BLM's management of energy development and its effects on sage-grouse habitat the BLM will not change.	-1	-.260
31	*The BLM says they are going to collect data and information to help the sage-grouse, but this is all an illusion. They are not really doing anything for them.*	*-1*	*-.314*
29	*The BLM will use whatever information they can to further control the oil and gas operators.*	*-1*	*-.426*
21	**The information necessary to make decisions about listing sage-grouse is incomplete.**	**-2**	**Lower** **-.926**
18	Residents of Sublette County know that development is hurting sage-grouse but there is so much money at stake they are not willing to stop it.	-2	-.943
12	**The primary reason for the decline in sage-grouse populations in Sublette County are predators.**	**-2**	**Middle** **-.1.034**
5	Energy companies have the power to develop as	-3	-1.058

	they see fit, even if science shows that development is harmful to sage-grouse.		
11	The primary reason for the decline in sage-grouse populations in Sublette County is gas development.	-3	-1.338
24	**We don't understand enough about the sagebrush ecosystem to know the best ways to create better sage-grouse habitat.**	**-3**	**Lower -1.385**
16	We need to decide quickly how we are going to conserve these birds or they are going to disappear completely.	-4	-1.436
13	The primary reason for the decline in sage-grouse populations in Sublette County is grazing.	-4	-1.677
26	**We need a purely scientific approach to dealing with the issue of sage-grouse. People's private profit (ranching, energy and home development, etc.) should be left out of it.**	**-5**	**Lower -1.723**

*This column shows statements that ranked significantly higher or lower than those for other communities.

Table 13: Data from interviews from participants in factor three, harmonizers.

Data reference	Participant data
T13-1	"I think there is value in assimilating information from all quadrants. I think there is value in incorporating pure scientific perspective and I think there is value in land managers and wildlife mangers and their perspective of just being on the ground and looking at it from a land management perspective. But I also think that gathering data from people like ranchers

	that have been here historically for hundreds of years who have anecdotal data about what they have seen and what they think the impacts are [is important]." (YEF)
T13-2	"You know you've got a natural gas resource out here and state's economy relies on recovering some of those natural resources and so the goal is to develop them and then to goal is also to protect wildlife habitat so accommodations get made." (EZM)
T13-3	"Wyoming, we are a mineral state. We, like Alaska, we are very lucky to have the natural resources we have available. Both biotic and mineral. With that we have, the population of Wyoming, the demographic are mostly folks who are here to make a living…we, because we have such a low population and because we are just still worker bees, we are making money off the extraction and the management of it, we are not doing it necessarily for ourselves. What we produce goes elsewhere and does not stay in this state. And that is hugely frustrating because that it where the decision making comes in. We are the worker bees providing resources for folks out of state who are then the ones out of state are then the ones making the decisions for us." (RZF)
T13-4	"The reality is, from my perspective, people consume energy, people need energy. People aren't going to stop heating their homes, driving their cars and running the lights in their house and the reality of that is you have to drill for natural gas, you have to dig coal out of the ground, you have to have nuclear power plants, you have to have solar, you have to have wind, you have to have all of that. Although I think it makes people feel better to say that there is research, I don't think it

	necessarily impacts what we do on a regular basis. The reality is that the BLM has leased [the minerals] and the federal government gets an incredible amount of revenue, the state gets an incredible amt of revenue and the community gets an incredible amount of revenue. I don't mean to be so crass that it comes down to money, but in many way it does. And that's the driver." (EEF)

Data also show that these participants felt as though the existing knowledge and the information needed to move the sage-grouse issue forward, closer to a resolution, was sufficient. Specifically, participants in this knowledge community believed that enough information existed to strike a balance between energy development, grazing and sage-grouse conservation (statement number 27 with z-score = 1.328; statement number 28 with z-score = 1.456). In other words, they felt as if there was enough information on sage-grouse and their habitat to work together toward an amicable solution (statement number 24 with z-score = -1.385). And based on the information available, harmonizers did not see the sage-grouse problem as urgent (statement number 16 with z-score = -1.436).

The desire of these participants to work together may explain why Q sort data show these participants resisting blaming one person or group for sage-grouse declines. Different from other knowledge communities pointing to energy development or predators as responsible for sage-grouse declines within the Q set, harmonizers rejected the notions that the declines in sage-grouse were primarily due to grazing, gas development or predators (statement number 13 with z-score = -1.677; statement number 11 with z-score = -1.338; statement number 12 with z-score = -1.034).

However, harmonizers felt that politics could be driving those presenting these explanations for sage-grouse declines. For example, these respondents believed that

people used information and policy to support their political agendas and actions within the sage-grouse debate (statement number 1 with z-score = 1.070; statement number 30 with z-score = .913). Despite this view that political influences may be shaping people's perspectives of the conflict, harmonizers denied that energy companies and the money development brought to residents (through government budgets, etc.) was influencing the actions of individuals or businesses involved in the debate (statement number 5 with z-score = -1.058; statement number 18 with z-sore = -.943). In other words, even though they see political agendas in play, data seem to illustrate that harmonizers are not ready to portray those seeking livelihoods as villains; they did not believe that energy companies had unlimited power or that local residents are ignoring the welfare of sage-grouse for monetary gains.

However, another important broad theme within this knowledge community and one that may serve to better understand this notion regarding energy development and energy companies, surfaced within the interview data. That is, harmonizers had mixed feelings regarding energy development and its political influence. During interview conversations, participants spoke about the importance of energy development and the extractive industries to both state and local governments (see Table 13 T13-2 – T13-4). Most readily, harmonizers believed that the extractive industries play a pivotal role in building adequate government budgets and consequently noted that these funds were indeed influencing decisions.

To summarize this knowledge community, it is clear that harmonizers are driven by their belief that stakeholders in the sage-grouse debate should all work together, based on the existing information, toward a resolution. Furthermore, they do not feel as though pointing fingers and placing blame is an effective way to achieve their goal. Despite this, these participants recognize that politics are indeed at play in this issue, influencing actions and ideas. Those in this knowledge community see value in creating a balance between energy development, grazing and sage-grouse conservation.

Descriptions of knowledge communities – Distinguishing statements

After discussing characterizing data the unique character of each knowledge community is more evident, including how each community defines the issue of sage-grouse management and its solutions. The next step in an understanding of each knowledge community is to analyze their distinguishing statements. This discussion proceeds in a similar fashion to the prior explanation of characterizing statements. It begins with the first knowledge community, ultra locals, then proceeds to the classic biologists and close with the harmonizers.

Distinguishing statements within a particular knowledge community can be significantly different from those in other groups in three ways. Statements can have significantly higher or lower z-scores than the same statement for another knowledge community. These distinctions are of great importance to how the statement impacts the overall summary of the group and its noted differences from other knowledge communities. Distinguishing statements with a significantly higher or lower z-score when compared to other groups signifies that particular a knowledge community agreed more or agreed less (or disagreed more or less) with participants in other groups. As a hypothetical example, imagine two groups' opinions on global warming measured within a Q sort. One important statement within the Q set may comment on the cause of global warming, by identifying the cause of global warming as part of a natural cycle. One group may decide they strongly agree with the statement, meaning they agree that global warming is part of a natural cycle and resulting in a z-score of 1.5. Another group may strongly disagree with the same statement resulting in a negative z-score of -1.5. This statement isolating the cause of global warming may be said to be a distinguishing statement for both groups. That is, this statement is helpful in determining the difference between the two viewpoints.

One last option for distinguishing statements is the ranking of the z-score between the z-scores of the other knowledge communities. For example, a z-score of .5 will fall

between a z-score of 1.0 and -1.0. If this is the case, the opinion expressed by the statement is in some way a midpoint between the other knowledge communities. In other words, distinguishing statements can be significant in three ways. They can be higher, lower or in the middle when compared to the same statements in other knowledge communities. These distinctions are helpful in determining the meaning of the distinguishing statements.

Ultra Locals When looking more closely at the Q sort data for the ultra locals, it became evident that many of the characterizing statements were also distinguishing statements. In total, six of the eleven distinguishing statements for this community were also characterizing statements. Fifty percent (n=5) of the distinguishing statements were identified as having significantly higher z-scores than other groups. In other words, ultra locals agreed more with these particular statements than did participants in other knowledge communities. Forty percent of the identified distinguishing statements (n=4) had z-scores that were significantly lower (agreed with less) while the remaining 10% (n=1) fell in the middle of the way the other two knowledge communities sorted the statement.

Because many distinguishing statements were also characterizing statements, the broad themes used to describe them are similar those used to describe the characterizing data. The first, broad theme separating ultra locals from the other knowledge communities was their view of local involvement and local knowledge. More than any other knowledge community, ultra locals felt that local management with the input of local information was most appropriate (statement number 15, distinguishingly *higher* than the same statement in other groups with a z-score of 1.610 compared to z-score for biologists (B) = .107 and for harmonizers (H) = .698; statement number 4, higher with z-score = 1.405 compared to B = -1.058 and H = .899). Because scientific information often excludes local information, ultra locals were less comfortable with need for a purely scientific solution to the issue than biologists, though not harmonizers (statement number 26, middle with z-score = -.768 compared to B = .015 and H = -1.723). Just as these participants believed most strongly in local decision making, ultra locals thought it was

more inappropriate than any other knowledge community to involve others in overseeing the BLM's management of energy development (statement number 20, lower with z-score = -1.226 compared to B = .084 and H = -.260). These statements and their placement compared to other knowledge communities, show that ultra locals agreed more with the idea of local management and the inclusion of rancher's information than did participants outside this knowledge community

Another theme highlighted in the analysis of both the distinguishing and characterizing data was views related to the adequacy of information underlying the sage-grouse debate. The distinguishing statements in this theme underscored that ultra locals perceived a lack of complete information in the debate more than the other knowledge communities. For example, ultra locals were more reticent to believe that there was adequate knowledge to list the sage-grouse or to balance the dominate land uses of energy development and grazing with sage-grouse conservation (statement number 21, higher with z-score = 1.417 compared to B = .212 and H = .-.926; statement number 28, lower with z-score = -.961 compared to B = -.064 and H = 1.456; statement number 27, lower with z-score = -1.068 compared to B = 1.328 and H = 1.328). In addition to these participant's views that the there was not enough information available in the debate, they also felt that there was not enough historical data describing sage-grouse populations to compare to current information (statement number 22, higher with z-score = .993 compared to B = -.757 and H = -.196). Complementing the view that the science is insufficient, the Q sort data show that these participants believed less strongly than any other knowledge community that politics was preventing the application of the findings (statement number 3, lower with z-score = -.102 compared to B = 1.390 and H = .627). This data reflects that ultra locals may be more wary of the limited amount of information in the sage-grouse debate than those in other knowledge communities.

Lastly, a closer look at the distinguishing statements within this knowledge community show that, similar to both Q sort and interview data, ultra locals felt differently than did respondents in other knowledge communities about the role of predators on sage-grouse populations. These participants felt more than any other group, that predators were

responsible for the sage-grouse population decline (statement number 12, higher with z-score = .916 compared to B = -1.985 and H = -1.034). Interview data also highlights the nature of the ultra local's view of predators and their role in the sage-grouse population declines (see Table 9 T9-4, T9-20 – T9-22). Based on their experience, many participants spoke of the role that they had seen predators play in reducing the number of sage-grouse. From ravens to foxes, these participants explained that they had seen an increase in the number of predators over the years and that they believed that this increase directly resulted in the decrease of sage-grouse populations.

Similar to the characterizing data, the distinguishing statements reveal that ultra locals place more value on the inclusion of local ideas and management than others sampled. These distinguishing statements serve to support the idea that ultra locals privilege local information in the debate about sage-grouse management.

Classic biologists More distinguishing statements for this knowledge community were identified than for any other knowledge community (n = 22). This provided some evidence that this knowledge community is most dissimilar compared to the other two knowledge communities as more statements were determined to be significantly different from other groups. Among the total of 22 distinguishing statements, 41% (n=9) had z-scores that were considered significantly higher than the others, 45% (n=10) were lower and 14% (n=3) were between the z-scores for the ultra locals and the harmonizers. Like the distinguishing statements for ultra locals, many of the distinguishing statements identified for classic biologists were also characterizing statements. In total, ten statements were both distinguishing and characterizing. Consequently, many of the themes discussed in the explanation of characterizing statements are also discussed in this section.

The first theme among the distinguishing statements regard biologist's views of science. Distinguishing statements show that classic biologists believe more than other participants that science is a distinct type of knowledge. Specifically, classic biologists were more resistant to the idea that ranchers' information should be considered science

(statement number 4, lower with z-score = -1.058 compared to ultra locals (UL) = 1.405 and H = .899; statement number 8, lower with z-score = -1.570 compared to UL = .198 and H = -.117). Quite probably because they believed that science was distinct from the local, experiential information of ranchers, they did not believe biologists with lesser length of residence in the community was a problem in their assessing trends in sage-grouse populations (statement number 7, lower with z-score = -1.205 compared to UL = .198 and H = -.117).

Just as these participants' agreed more strongly than others that the science definitively demonstrates a decline in sage-grouse populations (statement number 25, higher with z-score = 1.657 compared to UL = .329 and H = .290), classic biologists showed a propensity to agree more than those in other knowledge communities that the sage-grouse management issue should be resolved with a purely scientific solution (statement number 26, higher with z-score = .015 compared to UL = -.768 and H = -1.723). Perhaps this propensity to support a scientific solution led these participants to shy away from ideas of local management more than other knowledge communities (statement number 15, lower with z-score = .107 compared to UL = 1.610 and H = .698). Together, these distinguishing statements along with those in the preceding paragraph show that classic biologists believe science to be a distinct knowledge deserving of priority over other knowledge forms in management issues such as the sage-grouse.

In regards to the information available in the sage-grouse debate, distinguishing statements show that classic biologists believed there was sufficient information to state that sage-grouse were in danger and it was an urgent matter in need of a fast resolution (statement number 22, lower with z-score = .757 compared to UL = .993 and H = -.196, statement number 16, higher with z-score = 1.122 compared to UL = -1.043 and H = -1.436). However, the data show that their perception of the lack of data to make an ESA listing decision fell between the other knowledge communities (statement number 21, higher with z-score = .212 compared to UL = 1.417 and H = -.926). This may perhaps reinforce some of the hesitancy shown in the characterizing data regarding the listing of sage-grouse by those in the classic biologist group. It may reflect commonly held norms

in science to never state that things are proven with certainty, only disproven; however, it seems Q sort data are not clear on this point.

These distinguishing statements also revealed that classic biologists tended to agree less than other participants with the conclusion that the decline in sage-grouse is due to predators (statement number 12, lower with z-score = -1.985 compared to UL = .916 and H = -1.034). This data supports the classic biologists' resistance to a solution that merely addresses predator populations discussed in the prior section of characterizing data.

Distinguishing statements not discussed in the characterizing data, include statements regarding energy development, grazing, livelihood and politics. First, according to the distinguishing statements, classic biologists were more concerned about energy development than the other knowledge communities (statement number 11, higher with z-score = .926 compared to UL = -1.581 and H = -1.338). Specifically, biologists agreed more with this statement that energy development was responsible for the decrease in sage-grouse populations than did those in other knowledge communities. In addition, biologists showed significantly more agreement with the statement accusing energy companies of having the power to develop how they see fit regardless of developments impacts to sage-grouse (statement number 5, higher with z-score = .745 compared to UL = -1.028 and H = -1.058). Considering their greater concern about the effects of energy development on sage-grouse, an interesting result is that classic biologists show greater agreement than do ultra locals that existing research is sufficient to show how to balance energy development with sage-grouse conservation (statement number 27, middle with z-score = .391 compared to UL = -1.068 and H = 1.328). It is unclear whether this reflects greater faith in science among classic biologists, a general condemnation of science in any realm among ultra locals, or something else. This is another instance where Q sort can reveal interesting patterns while falling short of providing a clear answer to them in absence of more directed follow up interviews.

Classic biologists were more mixed in regards to their views on grazing. For example, data show that biologists disagreed less strongly than other participants with the idea that

grazing was responsible for the decline in sage-grouse (statement number 13, higher with z-score = -.385 compared to UL = -2.035 and H = -1.677). This may simply indicate that they are neutral while the other knowledge communities feel quite strongly that this is not the case. Beyond this, these participants tended to disagree that a sage-grouse listing would threaten livelihoods while those in other knowledge communities tended to agree with this view (statement number 32, higher with z-score = -.812 compared to UL = .655 and H = .698). But their views on the sufficiency of information to balance to grazing and sage-grouse conservation fell between other knowledge communities (statement number 28, middle with z-score = -.064 compared to UL = -.961 and H = 1.456). This is consistent with the above findings about energy development. In the end, data seems to outline harmonizers as the most optimistic about science being able to resolve conflicts and ultra locals the least willing to concede to the adequacy of science. In between the two views about science are the classic biologists who seem to believe that science can demonstrate a problem, but it is difficult to know when there is sufficient scientific information to adequately address the underscored problem.

Another new theme highlighted from analyzing the distinguishing statements within this knowledge community was that of politics and its involvement in the debate on the sage-grouse. Classic biologists acknowledge that politics seems to be an influence the relationship between science and conservation practice. On the one hand, statement number 3 (higher with z-score = 1.390 compared to UL = -.102 and H = .627) underscores classic biologists think how politics interfere with scientific findings being put into practice more so than the other knowledge communities. However, biologists seemed less convinced that science was used to support political agendas (statement number 1, lower with z-score = -.424 compared to UL = .797 and H = 1.070). Additionally, these participants believed less than other participants that people in large urban areas used science to tell resident of Sublette County what to do (statement number 6 , lower with z-score = -1.396 compared to UL = -.233 and H = .074). This may reflect an underlying belief among classic biologists that politics may inhibit application of science but science itself cannot be corrupted for political ends. Again, the Q sort points

to an intriguing pattern but the appropriate interpretation of the pattern remains somewhat elusive.

Finally, classic biologists were less likely to view the ESA as a tool for environmental groups to control development (statement number 30, lower with z-score = -1.371 compared to UL = .826 and H = .913). They also felt more strongly than other participants that the sage-grouse conservation efforts were largely due to the threat of listing (statement number 19, higher with z-score = 1.613 compared to UL = -.041 and H = .099). Lastly, biologists were more reticent to accept the political notion that money currently being garnered from energy development was preventing people from stopping energy development even though they know its hurting sage-grouse (statement number 18, higher with z-score = .830 compared to UL = -1.221 and H = .943). Collectively, these distinguishing statements suggest classic biologists viewed the ESA as an appropriate tool for conservation and that those opposing conservation efforts were doing so knowingly for selfish ends.

In sum, the analysis identified more distinguishing statements for this knowledge community than any others meaning that the views of participants within this knowledge community are more differentiated from the opinions of other knowledge communities. These differences ranged from opinions about science to energy development and its impact on sage-grouse.

Harmonizers Distinguishing statements among participants in this knowledge community show a unique pattern when compared to distinguishing statements in other knowledge communities. Among the eleven total statements identified as distinguishing almost half (47% or n=5) of them fell between or in the middle of the other two knowledge community's z-scores. In other words, the opinions expressed by these statements show that the views of those in this knowledge community strike a balance between the disparate perspectives of the ultra locals and the classic biologists. The remaining statements were either identified as having z-score significantly higher (27%

or n=3) or lower than those in other communities (27% or n=3).

Again, similar to the previous sections, many of the distinguishing statements were also characterizing statements, resulting in similar themes between the two types of analyses. The distinguishing statements commented on the amount of information available in the sage-grouse debate. In essence, harmonizers believe more than participants in other knowledge communities that there is enough information available in the conflict over sage-grouse management in Sublette County. Specifically, harmonizers were more accepting of the idea that enough was known about the sagebrush ecosystem to balance energy development, grazing and sage-grouse conservation (statement number 24, lower with z-score = -1.385 compared to UL = .768 and B = 1.190; statement numbers 27, higher with z-score = 1.328 compared to UL = -1.068 and biologists (B) = .398; statement number 28, higher with z-score = 1.456 compared to UL = -.961 and B = -.064). This may explain why harmonizers were more reluctant than other knowledge groups to conclude that the information needed to make a decision about listing sage-grouse was incomplete (statement number 21, lower with z-score = -.926 compared to UL = 1.417 and B = .212). However, this knowledge community's views on the sufficiency of historical information were found to fall between the opinions of other participants, perhaps serving as a bridge between the views of other knowledge communities (statement number 22, middle with z-score = -.196 compared to UL = .990 and B = -.757).

Another theme shared by the analysis of both the characterizing and distinguishing statements was that of the harmonizer's drive for balance among viewpoints in the study. First, these respondents believed, more than other participants, that existing research was sufficient to find a balance between energy development, grazing and sage-grouse conservation (statement numbers 27, higher with z-score = 1.328 compared to UL = -1.068 and biologists (B) = .398; statement number 28, higher with z-score = 1.456 compared to UL = -.961 and B = -.064). Furthermore, they were least likely to support a management decision that was purely based on science (statement numbers 26, lower with z-score = -1.723 compared to UL = .768 and B = .015). The prior statement may

well be linked to a pragmatic philosophy understanding that links to livelihoods, like energy development, influence decisions and are not going to simply disappear leading conservationists no choice but to balance conservation with energy development (statement number 17, higher with z-score = 1.540 compared to UL = .562 and B = .702). When the meanings of these statements are combined they provide evidence that these participants believed more than other respondents that there was a both a need and a way to find balance between science and current land uses of grazing and energy development.

The last similar theme between characterizing and distinguishing statement analyses within this knowledge community is the harmonizer's desire to bridge the views of other knowledge communities. Q sort data illustrates that harmonizers also disagreed that predators were primarily responsible for sage-grouse declines, although not as strongly as the classic biologists. In other words, they also disagreed that predators (statement number 12, middle with z-score = -1.034 compared to UL = .916 and B = -1.985). In other words, views of participants within this knowledge community struck a balance between views of ultra locals and biologists. Overall, this data supports the notion that a uniting characteristic among harmonizers is the drive for balance.

New to the data analysis and explanation of this knowledge community are the themes outlining harmonizer's views of science, politics and local management. Not only do these themes add to the depth of understanding of this knowledge community, but they also serve to further underscore the aforementioned desire for balance. Like ultra locals, harmonizers agreed, though not as strongly, that ranchers' knowledge was as useful as science (statement number 4, middle with z-score = .899 compared to UL = 1.405 and B = -1.058). However, like classic biologists they agreed (again not as strongly) that political agendas interfered with translating science into conservation practices (statement number 3, middle with z-score = .627 compared to UL = -.102 and B = 1.390). Thus, harmonizers appeared to believe that the science is there and the various interests can be balanced, but politics is preventing the application of science to management. Finally, like respondents in the other two knowledge communities harmonizers agreed that

management should focus on the local scale, yet they fall between ultra locals and classic biologists in where they chose to rank the statement in the Q sort (statement number 15 (middle with z-score = .698 compared to UL = 1.610 and B = .167).

In conclusion, the Q sort data presented here provides ample evidence that participants in this knowledge community aim to create a balance or a sort of harmony between otherwise disparate views within the sage-grouse issue. From their harmonizing views on the appropriate scale for management to the knowledge to influence that management, participants in this knowledge community seem to be interested in balancing vying opinions within the sage-grouse debate.

Descriptions of knowledge communities – Consensus statements

The last group of statements identified in the data analysis phase that may be helpful to understanding each knowledge community were the consensus statements. Recall that these statements are statements that are not helpful in identifying one factor from another, but instead may signify one of two meanings. First, a consensus statement may signify the statement was not meaningful to participants (i.e. that statement was not important to their viewpoint or was not appropriate for the sort), in which case the statement will be less likely to be a characterizing statement. The other possibility is that the statement shows an area of agreement and is more likely when the statement is also a characterizing statement. The latter type of consensus statements are more noteworthy to conflict discussions as they may highlight an idea agreed upon by participants. Thus, in some cases consensus statements may reflect important insights – points of commonality among conflict parties.

Q sort data show a total of seven consensus statements. However, six of those statements were placed very close to the center of each knowledge community's idealized Q sort. In other words, these were statements that either participants felt neutral about or found not meaningful (i.e. they did not understand them or the wording of the statement was not

meaningful to them). Because of these different possible meanings, it is difficult to interpret these statements and their relevance to participants sampled. Instead, this discussion will first center on the one remaining statement, statement number 14; a statement measured as both a consensus statement and a characterizing statement for all knowledge communities.

Statement number 14 underscored the need to look at multijurisdictional management, from local private land owner to Wyoming Game and Fish to the BLM. It communicates the importance of everyone working together to manage sage-grouse. At first, simply because each group strongly agreed with this statement it may be concluded that is indeed an important idea valued by all participants. However, interview data serves to complicate this seemingly simple interpretation.

After reviewing interview data, it seems as though participants concluded that this statement was important for different reasons. First, ultra locals may have agreed strongly with this statement because it addresses their strong preference to include locals, whose experiential knowledge they feel is valuable to management. Such an interpretation is consistent with the interpretation of the characterizing statements in the Q sort data. In contrast, classic biologists may have focused more on the other entities in the statement, the BLM and the Wyoming Game and Fish Department due to the classic biologists interest in including more local experts that understand the gross habitat variations on the landscape in sage-grouse management. Finally, this statement seems to most fit with the viewpoint of the harmonizers. Both interview and Q sort data show that these participants valued local information and expressed a drive to work together to find a resolution to the sage-grouse issue.

In summary, both data sets seem to support the conclusion that participants focused on different aspects of statement 14. Consequently, it is probably inappropriate to conclude that this statement simply indicated that all of these participants would be willing to work together merely because it is a consensus and characterizing statement.

However, based on analysis of the data, it would also not be entirely correct to state that these parties, simply because they may have focused on different portions of statement 14, would not be willing to work together in some capacity to manage sage-grouse. At the same time though, interview data show that participants in the sample do share at least one common perspective or broad theme. Specifically, respondents all stated that information used in this debate is linked to politics and power (see *Table 7*). Participants within each knowledge community often highlighted the use of information to support political agendas within the sage-grouse conflict, from private property rights to ranching and land control, respondents commented on the importance and power inherent in knowledge. This characteristic of knowledge, they noted, often influenced the direction of the debate and actions taken to address concerns about sage-grouse at many levels, including the local, state and federal scales. So long as such views are held, translating the desires for multijurisdictional management into the actual multijurisdictional management may be problematic.

Definitions built from knowledge community narratives

Ultra locals Both interview and Q sort data outline the narrative frame used by participants in this knowledge community. First and foremost, ultra locals seem to define and frame the problem of sage-grouse management as a problem regarding the limited number of sage-grouse. Ultra locals believe the problem is caused by an increase in predators and their effects on the sage-grouse is limited to the number of sage-grouse on the landscape as opposed to a larger, more complex problem, such as the effects of grazing on ecosystems. As a result of this problem definition, ultra locals see the solution to sage-grouse management in predator control, not through an ESA listing. Specifically, participants suggested that techniques used by Wildlife Services (a department within the US Department of Agriculture), would be most appropriate and successful in serving to increase sage-grouse populations (see Table 9 T9-23 – T9-24). They believed that Wildlife Services was ready and willing to begin predator controls at any time and supported this action to address sage-grouse population declines.

The ultra local's outlook on the sage-grouse problem is built based partially on their value of local and experiential knowledge. Much of this narrative is built on the participants' experiences and local observations of both sage-grouse and predator populations. The observed increase in predator populations and the coinciding decrease in sage-grouse populations was formative in building this shared narrative among ultra locals.

Classic biologists Characterizing and distinguishing data for participants in this knowledge community was helpful in understanding the central beliefs regarding sage-grouse management including their problem and solution definitions. The data from the classic biologists underscores the importance of science to these participants and their perceptions of the issue. As a result, science shapes the definition of the conflict and its preferred solution.

The influence of science on the classic biologist's view of the conflict, specifically its definition and proposed solution is evident in interview data (see Table 11 T11-12 – T11-13). These excerpts underscore that participants believed the problem was more than decreased sage-grouse populations, as ultra locals viewed it; instead, they described the issue as a more complex problem at the ecosystem level. In other words, the narrative of classic biologists pinpoints the problem as one where the sagebrush ecosystem is unhealthy and in danger. From their perspective, the decline in sage-grouse is but a symptom of a larger, more complex problem. According to classic biologists, other symptoms may include declines of other sage-grouse obligate species such as pygmy rabbits or brewer's sparrows. Consequently, the solution proposed by these participants is not simple requiring improvements and preservation of sagebrush habitat, not simply the sage-grouse.

The differences between the ultra locals and classic biologists' narrative are drastically different. The former emphasizes predator control as the most effective way to address the problem of sage-grouse management while the latter advocates wider ecosystem health. It is clear that these ideas are at odds for a number of reasons. First, perhaps as a

result of their professional training, many wildlife biologists believe predators serve an important role in maintaining ecosystem health. As a result, the idea of controlling predators to address an unhealthy ecosystem is extremely troubling to them. According to the classic biologist view, such an action may tip the scales of ecosystem health further in the wrong direction serving to exacerbate their view of the problem.

This shows how these knowledge communities may actively disagree with the other's narrative on sage-grouse management leading to a more tense and difficult conflict. In other words, these mis-matched and contested narratives may be a powerful driver in the conflict over sage-grouse management in Sublette County and perhaps at larger scales outside the scope of this research.

Harmonizers Different from the above narratives was the narrative of participants in the harmonizer knowledge community. Although these participants recognized that sage-grouse numbers had declined, their narrative did not explicitly focus on this point. Instead, much like the driving theme discussed in the characterizing data describing the harmonizers, they focused on having everyone come together to identify a resolution to the conflict. In other words, they felt as though the problem was defined by the lack of cooperation and the focus on differences instead of similarities. As a result, they felt as if parties involved in the conflict should come together and work toward a solution that all parties can live with.

Both these definitions, of the problem and the solution, reinforce the notion that according to the data collected, participants in this knowledge community valued the information provided by all parties. From ranchers to biologists to energy companies, harmonizers felt that everyone had something valuable to bring to the table.

Conclusion

One goal of this research was to use Q-method as means of identifying different viewpoints or different ways of framing the debate about sage-grouse management that may exist among residents of Sublette County Wyoming. The analysis suggested that there are 3 different narrative frames linked to 3 different knowledge communities. The following discussion seeks to summarize, incorporating both Q sort and interview data, the frames for each knowledge community within the study. Included in these narratives are each group's definitions of the problem and solutions, as well as the type of knowledge valued by each community. Noting the knowledge valued by each community is helpful to understand how each narrative may contribute to the political atmosphere surrounding sage-grouse management in Sublette County.

Summarizing shared narratives within knowledge communities

This section of the conclusion emphasizes the Q sort data as a basis for understanding how respondents' framed the issues. The goal of the results section above was to provide an in-depth analysis that richly characterized each knowledge community individually. The goal of the conclusion is to provide a more succinct contrast of the three knowledge communities that reveals insightful differences of how knowledge communities appear to frame the issue. Based on the Q sort data, all three of the knowledge communities and their associated narratives can be contrasted according to their approach to framing four broad themes: the causes of sage-grouse decline, preferred solutions to the issue, knowledge and its perceived value and the politics involved in the debate.

First, in regards to the causes of sage-grouse declines, each knowledge community framed the problem differently (Table 15). For instance, the analysis suggested that the harmonizers do not agree that any one cause for sage-grouse population declines can be pinpointed as the primary cause. In contrast, ultra locals do attribute the decline to a single predominant cause: predation. They just as ardently argue that causes of decline associated with local livelihoods, such as gas development and ranching are not to blame. Still different from these two knowledge communities is the narrative presented by the classic biologists. According to the data, classic biologists point toward gas development

as primarily responsible for the decline, while even more strongly denying that predators are to blame.

Table 15: Ways the three knowledge communities framed causes of sage-grouse decline.

Statement number	Harmonizers	Rank	z-score
13	The primary reason for the decline in sage-grouse populations in Sublette County is grazing.	-4	-1.677
11	The primary reason for the decline in sage-grouse populations in Sublette County is gas development.	-3	-1.338
12	**The primary reason for the decline in sage-grouse populations in Sublette County are predators.**	**-2**	**Lower -.1.034**
	Ultra Locals		
13	The primary reason for the decline in sage-grouse populations in Sublette County is grazing.	-5	-2.035
11	The primary reason for the decline in sage-grouse populations in Sublette County is gas development.	-4	-1.581
12	**The primary reason for the decline in sage-grouse populations in Sublette County are predators.**	**3**	**Higher .916**
	Classic Biologists		
12	**The primary reason for the decline in sage-grouse populations in Sublette County are predators.**	**-5**	**Lower -1.985**

11	**The primary reason for the decline in sage-grouse populations in Sublette County is gas development.**	**2**	**Higher .926**

Another theme evident across all three knowledge communities was their framing of their preferred solution (Table 16). The Q sort data illustrates that ultra locals prefer a local solution to the sage-grouse management issue, one that includes involvement of local land owners, local management and local experiential knowledge in addition to science. Harmonizers agree with the ultra locals in many respects showing an interest in a balanced approach, including knowledge from ranchers and working with energy development while not looking only to a scientific solution. Turning to classic biologists and their views on the appropriate solution to the sage-grouse issue, on the surface the data suggest that these participants may share in common with the other knowledge communities a view that multijurisdictional management is appropriate. However, as the discussion of interviews in the results section suggest, what is meant by agreement with this statement differs across the knowledge communities with classic biologists apparently meaning management adapted to local ecological conditions rather than management that is locally controlled and informed by locals' knowledge. And as the theme discussed below indicates classic biologists prefer a solution based more on science alone rather than one that incorporates local knowledge.

Table 16: Ways the three knowledge communities framed preferred approaches to solving the conflict.

Statement number	**Ultra Locals**	**Rank**	**z-score**
15	**Local management of sage-grouse is most appropriate.**	**4**	**Higher**

			1.610
4	**Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.**	**4**	**Higher** 1.405**
14	*We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM. Everyone needs to work together.*	*5*	*1.902*
	Harmonizers		
14	*We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM. Everyone needs to work together.*	*5*	*1.924*
26	**We need a purely scientific approach to dealing with the issue of sage-grouse. People's private profit (ranching, energy and home development, etc.) should be left out of it.**	***-5***	***Lower -1.723***
17	**You can't make gas development go away, so you have to work around it.**	***4***	***Higher 1.540***
	Classic Biologists		
14	*We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM. Everyone needs to work together.*	*4*	*1.461*

Data also show that each knowledge community reflects different frames regarding science, knowledge and its value. For almost all characterizing statements in this area,

differences were statistically significant compared to both the other groups (see Table 17). Classic biologists noted that science was superior to experiential knowledge held by ranchers, was sufficient to show a decline in sage-grouse populations and reflected the urgent nature of the sage-grouse issue. However, they also felt that science was not sufficiently developed to know how to create better sage-grouse habitat. Harmonizers were somewhat similar in that they seemed to emphasize science. However, in contrast to classic biologists, harmonizers believed that sufficient scientific research was available to balance current land uses with sage-grouse conservation. Further they did not believe there was enough information to make a decision regarding an ESA listing. It may be that this latter notion was influenced both by their perception that the sage-grouse situation did not require urgent action and that the research needed to balance livelihood activities with sage-grouse existed. Contrasting more drastically with the narrative of classic biologists and their comments on knowledge were the perceptions of ultra locals. Those in this knowledge community did not seem to believe that the scientific information was sufficient, either to reach a balance among land uses and sage-grouse conservation or to make an ESA listing decision. Further, they believed that experiential knowledge should be considered useful scientific information.

Table 17: Ways the three knowledge communities framed issues related to science and local knowledge.

Statement number	Classic biologists	Rank	z-sore
25	**The scientific research definitively demonstrates that sage-grouse populations have declined dramatically in Sublette County.**	**5**	**Higher 1.657**
16	**We need to decide quickly how we are going to conserve these birds or they are going to disappear completely.**	**3**	**Higher 1.122**

24	We don't understand enough about the sagebrush ecosystem to know the best ways to create better sage-grouse habitat.	3	1.190
8	**Ranchers know more about sage-grouse than wildlife researchers because their understanding comes from experience developed over a long period of time.**	**-4**	**Lower -1.570**
7	**Biologists working in Sublette County only a few years have not been here long enough to understand trends and influence on local sage-grouse populations.**	**-3**	**Lower -1.205**
4	**Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.**	**-3**	**Lower -1.058**
	Harmonizers		
28	**The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.**	**4**	**Higher 1.456**
27	**The existing scientific research is sufficient for telling us how to balance energy development with sage-grouse conservation.**	**3**	**Higher 1.328**
21	**The information necessary to make decisions about listing sage-grouse is incomplete.**	**-2**	**Lower -.926**
24	**We don't understand enough about the sagebrush ecosystem to know the best ways to create better sage-grouse habitat.**	**-3**	**Lower -1.385**
16	We need to decide quickly how we are going to conserve these birds or they are going to disappear completely.	-4	-1.436

	Ultra locals		
21	**The information necessary to make decisions about listing sage-grouse is incomplete.**	**3**	**Higher 1.417**
4	**Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.**	**4**	**Higher** ** **1.405**
22	**There is not enough historical scientific data to clearly understand what has happened to sage-grouse populations over long periods of time.**	**2**	**Higher .993**
27	**The existing scientific research is sufficient for telling us how to balance energy development with sage-grouse conservation.**	**-2**	**Lower -1.068**
28	**The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.**	**-2**	**Lower -.961**

Finally, each knowledge community seemed to frame the role of politics in this wildlife conflict somewhat differently (see Table 18). Looking at characterizing statements, the ultra locals disagreed that those with livelihood interests had unlimited power, were selfishly ignoring conservation interests or that the courts needed to exert authority over the BLM. Harmonizers similarly seemed to believe those with livelihood interests were not sinister figures. However, they did emphasize that science was being used politically in the debate and that environmental groups were using the ESA as a tool. In contrast, classic biologists did not view the ESA as a political tool for environmental groups or science as a tool used by people from large urban areas. However, they did agree that political agendas were interfering with putting scientific findings into practice.

Table 18: Ways the three knowledge communities framed issues related to politics.

Statement number	Ultra locals	Rank	z-score
5	Energy companies have the power to develop as they see fit, even if science shows that development is harmful to sage-grouse.	-3	-1.028
18	Residents of Sublette County know that development is hurting sage-grouse but there is so much money at stake they are not willing to stop it.	-3	-1.221
20	**Unless you get a judge to rule against the BLM's management of energy development and its effects on sage-grouse habitat the BLM will not change.**	**-4**	**Lower -1.226**
	Harmonizers		
1	The people debating sage-grouse management use scientific data to further their political agendas to list or not to list sage-grouse.	**3**	**1.070**
30	The Endangered Species Act is a tool extreme environmental groups want to use to control development they do not approve of.	**3**	**.913**
18	Residents of Sublette County know that development is hurting sage-grouse but there is so much money at stake they are not willing to stop it.	**-2**	**-.943**
5	Energy companies have the power to develop as they see fit, even if science shows that development is harmful to sage-grouse.	**-3**	**-1.058**
	Classic Biologists		
30	**The Endangered Species Act is a tool extreme environmental groups want to use to control development they do not approve of.**	**-3**	**Lower -1.371**

6	**People from large urban areas are using science to try to tell residents of Sublette County what to do.**	**-4**	**Lower -1.396**
3	**Scientific findings about sage-grouse are not put into practice because of political agendas.**	**3**	**Higher 1.390**

Building narratives in the conflict over sage-grouse management

To build narrative frames, participants in knowledge communities may select to highlight certain pieces of information or knowledge to support their narrative. This process of selecting information and knowledge is similar to passing these ideas through a filter. Some things are retained in this filter and some items are discarded. The retained items serve to build narratives while also serving to minimize and decrease the validity of the discarded items and their associated narratives, especially within a shared knowledge community.

For example, an ultra local may choose to highlight the increased number of ravens or foxes and decreased sage-grouse populations to support their call for increased predator management in place of a need for an ESA listing. Similarly, a classic biologist may select to highlight certain research while ignoring other knowledge (eg. local knowledge) to support their narrative, privileging science and focusing on ecosystem health. These examples serve to underscore how narratives in the debate about sage-grouse can be constructed to support conflict positions within the debate while also down-playing the validity of others. As a result, shared narratives can be contested in subtle ways, including in the process of building narratives and acceptable definitions of conflict solutions.

This process of selecting and rejecting information to build narratives may also be a political process, using knowledge to build and maintain narratives supporting key definitions, such as problem and solution definitions. Moreover, due to the political

nature of the sage-grouse issue, definitions of conflict solutions suggested by narratives within knowledge communities can be considered politically charged.

Political nature of shared narratives in the sage-grouse debate

This wildlife conflict in the West had been ripe with politics for many years, from the political interference in USFWS science to determine the status of the bird to the years of federal court litigation. In addition, the increase in natural gas development and exploration in the area and the large sums of money reaped from it complicate the political nature of this debate.

Because this conflict is socially constructed within this political atmosphere, knowledges and narratives are embedded within this atmosphere (Murdoch and Clark 1994, Forsyth 2003) making the problems and solutions outlined within the narratives subject to these particular political forces. As a result, no problem definition can be said to be free of politics, rendering all proposed solutions inherently political, no matter the narrative.

Data collected within this study provides evidence of three distinct narratives promoting different frames regarding the sage-grouse conflict. As a result, these common narratives within groups may reflect, or ultimately lead to, political alliances of knowledge communities supporting contrasting agendas with respect to sage-grouse management. These possible political alliances are not typical political alliances, such as political parties with large budgets who seek complex, sometimes long-term strategies. Instead, the political alliances characteristic of these knowledge communities are more accidental, supporting shared narratives serving to increasing the social validity of one knowledge community's idea of the problem and solution while decreasing the validity of others. As a result, tensions between knowledge communities can rise and an intractable conflict can ensue.

In conclusion, this discussion has outlined how different knowledge communities in the conflict over sage-grouse management have distinct narratives supporting different definitions of the conflict and its solution. Furthermore, the discussion has shown how these varying narratives can potentially serve to create tension between knowledge

communities, resulting in more tense conflict situations. These circumstances may prove to make a conflict more difficult to resolve.

Moving forward

This research highlights a number of disagreements between different knowledge communities that may affect the ability to arrive at a politically and socially viable approach for future sage grouse management. For example, harmonizers seem likely to support a number of different approaches to the problem, especially those that draw opposing viewpoints closer together. In contrast, the most apparent tension appears to be between ultra locals and classic biologists and because they are not likely to agree, efforts to bring about consensus may be futile.

One of these key areas of disagreement between ultra locals and classic biologists regards views on the role of predators in the sage grouse decline and the need for solutions to address predator populations. It is not likely any information, scientific or otherwise, will change perceptions of the ultra local knowledge community regarding the role of predators in sage-grouse declines. Furthermore, given the strength of their perspective, it is unlikely that biologists will believe it is worthwhile to design or pursue further studies to examine this issue. Given this situation, continued emphasis on the role of predators and predator controls is unlikely to move the political and social debate about sage grouse management forward toward a constructive solution. Rather, considering the disparate and entrenched perspectives on this issue, a debate focusing on this issue may only point to a dead-end road that leads nowhere in regards to social and political consensus.

Similarly, focusing the debate on the source of knowledge, especially the relative values of science versus local knowledge appears to be an equally problematic avenue to pursue. Due to ultra locals' skepticism and distrust of science, placing a central emphasis on scientific findings and solutions seems to be an unpromising route for finding or executing solutions to conserve sage-grouse and their habitat with regard to this knowledge community. Furthermore, it is possible that the tension over the use of science may also make it difficult for ultra locals to support any ESA listing decision as

they are all based on science. Instead, they may prefer decisions infusing local information into ESA decisions and management which may prove difficult due to the scientific requirements of the ESA.

To begin to break the tension regarding the use of science, perhaps biologists can better recognize the role of local knowledge in determining possible research paths. This is not a path typically taken in these types of controversies. Typically agencies and decision makers move in the other direction, trying to increase public receptivity toward science after results are in. However, given the strength with which classic biologists within the sample disagreed with those in other knowledge communities about the merits and relevance of local knowledge, it seems unlikely that emphasizing scientific results will lead to a greater degree of consensus across knowledge communities in the readily foreseeable future.

Instead of pursuing issues that may only serve to increase the conflict, such as issues of predators or sources of knowledge, a path forward may be found in merging the livelihood interests of ranchers with the preservation interests of biologists. Both groups recognize the importance of habitat and can agree that much of the habitat exists on land critical to ranching, both public and private lands. In addition, they agree that sage-grouse populations are declining. As a result, perhaps a more realistic means to move forward would be for classic biologists to work with ultra locals to create solutions that preserve ranching and the sage-grouse habitat it requires. This may successfully marry the interests of both groups while setting aside differences that provoke emotional responses, progress may be made in sage grouse conservation.

Summary of the useful nature of Q method

This study provided a meaningful exercise in evaluating the usefulness of Q method and its ability to measure and capture various viewpoints and frames within a complicated multiparty conflict. The Q method proved to be effective at isolating distinct, meaningful viewpoints among participants. However, both advantages and disadvantages to using the method were highlighted in the process.

First, the Q sort exercise forces participants to express their views and make choices regarding which items are more or less meaningful to them. Another advantage to the Q method is that it serves as a guide on how to group respondents with similar views, a sometimes difficult process in qualitative studies.

An equal number of disadvantages were also pinpointed. For example, the interview seems to be an integral part of the data collection phase. It serves to provide important insight into the meaning of each perspective measured. That said, conducting an interview immediately after the Q sort is completed by respondents seems necessary but not sufficient. This is because questions arise during data analysis, questions that limit the ability to interpret and understand the meaning of the Q sort data. Thus, the data obtained in an interview that occurs immediately at the conclusion of a Q sort cannot fill in all gaps that may arise when interpreting Q sort results.

However, the most important finding regarding Q sort was the indispensable nature of the interviews in identifying and clarifying the distinct viewpoints and their complexities. The above discussion highlights a number of key insights that were uncovered though interview data. Without this data, the depth of the analysis and its interpretation would be greatly decreased. As a result, completing a Q sort without including an interview component is not recommended.

Moreover, the interview component should not be conceived of as an entirely separate component of the research. Contrary to this idea, the interview can be viewed as wholly complementary, and as a result, it should not be completed simply as a follow-up to a completed Q sort. Instead, the complete interaction between the researcher and the participant should be treated as an interview. That is, recording (audio or visual) should commence as the interaction begins, capturing questions and comments about the Q sort and its individual Q set items. This may yield data helpful in interpreting the intent of participants. In addition, it may result in a more meaningful and accurate result.

Furthermore, interview data is most helpful if, it viewed as an important component of the full data set instead of treating it as supporting or auxiliary data; without it, the data would not be complete. As a result, it is suggested that interviews be fully transcribed as

simply taking notes may result in missing important points that may increase the richness of the results and their interpretation.

Closing

The knowledge communities discussed here are merely those present within the purposive sample in Sublette County. An attempt was made to capture a sample representative of the diversity that existed within the community, but it is possible other knowledge communities could be present, especially considering the fact that two of the respondents did not load on any of the three knowledge communities discussed in this thesis. and the existence of additional knowledge communities could serve to further complicate the ability to find the least politically contentious resolution to the sage-grouse issue. However, the Q method coupled with the use of interviews proved useful in addressing issues of environmental conflict and shows promise for assessing shared knowledges and narratives within these conflicts.

This has been a study focusing on the facts surrounding the conflict over sage-grouse management and what they are perceived to be by conflict parties. Contemporary conflict resolution practices would suggest a shift of focus from the facts or positions outlined here, to the underlying interests of the parties (Fisher et al. 1991). A focus on overlapping interests and a possible solution may be highlighted and agreed upon. The Q sort analysis in this specific study was more effective at identifying points of disagreement than points of overlapping interests. However, considering the points of disagreement, the suggestion to shift the public debate away from strongly contested issues like the role of predators, predator control and the value of various sources of knowledge, to a possibly shared interest in ranching as a means of livelihood for ultra locals, as means of habitat protection for classic biologists, and a means of bringing greater community harmony for harmonizers, may yield the necessary kind of overlapping interest. However, given the extremely political nature of this environmental conflict, such a shift may be difficult to obtain as the identities of many participants are inextricably linked to their positions and knowledge communities.

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Appendix I- Distribution of sampled participants into knowledge communities

Ultra Locals	Classic Biologists	Harmonizers	No group
R	B	B	CC
R	B	B	B
AB	B	E	
R	B	EB	
R	CC	B	
EB	CC/B		
R	CC/C		
R			
R			
R			
AB			
E			
EB			
R			
B			
CC			

Table A: Distribution of sampled participants into knowledge communities. AB – Agriculture business; B – Biologist; CC – Career conservationist; E – Energy employee; EB – Energy biologist;

Appendix II- Q set

Table 14: Q Set items.

Statement Number	Statement
1	The people debating sage-grouse management use scientific data to further their political agendas to list or not to list sage-grouse.
2	I think information provided by ranchers is only used by decision makers if it meets political needs.
3	Scientific findings about sage-grouse are not put into practice because of political agendas.
4	Rancher's information about sage-grouse is more than anecdotal and should be considered useful scientific information.
5	Energy companies have the power to develop as they see fit, even if science shows that development is harmful to sage-grouse.
6	People from large urban areas are using science to try to tell residents of Sublette County what to do.
7	Biologists working in Sublette County only a few years have not been here long enough to understand trends and influence on local sage-grouse populations.
8	Ranchers know more about sage-grouse than wildlife researchers because their understanding comes from experience developed over a long period of time.
9	People who are in decision making positions are misinterpreting the scientific research that exists on sage-grouse in Sublette County.
10	I think there is more expertise on sage-grouse in the local Game and Fish office than at the local BLM office.
11	The primary reason for the decline in sage-grouse populations in Sublette County is gas development.
12	The primary reason for the decline in sage-grouse populations in Sublette County are predators.
13	The primary reason for the decline in sage-grouse populations in Sublette County is grazing.

14	We have to look at multijurisdictional management for sage-grouse, including private land owners, Game and Fish and the BLM. Everyone needs to work together.
15	Local management of sage-grouse is most appropriate.
16	We need to decide quickly how we are going to conserve these birds or they are going to disappear completely.
17	You can't make gas development go away, so you have to work around it.
18	Residents of Sublette County know that development is hurting sage-grouse but there is so much money at stake they are not willing to stop it.
19	Current sage-grouse conservation efforts are primarily a result of the threat of listing. Without this threat there would be little interest in sage-grouse conservation efforts in Sublette County.
20	Unless you get a judge to rule against the BLM's management of energy development and its effects on sage-grouse habitat the BLM will not change.
21	The information necessary to make decisions about listing sage-grouse is incomplete.
22	There is not enough historical scientific data to clearly understand what has happened to sage-grouse populations over long periods of time.
23	People have taken sides on this issue without adequate information to back up their opinions.
24	We don't understand enough about the sagebrush ecosystem to know the best ways to create better sage-grouse habitat.
25	The scientific research definitively demonstrates that sage-grouse populations have declined dramatically in Sublette County.
26	We need a purely scientific approach to dealing with the issue of sage-grouse. People's private profit (ranching, energy and home development, etc.) should be left out of it.
27	The existing scientific research is sufficient for telling us how to balance energy development with sage-grouse conservation.
28	The existing scientific research is sufficient for telling us how to balance grazing with sage-grouse conservation.
29	The BLM will use whatever information they can to further control the oil and gas operators.
30	The Endangered Species Act is a tool extreme environmental groups want to use to control development they do not approve of.
31	The BLM says they are going to collect data and information to help the sage-grouse, but this is all an illusion. They are not really doing anything for them.

32	Listing sage-grouse will severely threaten the livelihood of many people here in Sublette County and that is not fair. A bird should not take priority over people's ability to put food on the table.

Appendix III – Interview guides

Preliminary Interview Guide

Thanks for your time. With your help I am hoping to understand your thoughts on sage-grouse management in this area and more about who you are. This anonymous, confidential, recorded interview should take less than one hour and may sound more like a conversation than a formal interview. If you have any questions at any point during our conversation, please let me know. Do you have any questions before we get started?

Opening/Background Questions

1. Can you tell me a little bit about yourself? (For example, where are you from – urban or rural (define each), how long have you lived here and what you do for a living?)
2. What brought you to this area? What keeps you here?
3. Can you describe your profession?

Understanding the issue

4. What are your thoughts about sage-grouse management in this area? What are the key issues and concerns? How does sage-grouse management affect your work (or in the case of an environmental group – How is sage-grouse management relevant to your mission?)
5. Is sage-grouse management important to you?

Knowledge about the issue

6. If someone didn't know much about sage-grouse, how would you recommend they come up to speed on the issue?
7. Can you tell me what information about sage-grouse local Sublette County Ranchers/biologists/conservationists/energy employees such as yourself (choose appropriately) can bring to the table? Where do you prefer to get your information from (newspapers, friends, etc.)?
8. *For landowners:* Have you seen sage-grouse in the area? What have you and your neighbors learned from observing the sage-grouse on ranchlands?

9. What do you think about scientific information about sage-grouse? Is this information useful? How is it used in decision-making?

10. What do you think about the observations ranchers and other residents make about sage-grouse in this area? Is this information useful? How are these observations used in decision-making?

11. What kind of information do different groups have and how do they use that information? (not sure this will work)

12. We have talked about a number of different sources or types of information, but whose information do you trust?

Decision-making

13. In your eyes, what groups of people or individuals are best qualified to make decisions about sage-grouse management? Why?

14. What if different sources of information about sage-grouse are in conflict? How should decision-makers handle that?

15. From your perspective, who do you think should supply the information upon which sage-grouse management should be based on?

16. Who do you think should manage sage-grouse?

17. Do you think decisions about sage-grouse should be made locally, state-wide, or nationally? Why?

Understanding the issue

18. What is at the heart of this issue? Is it different from other areas of the West or Wyoming?

19. What would be your ideal way to address this issue of sage-grouse management?

Closing

20. Is there anything else you would like to add?

21. Who else would you recommend I talk to? Would it be alright if I told them they were recommended by you? Also, I am looking to talk to people with all different types of views. Is there someone you can recommend who thinks differently about this issue than you do? Would it be alright if I told them they were recommended by you?

Interview guide

Opening/Background Questions

22. Can you tell me a little bit about yourself? (For example, where are you from, how long have you lived here and what you do for a living?)

23. What brought you to this area? What keeps you here?

24. Can you describe your profession?

25. Do you know of any sage-grouse or sage-grouse leks on or near your property?

Questions about the Q sort

26. Can you tell me about the statements you decided were most important and why? How about those you felt were less important?

27. Do you feel the statements allowed you to accurately reflect your views?

    a. Do you feel that the statements accurately reflected the different views on the issue you have heard?

28. Would you have added or eliminated any statements to the current group of statements?

29. I noticed you had trouble arranging some of the statements (researcher may identify one or more particular statements of interest), can you tell me what made it/them more difficult than the others to arrange? Were there any other statements that were difficult for you to arrange? If so, why?

30. How was the sorting exercise overall? Was the sorting task difficult? If so, why? How can the process be improved?

Conflict over sage-grouse management and policy

31. Can you tell me what you think about management of sage-grouse?

32. Have you participated in public meetings where sage-grouse were discussed or formally commented on the management proposals?

33. Has this conflict affected you directly?

34. Are politics at play in this issue? How? Why? If so, how?

35. Are you concerned about infringement of private property rights?

36. What do you think about the local energy development? Do you support it?

37. What do you think about the local energy development and sage-grouse? Is energy development compatible with healthy sage-grouse populations?

38. What do you think about grazing and sage-grouse? Is grazing compatible with healthy sage-grouse populations?

39. *Only for biologists:* What do you think about the perception that the decrease in sage-grouse is due to the increase in the number of predators (mainly foxes, coyotes and ravens)?

40. Are different kinds of people, such as ranchers, conservationists, and the Wyoming Dept. of Fish and Game and energy companies, working together on the issue of sage-grouse? If so, do you feel their efforts are successful?

41. Do you see the goals of ranchers and conservationists as compatible? How about those of energy companies and the Wyoming Dept of Fish and Game? Can you tell me more? (Be sure that answer is specific re: compatible and incompatible goals by population)

42. Do you think there is sufficient collaboration between different groups of people in regard to sage-grouse management? Are there particular issues that are ripe for this type of collaboration?

43. What would be your ideal way to address this issue of sage-grouse management? At what scale would you like to see sage-grouse managed on?

Closing

44. Is there anything else you would like to add?

45. Who else would you recommend I talk to? Would it be alright if I told them they were recommended by you?