AN ABSTRACT OF THE DISSERTATION OF

Casey Lynn Taylor for the degree of Doctor of Philosophy in Environmental Sciences presented on October 17, 2016.

Title: The Challenges and Opportunities of a Proactive Endangered Species Act: A Case Study of the Greater Sage Grouse.

Abstract approved:

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The Endangered Species Act of 1973 (ESA) is considered by many to be among the most powerful and most contentious environmental laws in the United States. Persistent challenges to the Act's implementation make reaching conservation goals problematic. Most notably, the very nature of the law—providing protections for species already at risk of extinction—means its protections are offered only when the situation is already dire, when conservation efforts will be the most difficult, costly, and controversial. Impacted industries and rural communities have frequently chafed under the regulations imposed by the Act, while environmentalists have seen the ESA as a reliable tool for slowing or stopping unwanted development.

The U.S. Fish and Wildlife Service (FWS) has begun altering its approach to species conservation by pursuing a series of more proactive tools within the ESA in an effort to address declining species before emergency action under the Act is required. These efforts, including working collaboratively with state governments, federal management agencies, and private landowners, were highly visible in the case

of the Greater Sage Grouse, a recent candidate for ESA protection in the western United States.

Using the sage grouse as a focal case study, this dissertation evaluates some of the challenges and opportunities involved in these proactive, collaborative conservation efforts. In particular, analysis focuses on one of the key components of the ESA process—the selection, interpretation, and application of scientific evidence. Interviews with stakeholders across three sage grouse states—Idaho, Oregon, and Wyoming—as well as planning documents, government reports, and media accounts in these states were collected in order to understand the relationship between collaboration and the use of science in proactive conservation efforts for the sage grouse. Evidence from the three studies in this dissertation suggests that in such efforts, discussion and negotiation surrounding the nature of species threats and possible conservation actions can be hampered by the lack of trust between stakeholders and administrative agencies.

The first study (Chapter 2) examines three different conservation efforts in Oregon, and finds that organizational goals, history, and scale of operations influence the degree of collaboration within a particular effort, when then influences the manner in which science is utilized in the process. The second study (Chapter 3) compares the development of voluntary conservation agreements between private landowners and FWS across three states and finds that positive working relationships and trust are critical in effectively negotiating species threats, conservation actions, and monitoring protocols. That being said, when relationships and trust are still being developed, as they often are for the FWS with regard to the ESA, these can be

supplemented by partnering with other agencies and organizations with better relationships with communities on the ground, such as the NRCS. The third study (Chapter 4) asks participants from the two earlier portions of the dissertation to define the term 'best available science,' an ambiguous concept which is often used as a metric for decision-making in environmental law. Analysis of these responses finds substantial common ground regarding how 'best available science' should be defined and identified, but also points to areas of concern with the practice of science-based decision-making.

The Challenges and Opportunities of a Proactive Endangered Species Act: A Case Study of the Greater Sage Grouse

by
Casey Lynn Taylor

A DISSERTATION

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Presented October 17, 2016
Commencement June 2017

Doctor of Philosophy dissertation of Casey Lynn Taylor presented on October 17, 2016

APPROVED:

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Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Casey Lynn Taylor, Author

ACKNOWLEDGEMENTS

I would like to thank my committee for their support, advice, and mentorship as I worked my way through the process of earning this doctorate. You each meaningfully contributed to my experience, and made it enjoyably challenging as well. Dr. Brent Steel, the heart and the energy you put forth in pursuit of supporting the graduate programs and graduate students in the School of Public Policy are amazing, and I am lucky to have you as my chair. You helped make my experience successful in so many ways—thank you. It would be difficult to find a better role model and guide in navigating the world of social research than Dr. Hilary Boudet. Thank you for providing both challenging feedback and constant encouragement. Dr. Ed Weber was wonderful for bouncing around ideas and indispensable for providing a critical ear as I developed my research. Thank you for your insight, humor, and generosity. The first day I walked into Dr. Bryan Tilt's "Natural Resources and Human Values" class, I joked with friends that I had finally found my people at Oregon State, and it was true. Your class challenged the way that I saw the world and helped me to find my academic niche. Thank you for your kindness and encouragement. Dr. John Bailey, in addition to being the first person I met in Corvallis, provided a helpful link to my "past life" in ecology as I tried to make sense of the world of social science and public policy. In addition to discussing the scientific issues related to wildfire and sage grouse management, John encouraged me to audit his fire ecology course, which both provided a valuable knowledge base for my research. Thank you for your enthusiasm and encouragement.

Through my time at Oregon State, I have been blessed with the love, friendship, and support of an amazing group of people, without which I would not have succeeded. To the Dewar and Chonaiew families who I consider my own, thank you for your love and support—I don't know what I would do without you. To my dear friends M. Jahi Chappell, Brianne Studer, Lindsay Watkins, Alison DeSimone, and Sean Lanigan—you have stuck with me for years, and are the best, if most geographically dispersed, group of friends one could ask for in this world—thank you for being there for me. Thank you as well to Erika Wolters, Kirsten Winters, Ashley Parker, Sara Chonaiew, Leanne Giordono, Hillary Fishler, Shannon and Chase Campbell, Jos Grandolfo, Neal Kern, Brian Zulauf, and Amy Carter for your comradery and friendship. Lindsay Watkins, Brian Zulauf, and Claire Cvitanovich contributed their valuable editing skills to this dissertation—thank you for your help!

Thank you also to Katie Goodall, Heidi Liere, Brenda Lin, Kim Williams-Guillen, Shalene Jha, Ivette Perfecto, John Vandermeer and the rest of the NWAEG group, thank you for keeping me grounded in all the things that are important to cultivate and fight for in this world.

Funding for my dissertation research was provided by "Climate Change Adaptation, Sustainable Energy Development and Comparative Agricultural and Rural Policy," a USDA National Institute of Food and Agriculture (NIFA) Higher Education Challenge (HEC) Grant awarded to Dr. Brent Steel. Additional support and funding

was provided by the School of Public Policy, the Environmental Sciences Graduate Program, and the Graduate School.

Finally, I would like to recognize and thank the dozens of ranchers, community members, scientists, government officials, and others who generously shared their time and knowledge with me. In addition to providing data for this dissertation and future work still to come, they provided me with an eye into their lives and experiences. Further, these individuals were patient and kind as I made my first major foray into social research and made the many mistakes—some known and probably many unknown—that such inexperience can help create. I am honored that these participants were willing to so openly share their experiences with me, and I aspire to create works that are worthy of that kindness and generosity.

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Chapter 1—Introduction

The Challenges of the Endangered Species Act

In the last few decades, it became clear that addressing any but the simplest environmental problems facing society was more complex and difficult than may have been earlier anticipated. In particular, massive, globe-spanning issues like climate change and biodiversity loss require the integration of diverse sets of technical expertise as well as navigating complex socioeconomic and political challenges. Meanwhile, the traditional model of managing environmental concerns—regulatory measures implemented by public agencies, advised by scientific experts—began to show its limitations in a world of complex challenges and contested solutions.

In the United States, administration of one of the nation's landmark environmental laws, The Endangered Species Act of 1973 (ESA), has been influenced by these challenges among many others. Over the ESA's history, the strategies, tools, and politics involved in implementing the law have varied, but decades into the life of the ESA have shown growing consensus regarding some of the key problems found in the Act. The problem it seeks to address is massive in size, complexity, and controversy—no less than to protect each and every species and ecosystem from the impacts of a society and its powerful economic engine. By its nature, the ESA's efforts are aimed at species when they are already at or near the brink of extinction—and thus conservation efforts are all the more difficult, expensive, and controversial. It is a law that is distributive in nature, in which the benefits are spread wide throughout society but the costs are confined to a small set of actors. Further, it often pits largely urban conservation interests against the interests of rural communities and their economies.

The ESA is a law that faces many challenges, but among the top of these are three critical areas. First is this deep-seated conflict inherent to a law that is narrowly focused on the conservation of species—protecting species at the expense of economic development. Many of critics of ESA regulations, particularly rural communities, chafe under the rigidity of the Act as well as its rejection of cost-benefit analysis (T. Clark & Wallace, 2005; Doremus, 2005). The conflicts associated with the ESA often provide a clear illustration of "wicked problems" (Kettl, 2006; Ludwig, 2001; Rittel & Webber, 1973). Wicked problems, as opposed to more conventional policy problems, involve multiple, conflicting sets of values and complex social and ecological issues that cross disciplinary and programmatic boundaries. Programs like the ESA which emphasize science and professional expertise as the means to solving problems often founder on complex, broad-scale problems, which evade both objective definition and generally agreed-upon solutions (Rittel & Webber, 1973).

Second is the alienating relationship between the ESA and private landowners, who often own large amounts of the high quality habitat necessary to maintain at-risk species (Groves et al., 2000; Shogren, 2005; U.S. General Accounting Office, 1994). Controlling the management of private lands through traditional enforcement mechanisms is problematic both from viewpoints of practical logistics as well as conservation outcomes. Limited budgets and shifting Interior department priorities are frequently blamed for the inability of the FWS to keep up with ESA listing decisions for the species that should be covered under the law (Greenwald, Suckling, & Taylor, 2005), and it is unlikely that the agency will suddenly receive the resources it would need to undertake a large-scale enforcement effort on private land. Instead, it largely must rely on the goodwill of landowners towards species conservation, when every institutional signal has the potentially opposite effect on landowner behavior (Adler, 2011).

Third is the unique provision of the law, in which listing decisions are required to be based "solely on the best available science," precluding the consideration of economic or social consequences. This requirement invites controversy because the scientific record is often incomplete and filled with uncertainty, giving ESA proponents and opponents the opportunity to interpret uncertainties in their own favor (Doremus, 2006). Such controversies have led to legislative battles in Congress over the ESA as well as a rapid increase in litigation, as both sides sought to have their preferred outcome carried out through the court system. Doremus (2006) suggests that these controversies may be the result of expectations on the part of Congress as well as the public that science be able to provide a neutral, objective answer for such policy problems. However, most experts on the use of science agree with the National Research Council when it argues that this is not possible (National Research Council, 1996, 2012). Therefore, one step in addressing the controversy involved in ESA implementation is to be open about what science can and cannot do, and be open about its limitations (Doremus, 2004, 2006).

Addressing these challenges requires a change in tactics and approach. In some cases of ESA implementation, or anticipation of the future involvement of ESA regulations, conservation efforts have become more proactive and they have become more collaborative (Donlan, 2015; Yaffee, 2006). This reflects a wider trend towards collaboration in many areas of policy implementation, including health, education, and law enforcement as well as widespread use of collaborative strategies in natural resource management (i.e. Ansell & Gash, 2008).

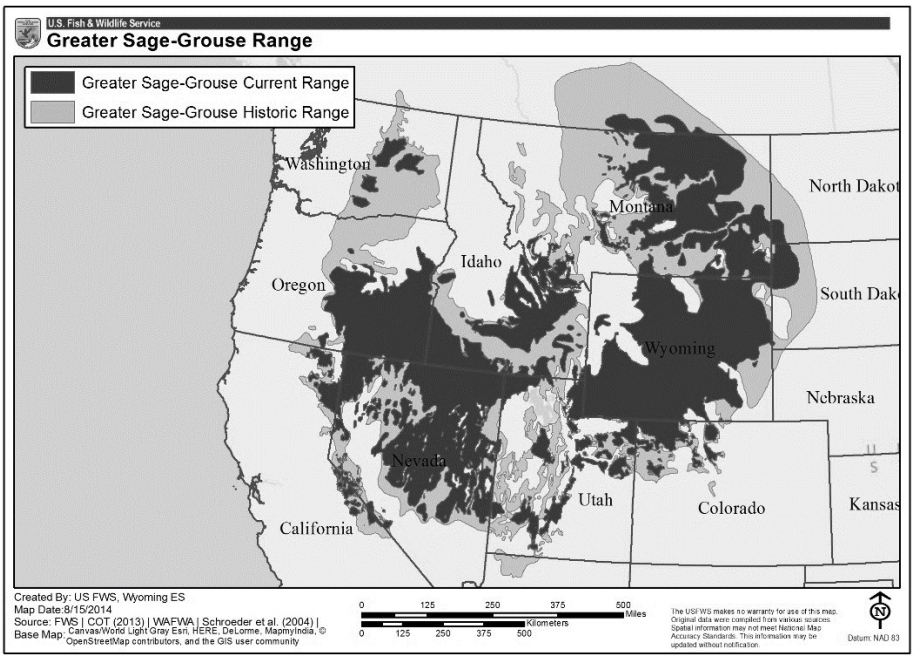
As this shift in ESA implementation occurs, it is valuable to ask how new proactive models for ESA implementation are addressing the critical challenges above, which helped to prompt the shift in the first place. In the early to mid-2000s, an enormous test case for these new

approaches arose in the form of the Greater Sage Grouse, a candidate for ESA protection that lives in the high desert sagebrush landscape of the intermountain West.

The Greater Sage-Grouse and the Threats of a Changing Sagebrush Landscape

The sage grouse, the largest North American grouse species, lives in sagebrush dominated landscapes across eleven western states and a portion of Canada. Faced with the task of managing and conserving the species, U.S. federal agencies divided this range into two regions: the Great Basin region, including Oregon, Washington, Idaho, California, Nevada, and portions of Utah and Montana, and the Rocky Mountain region, which includes Wyoming, Colorado, North and South Dakotas, and the remaining portions of Utah and Montana (see Fig. 1 for sage grouse range map) (Bureau of Land Management, 2015). This geographical and logistical division also illustrates one of the biggest threats to sage grouse conservation—states with and without large-scale oil and gas development. The Great Basin states, with the exception of Utah, do not have major oil and gas activity, while oil and gas is the dominant interest in many of the Rocky Mountain states.

Figure 1. Geographic range for the Greater Sage-Grouse. From U.S. FWS (2013).



The sage grouse is a species that, while well-attuned to its natural habitat, is poorly adapted to the impacts of habitat development and fragmentation. Connelly et al. (2011) describe the critical elements of the sage grouse seasonal habitat use, which plays in to the sensitivity of the species. The birds in a particular area are highly dependent on an undisturbed "lekking ground," where males congregate to perform courtship displays for attending females in hopes of breeding. After the mating season, the males disburse while the females seek out nesting and brooding habitat, which is often at lower elevations and in wetter environments—better sources for forbs (flowering vegetation not including grasses, sedges, and rushes) for adult sage grouse to eat, insects to feed their young, and protective nest cover. In the summer, as the grouse chicks transition from insects to a forb-based diet, sage grouse utilize a variety of habitats, including riparian areas, wet meadows, and agricultural fields, In a few months, the grouse move upland

again, forming larger flocks and seeking upland sagebrush, upon which they depend for winter forage and shelter.

Because of its dependence on sagebrush, especially for winter forage and protective cover, sage grouse are considered "sagebrush obligates," which means they are dependent on it for survival (U.S. Fish and Wildlife Service, 2013). Unfortunately, this specificity is out of step with the large scale ecosystem shifts occurring over the bird's range, with dire implications for the future of the species. In addition to outright habitat loss, climate change, historic ranching practices, and increasing development have led to a state of affairs in which two landscape-level forces—invasive species and wildfire—have become the twin threats to sage grouse and other sagebrush inhabitants. Historic fire-return intervals in sagebrush ecosystems range up from 40 to 350 years, varying with sagebrush species and local conditions (Baker, 2011). Baker (2011) in some areas of the sage grouse's range, recent records suggest that climate change, the spread of cheatgrass, and human-set fires could be causing an increase in the frequency of fires that is well outside of the historic range. Baker notes that all of the areas with increased fire frequency face extensive cheatgrass invasions, an invasive annual grass that is also a concern for grouse.

The increase in fire frequency has been partially facilitated by the spread of such invasive species. These grasses, including cheatgrass and medusahead, are nearly ubiquitous in sagebrush country, and are able to outcompete many native bunchgrasses and ultimately take over huge swaths of the high desert. Once established, these invasive annual grasses can affect the regional wildfire regime—they dry and cure much earlier in the summer than native grasses, and grow in dense monocultures, providing an easy and continuous fuel source in the tinder-dry high desert of the summer (Miller et al., 2011). Because such wildfires now occur more often and with higher intensity, they are impacting the ability of sagebrush to maintain its foothold—the shrubs

may be able to handle less frequent, less intense fires, but the not the large, frequent, and continuous fires that develop with increased presence of cheatgrass. The decline of sagebrush then facilitates increased presence of invasives annual grasses, creating a positive feedback loop in which increased wildfire and the spread of invasive species mutually reinforce each other over time (U.S. Fish and Wildlife Service, 2013). Further, with less sagebrush and more invasive annuals like cheatgrass, there is less cover and food sources available for sage grouse (2013).

The increase in wildfire frequency and historic grazing patterns have also facilitated the expansion of native conifers, especially western juniper, in sagebrush habitats, leading to increased habitat loss for sage grouse (U.S. Fish and Wildlife Service, 2013). The spread of junipers is not entirely understood, however, as wildfire and grazing do not fully explain the degree of expansion seen in some areas of sage grouse habitat. As with many factors in sagebrush ecosystems, it has been hypothesized that climate change and increased carbon dioxide concentrations may be playing a role as well (2013).

These transitions have impacted human communities as well. In many areas of the high desert, livestock ranching is a dominant economic activity for local communities. The wildfires that scorch sage grouse habitat can also damage ranching operations by consuming anticipated livestock forage as well as the livestock themselves (Guerin, 2013; Krebs, 2014; Oregon Cattlemen's Association, 2014). Further, the spread of cheatgrass and encroaching juniper are impacting the ability of ranchers to grow the nutritious forage that their animals depend on (Mortenson, 2015). In some areas, particularly on the outskirts of population centers, these pressures combine with the increasing sprawl of urban development, another socioeconomic force that impacts both sage grouse and the ranching community. As a result, there are many areas of common cause between the sage grouse and one of the dominant industries with which it

shares the high desert, and thus opportunities for cooperation between local communities and conservation interests (Krebs, 2014).

However, there are areas of conflict as well. Although ranching and sage grouse have historically coexisted, some ranch practices can have negative impacts for the bird. Since they are so sensitive to habitat modification and fragmentation, sage grouse are impacted by seemingly small landscape changes. These various impacts are described in detail in Knick et al. (2011) and Boyd et al. (2014), and briefly summarized here. Since they are ground birds whose biggest predators are aerial hawks and ravens, sage grouse are impacted by any development that could be construed as a perching ground for large birds, including fence posts, outbuildings, and wind turbines. Further, some studies have documented sage grouse losses from collisions with fences and accidental drownings in stock-water tanks. While these last items are relatively easy to address—large scale conservation programs have focused on providing reflective markers for fences and emergency ramps for water tanks—fences, ranch infrastructure, and turbines are a more difficult challenge to address. Ranching activities and other types of development can also impact sage grouse by "subsidizing" increased predator populations through increased habitat fragmentation and food sources, which then negatively impacts sage grouse populations. The timing and execution of specific ranching practices, such as cutting hay, can also affect sage grouse populations when the birds utilize agricultural land for nesting and brooding.

Of course, although grazing may be one of the most widespread land uses in sagebrush country, it is certainly not the only one, or even the most economically central industry. Particularly in the Rocky Mountain region, mining and oil and gas development are of much greater concern, due to the associated infrastructure development, noise, and habitat fragmentation they bring to the landscape. Sage grouse populations have been found to decline

or even become locally extirpated following oil and gas development (B. L. Walker, Naugle, & Doherty, 2007). In states such as Wyoming, where energy and mineral development are dominant industries, these activities were a major focus of sage grouse conservation plans (Wyoming Game and Fish Department, 2016). The rapid development of the wind energy industry also caused concerns for sage grouse conservation, for many of the same reasons as oil and gas development—fragmentation, noise, and opportunities for perching predators. In some states, such as Oregon, the economic opportunities presented by the emerging wind industry formed the impetus for initiating management plans for sage grouse, to try and find ways to help the industry and birds co-exist (Oregon Solutions, 2016a).

The westward spread of West Nile virus presented another concern for sage grouse. The disease has been documented in these as well as all eleven states with sage grouse populations (B. Walker & Naugle, 2011). Outbreaks of the disease led to considerable concern that the virus could complicate conservation efforts for sage grouse, since the bird showed evidence of being particularly susceptible to infection and mortality is nearly guaranteed after infection (Naugle et al., 2004). The effects of West Nile are often likely to be localized and of short duration, but can have dramatic results for small or isolated populations, such as the 2008 outbreak observed in North Dakota (U.S. Fish and Wildlife Service, 2013; B. Walker & Naugle, 2011). Such localized outbreaks are difficult to predict, and management options for addressing the virus are limited aside from reducing availability of water sources (B. Walker & Naugle, 2011).

Proactive Sage-Grouse Conservation and Collaboration

On Tuesday, September 22 Secretary of Interior Sally Jewell made the announcement that many had been anticipating for years. In light of the conservation efforts being conducted by private landowners, the states, and federal agencies like the BLM and Forest Service, the Service

officially decided that protection under the Endangered Species Act was not necessary. As Jewell commented (Department of Interior, 2015): "*The deteriorating health of the bird has sparked the largest land conservation effort in U.S. history. This has been an extraordinary effort on a scale we've never seen before. And the U.S. Fish and Wildlife Service has determined that these collective efforts add up to a bright future for the sage-grouse.*"

According to FWS Director Dan Ashe:

> We've written an important chapter in sage-grouse conservation, but the story is far from over. By building on the partnerships we've forged and continuing conservation efforts under the federal and state plans, we will reap dividends for sage-grouse, big game and other wildlife while protecting a way of life in the West. That commitment will ensure that our children and grandchildren will inherit the many benefits that this rich but imperiled landscape has to offer. *(USFWS, 2015)*

Secretary of Agriculture Tom Vilsack celebrated the decision, commenting:

> *Today's decision reflects the joint efforts by countless ranchers and partners who have worked so hard to conserve wildlife habitat and preserve the Western way of life . . . . Together, we have shown that voluntary efforts joining the resources of private landowners, federal and state agencies, and partner organizations can help drive landscape-level conservation that is good for sage-grouse, ranching operations, and rural communities. Through the comprehensive initiatives on both public and private lands, the partnership has made and will continue to make monumental strides in supporting the people and wildlife that depend on the sagebrush landscape. (USFWS, 2015)*

In her announcement, Jewell also emphasized that the case was not closed on the sage grouse. "*We've got a lot of work ahead . . . . In the weeks, months and years ahead, we need to implement the state and federal plans and the rangeland fire strategy, learning what's working, incorporating science into decisions, and staying committed to what's right for sage grouse*" (Department of Interior, 2015). The proactive nature of sage grouse conservation mirrored a changing approach to ESA implementation that has been observed in cases of declining species around the country, and noted as a strategy with potential to improve stakeholder relationships

and outcomes for species conservation (Donlan, 2015). "*Acting early, more often than not, is cheaper, more effective, and less contentious,*" reflects Josh Donlan, whose book, "Proactive Strategies for Protecting Species," documents the use of these emerging strategies, and provides guidance for their implementation (2015).

Regarding the sage grouse decision, many hailed the decision as evidence of conservation done right, as did National Audubon Society Vice President Brian Routledge: "*I believe this is the way to do conservation . . . . We're engaging every tier of society that's making a living in sagebrush. (But) we're not stopping development and everybody's a little unhappy*" (Peterson, 2015b). National Audubon Society's President, David Yarnold, commented "*finding a shared path forward beats scaring all the stakeholders into their corners. Of course, now all of these stakeholders have to fulfill their commitments in order to make today's decision stick*" (Fears, 2015). Environmental Defense Funds' Associate Vice President for Working Lands, Eric Holst, echoed that sentiment: "*Today's 'not warranted' decision sends a strong signal that investments in conservation are making a difference and provide the catalyst for a different kind of politics*" (Carlton, 2015).

Others were cautiously optimistic that the plans would be a good deal in comparison to ESA regulation, like Republican Nevada Governor Brian Sandoval:

> *Today we reinforce the fundamental importance of a public-private partnership where federal and local stakeholders have equal platforms and participate as partners . . . . I appreciate Secretary Jewell's commitment to continue working with us and I take her at her word that we will collaborate in good faith during the next two years so that we have the opportunity to demonstrate that the Nevada plan provides the best conservation for sage-grouse in Nevada. (Taylor, 2015)*

Meanwhile, another governor in the Great Basin—Gov. "Butch" Otter of Idaho (R) filed suit within days against the federal agencies for their preemptive conservation efforts, which he

and the Idaho legislature argued would have devastating impacts on Idaho's economy, and that the administratively-implemented were in some ways worse than a listing itself (Johnson & Gorman, 2015). According to Utah Governor Gary Herbert (R), who also announced that he was considering legal action, the administration's "*actions constitute the equivalent of a listing decision outside the normal process*" (Fears, 2015). Along with Otter's suit, Elko and Eureka Counties in Nevada, along with a few mining companies, filed suit against the Department of Interior and other federal agencies for restrictions on land use that they argued would cripple gold and silver mining in addition to oil and gas exploration and grazing (Associated Press, 2015). Nevada Republican Senator Dean Heller called the threat of an ESA listing a ruse, aimed at allowing the federal government "*to tighten its grip [on federal lands] at the expense of rural America's future*" (Kaufman, 2015). Many opponents saw the pre-emptive conservation plans, administered by the BLM and the Forest Service, as being close to if not as restrictive as an actual ESA listing. Barry Russell, President of the Independent Petroleum Association of America, argued "*while this non-warranted decision is a step in the right direction for the grouse, and recognizes the immense efforts already underway, these federal land use plans and their impact on energy development must still be addressed*" (Russell, 2015).

On the other side of the political spectrum, several environmental organizations, including the Portland Audubon Society and WildEarth Guardians, were highly critical that the state and federal plans were not enough to save the sage grouse, and announced their intent to "*review the science and next steps*" through the legal system. John Horning, President of WildEarth Guardians—one of the organizations who initiated lawsuits forcing the FWS to make a decision on the sage grouse and hundreds of other backlogged species—argued "*that is the great tragedy of the day, that this decision would be based on politics not science,*" (Carlton,

2015). Others plainly voiced their opposition to the decision. According to Jamie Rappaport Clark, the President of Defenders of Wildlife, the decision "*failed to adopt key conservation measures identified by the government's own scientists and sage-grouse experts as critical to conserving the bird, such as protecting winter habitat or confronting the growing threat of climate change to the species' habitat*" (Fears, 2015).

As was quickly emphasized following the FWS announcement, the agency, and others who submitted the revised management plans that formed the basis of its decision, were well aware of the legal minefield that awaited them once the decision was made (Rott, 2015). The ability to withstand such legal challenges goes back to the wording of the federal Endangered Species Act, which specifically requires that listing decisions under the Act be made solely based on the "best available science."

This requirement has long made the ESA what has been variably called the "pitbull," and the "work horse" of American environmental law. By leaving no room for economic or political considerations in its protections for threatened and endangered species and their critical habitat, the ESA has found jubilant support among environmental organizations and near-universal disdain and animosity among resource users and economic interests. In this way, the ESA is a highly visible crucible for understanding the politics of science and its use in environmental management.

Science, Conflict, and Collaboration

At the time of the "environmental decade" of the 1970s, American public policy, and particularly environmental policy, was in the midst of a love affair with "scientific"—or expert-based—decision-making. For decades prior, federal agencies had been given wide discretion in administrative rule-making by Congress and the courts, under the assumption that agency

officials were the experts in their domain and knew better how to manage agency tasks (Jasanoff, 1990). With the rise of the environmental movement and the accompanying flood of environmental laws in the 1970s, however, this discretion was opened up to legal challenge by the public in an effort to force agencies to follow through on the new laws. Given the scientific standards and the perhaps unintended reach of the ESA, the law became a useful strategy for environmentalists seeking to slow or stop unwanted development or resource use (Nathanson, Lundquist, & Bordelon, 2015). Despite backlash in the late 1970s and 1980s that brought some restraints to the law[1] and continued opposition among congressional conservatives, the ESA has persisted largely in original form, with its clear and direct requirement for science-based decisions intact.

Even beyond the political troubles of the ESA, the use of science-based decision making has faced growing criticism in recent years. For one thing, by basing decisions on science with the assumption it provides an objective, unbiased view of reality, many stakeholders soon learned from environmentalists how useful scientific arguments could be in achieving policy ends. Instead of providing a neutral arbiter of environmental conflict, the "best available science" requirement made challenges to scientific methods, data, and analysis the strategy of choice—adding considerable confusion and a profusion of competing experts, studies, and analyses (Jasanoff, 1990). Other critics complained that rigid, top-down decisions based only on technical expertise are undemocratic and inevitably leave stakeholders frustrated and disillusioned (Beierle & Cayford, 2002).

[1] Most notably the creation of the Endangered Species Committee (the so-called 'god squad') that can block enforcement of the ESA in the event such enforcement would cause "undue" economic damage. This development resulted from the Supreme Court case TVA vs. Hill, which addressed the listing of the snail darter which threatened the Tellico Dam.

In response, what started as a scattered, experimental approach—collaborative governance—has gained increasing dominance to questions of public policy. As an approach to decision-making, collaborative governance seeks to bring diverse interests together to develop mutually agreeable negotiated outcomes by improving relationships and building trust. In many cases, this approach developed from a frustration with the status quo in public resource management—including the intensely litigious and highly polarized climate epitomized by ESA conflicts. Such collaborative arrangements seek to moderate the "zero sum" outcomes typified by top-down, science-based frameworks by creating an open and transparent process in which knowledge is shared and welcome in multiple forms—acknowledging that multiple forms of expertise, in addition to science, are necessary for good decisions (E. P. Weber, 2003).

However, the rhetoric surrounding science-based decision making persists, and did not take long to emerge following the FWS' announcement. Disappointed environmental groups complained that the updated BLM/Forest Service Management Plans, which formed much of the justification for the "not warranted" decision ignored advice and input from the agencies' own scientists regarding what was important to maintain grouse populations (Peterson, 2015a). Both supporters and opponents found fault with those plans. "*The federal plans fall well short of what the science says sage grouse need to survive*" according to Eric Molvar of Wild Earth Guardians, while Kathleen Sgamma of the Western Energy Alliance argues "*science does not support these extreme draconian restrictions in the land use plans*" (Rott, 2015).

Meanwhile, the L.A. Times commented in an editorial:

> Decisions about [sage grouse and prairie chickens'] conservation shouldn't be made by members of Congress and corporate interests. Whether a species is so robust that it does not require the protection of the Endangered Species Act must ultimately be a scientific call, not a political one.
> *(L.A. Times Editorial Board, 2015)*

While the law indeed dictates scientifically-grounded decisions, to suggest that ESA protections are not political ones highlights the common dichotomous view toward science and politics—that they must not touch. However, the increasing popularity of collaborative governance suggests that it is important to bring multiple perspectives to the table, not just a narrowly constructed scientific assessment.

Research Goals

This study aims to investigate how new efforts to proactively engage in collaborative conservation actions before a species is in crisis are able to address some of the critical challenges concerning science and scientific evidence facing the ESA. The case of the Greater Sage-Grouse and its proposed listing under the ESA is used as a focal point for reviewing such efforts. The example of the sage grouse is interesting from many angles, not least due to its wide geographic range covering many states and its sensitivity to a variety of habitat threats. In the interest of conducting an in-depth case study, the story must be simplified, and this dissertation will address only a narrow slice of the sage grouse story, emphasizing the relationship between collaboration and the use of science and technical expertise in decision making.

As conservation and management efforts are on-going and require continued community engagement, all agency staff participants in the study have been kept anonymous, with the exception of individuals occupying top administrative posts within each state (by their permission). In addition, the topic of sage grouse management is vast, but the time spent and resources available to complete a dissertation are not—and as a result, I was unable to utilize all of the data that I collected. In order to give it the attention, time, and space that it deserves, I am

saving my data regarding Wyoming's Sage-Grouse Implementation Team (SGIT) for a future publication. My apologies to my participants in Wyoming for this delay in the end-product.

The first paper (Chapter 2) presents a detailed case study of a three-pronged effort to conserve sage grouse in the state of Oregon, with the aim of understanding the relationship between collaboration and the use of science in decision-making. These efforts ranged from the regional to local scales, all aimed at avoiding a listing for sage grouse, or, at the very least, providing protections for private landowners in the event the bird was listed. The Oregon Bureau of Land Management (BLM) office, in keeping with the agency's national strategy, aimed to amend existing Resource Management Plans (RMPs) to address threats to sage grouse within the state. The Sage-Grouse Conservation Partnership (SageCon) was an effort convened by the Governor's Office, which brought together stakeholders from throughout the state to develop regulatory land use rules aimed at protecting key sage grouse habitat. In Harney County, in rural, eastern Oregon, ranchers, environmental organizations, and federal, state, and local officials came together to develop a voluntary Candidate Conservation Agreement with Assurances (CCAA) that provided regulatory protection from the ESA to local landowners in exchange for conservation actions to benefit sage grouse.

There was significant overlap in both content and participation among these three efforts—in fact, all three were represented at the statewide SageCon meetings. Each of these efforts, however, varied in its scale of operation and the degree of collaboration involved. Through the perspectives and knowledge of the stakeholders involved, this study evaluated the nature of each process as well as the role that scientific expertise played in developing the final product of each effort. The results of this analysis indicate that organizational goals, past history,

and scale of operation influence the degree of collaboration within each planning effort, and indirectly impact the use of science and technical expertise in each of the three efforts.

The second paper (Chapter 3) narrows in on the subject of CCAAs, which are a relatively new tool under the ESA, and evaluates the development of programmatic agreements in the three states that sought to incorporate CCAAs as a component of broader sage grouse conservation efforts: Idaho, Oregon, and Wyoming. CCAA are being pursued by the FWS as a way to address one of the long-standing challenges in ESA implementation—the alienation that the Act creates among the private landowners whose lands include important species habitat. Navigating relationships with landowners is a critical challenge for the FWS, and even further so as species increasingly face landscape-level challenges that involve complex social and ecological factors. The concept of "post-normal" model of science is used to suggest how these relationships might be navigated more effectively while pursuing species conservation.

Specifically, this study aimed to examine how the process of evaluating scientific evidence and negotiating species threats, conservation actions, and monitoring protocols in a CCAA impacts the ultimate success of the agreement in terms of landowner enrollment. The findings from the three case studies presented here suggest that CCAAs can provide a valuable opportunity to build wider support for conservation among private landowners. However, several potential "land mines" exist, particularly for those stakeholders and officials inexperienced with collaborative management. Relationships and trust are critical for the successful negotiation of agreements, and must be treated with care and diligence. However, it appears that where trust and relationships are limited, these can be supplemented through the inclusion of agencies and organizations that have long-standing ties to local communities and their representatives.

The third study (Chapter 4) takes a wider view at the nature of science and its use in management decisions. Many environmental laws, including the ESA, require that decisions be based on 'the best available science.' However, there is little guidance regarding how this term should be defined or applied in a management context. At a time when collaborative management is gaining increasing momentum, this ambiguity has the potential to be divisive if stakeholders maintain different perspectives about the nature of science and how it should be used in making management decisions. The goal of this study is to understand how participants in the collaborative management efforts studied in this dissertation define the concept of 'best available science, and to consider what implications these definitions may have for the implementation of decisions based on the metric of 'best available science.' Because the goal is to analyze responses to a single question across a large number of participants, the analysis in this study follows a different, more quantitative strategy than the other two papers presented in this dissertation, where efforts focused on creating a combined narrative derived from the perspectives of multiple stakeholders.

The results of this analysis found that in general, many stakeholders agreed on key themes regarding the nature of the 'best available science,' including the need to assess the technical validity of information, to consider diverse sources of information, and the importance of human judgement and a diverse set of perspectives in evaluating and applying the information to the management problem. A noticeable tension appears to exist, however, between the dual needs for technical and political credibility in management decisions. This often existed even within the same individual's responses, and seems to reflect an awareness among participants that management decisions are by nature political decisions, even when based on science evidence.

The expansive literature on collaborative governance and management makes it clear that relationships and trust are key to successful outcomes. Fundamental to the work of many collaborative programs is the need to evaluate, interpret, and apply scientific information to the problem they are seeking to address. In addition, these efforts are often operating within the constraints of established legal frameworks, such as the ESA's requirement to base decisions in the best available science. The goal of this dissertation is to evaluate how discussions of science and scientific evidence are navigated in a collaborative environment, and what those discussions suggest for future collaborative efforts in ESA implementation.

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Chapter 2

Science, Collaboration, and Sage Grouse: Proactive conservation efforts in Oregon

Abstract
Collaborative planning and cooperative conservation agreements are increasingly popular tools in implementing the Endangered Species Act (ESA), which seek to reduce the level of conflict associated with decisions under the Act by bringing stakeholders together to develop mutually acceptable outcomes. The literature on the relationship between science and politics suggests that the degree of collaboration involved in planning efforts may alter the manner in which scientific evidence and expertise is utilized and discussed by those involved, including learning, political, and instrumental uses. This study evaluates this proposition through a focused case study of the three-pronged effort to protect sage grouse in Oregon, a species considered for ESA protection. The effort included the statewide Sage Grouse Conservation Partnership (SageCon), the BLM Resource Management Plan Amendment (RMPA) process, and the development of the Harney County Candidate Conservation Agreement with Assurances (CCAA). Through the perspectives and experiences of the stakeholders involved, this study assesses the manner in which science and expertise is utilized and discussed in these on-going conservation efforts. Study results indicate that organizational goals, history, and scales of operation influence the degree of collaboration within a planning effort, and that this degree of collaboration can have effects the use of science and technical expertise in the process.

Introduction

In 2010, the US Fish and Wildlife Service (FWS) determined the Greater Sage-Grouseto be "warranted but precluded" from protection under the Endangered Species Act (ESA) due to limited agency resources. Soon after, as part of a legal settlement with environmental organizations over the backlog of such "warranted but precluded" species, the FWS was under court order to review its sage grouse decision and make a new determination by September 2015. As a result, many states with sage grouse populations, including Oregon, were spurred to develop management plans aimed at conserving the species in order to avoid a future listing, while federal land management agencies, particularly the Bureau of Land Management (BLM), worked to amend relevant Resource Management Plans (RMPs) to incorporate further protections for sage grouse. Many of these planning processes demonstrated varying degrees of collaboration, as stakeholders worked to protect sage grouse and their habitat while also

protecting the economic livelihood of the rural communities around them. Such collaborative efforts have been a growing theme in ESA implementation, as agencies and stakeholders seek to limit the divisive conflict that was becoming the cornerstone of the Act (Yaffee, 2006). One of the goals for such collaborative efforts is that by bringing diverse stakeholders together, group interpretation of scientific evidence and policy options will facilitate mutual learning and the growth of trust (Daniels & Walker, 2001).

Increased trust and mutual learning are important in navigating the perceptual barriers in sharing information (E. P. Weber & Khademian, 2008). Such barriers, like competing core values, social constructions, and perceptual filters can lead to skewed interpretation and presentation of scientific information, which some authors suggest may be nearly inevitable in policy conflicts (Ingram, Schneider, & DeLeon, 2007, Sabatier & Weible, 2007). This creates a tension between goals of using the best available science for making decisions and incentives for stakeholders to pursue and promote information allied with their own policy goals.

Weible (2008) reviews the literature on the use of science and other expert-based information, and proposes that the type of policy arena is likely to affect how such information is used by political actors within that arena. He identifies three main categories of policy arena: unitary (central decision authority with little outside input), adversarial (stakeholders compete to convince decision authority to take their side), and collaborative (stakeholders work together to identify mutually acceptable solutions). He then suggests that there are three general types of information use that he calls learning, political, and instrumental uses. Concerning the different types of policy arenas, Weible proposes that the political use of information (using information to legitimize previous decisions or preferences) is likely to be the highest in highly adversarial arenas, and that instrumental uses (based on the rational ideal approach to decision making) will

vary from highest in collaborative arenas to lowest in adversarial ones. Learning uses, which Weible derives from Weiss' (1977) definition as the slow accumulation information that indirectly affects policy by altering "beliefs about the causes of problems and preferred solutions," will mostly occur within allied coalitions in unitary (where no functional opposition exists) or adversarial policy arenas and serve to reinforce existing beliefs, but may occur across coalitions in consensus-based collaborative arenas (2008).

This study seeks to understand the use of science in the context of sage grouse conservation in Oregon, and the role that collaboration may have in that use. In order to do so, semi-structured interviews were conducted with two dozen stakeholders involved with the Oregon Sage Grouse Conservation Partnership (SageCon), the state's BLM Resource Management Plan Amendment (RMPA) process, and the Harney County CCAA, focused on their experience of the use of science in these efforts. These interviews are then analyzed for themes regarding the degree of collaboration involved and the use of science in each process, according to the propositions put forth by Weible (2008).

Methods and Analysis

Oregon was chosen for an in-depth case study on this topic due to its past history of extensive conflict over issues involving threatened and endangered species (i.e. the Northern Spotted Owl and logging, salmon and the Klamath River Basin) as well as its evolution toward collaboration in nearly all areas of resource management, including water, forests, fisheries, and wildlife. As a result, many actors and organizations within the state are experienced in collaborative management to some degree, and it is quickly becoming the norm for solving problems within the state. As a result, Oregon's approach to sage grouse, the Sage-Grouse Conservation Partnership (SageCon) has been held up as a model approach by the US Fish and

Wildlife Service, producing one of three state plans that were endorsed by the agency, along with Wyoming and Montana (Interview 36). Similar to previous conflicts, the issue of the Greater Sage-Grouse places rural land use at odds with statewide conservation goals and often urban-centered environmental organizations. In fact, for many in the state, the potential listing of the sage grouse so mirrored that of the spotted owl that the grouse is often commented to be 'the spotted owl of the desert,' or 'the spotted owl of the East side' (Jacoby, 2008; Sonner, 2000).

Oregon presents the story of only one out of eleven states faced with sage-grouse management, but it is a story that reflects the broader patterns in the issue (competing values and collaboration, the combined threat of wildfire and invasive species, state-federal politics, among many others), as well as the three general areas of conservation action: state planning and management, federal public lands, and private land. Complex environmental management issues and collaborative management are no longer new ideas—increasingly, they are the standard. What the story of sage-grouse conservation in Oregon can provide is the experience of stakeholders, scientists, government officials, and land managers as they navigate a complex, regional issue with a history of collaborative skills and relationships in their back pocket. This relative lack of novelty in collaborative practice does not take away from the value of that practice—instead, it provides an avenue to look deeper into its operation as it moves to a larger scale.

Within Oregon, there were three major organized planning efforts for sage grouse leading up to the 2015 FWS decision: the SageCon partnership initiated by Governor John Kitzhaber, the BLM's Resource Management Plan Amendment (RMPA) process, and the efforts of the Harney County CCAA Steering Committee. While not entirely separate and involving multiple overlapping stakeholders, these three efforts represent substantial differences in goals, content,

and process, all of which influenced variation in their approach to scientific evidence. The analysis in this study will proceed by considering these efforts as "subunits" within a single-case, embedded design described by Yin (2013).

A panel of informants method (R. Weiss, 1994) was used to select interview participants from among those who participated in SageCon (23), the BLM RMPA process (8), and the Harney County CCAA Steering Committee (11). Participants were selected to achieve a representation of the major individuals and organizations involved in each case sub-unit as indicated by attendance records from SageCon meetings posted on the SageCon website (Oregon Solutions, 2015), media reports, and the participants themselves. The resulting distribution of participants is found in Table 1. Semi-structured interviews were conducted with each participant, with interview items focused on both the degree of collaboration involved in each process, as well as the role and discussion of science in each (see Appendix A for interview protocol). Analysis of government documents and media reports was used to supplement and confirm information derived from the interviews.

Table 1. Distribution of interview participants across stakeholder groups.

Oregon Case Study Sub-Unit	Number of Participants
SageCon	**23**
Environmental Group	4
Federal Agency	9
Local Official	3
State Official	2
Rancher	2
Scientist	3
BLM RMPA	**8**
Environmental Group	2
Federal Agency	4
Local Official	1
State Official	0
Rancher	1
Scientist	0
Harney County CCAA	**12**
Environmental Group	3
Federal Agency	4
Local Official	2
State Official	0
Rancher	2
Scientist	1

Twenty-two interviews were conducted with twenty-four participants, including statewide officials and staff (3), federal agency officials, staff, and scientists (12), environmental group representatives and scientists (4), ranchers (2), local government/managers (2), and a tribal natural resource manager (1), who for purposes of analysis is considered jointly with other local government officials and managers (see Appendix C for a full list of interview participants). Many individuals participated in all three efforts, particularly as the Harney County CCAA ultimately became part of the statewide sage grouse plan as well as the model for the Oregon Cattlemen's Association CCA for grazing allotments on public land. Interviews lasted an average of 82 minutes, and ranged from 47 to 130 minutes and took place between October and December of 2015.

Interview notes and recordings, media reports, and relevant government reports and plans were coded in order to organize research results into analytic themes (e.g. Lofland & Lofland,

2006) related to opportunities to participate in each process, sources of scientific information, the use and role of science in each process, and stakeholder conflicts about science or its use (see Appendix B, Part A for analytic codebook). These themes were based in the propositions developed by Weible (2008) regarding the use of science (political, instrumental, learning) across different types of policy arenas (unitary, adversarial, collaborative). Institutional goals, operational scale, and collaborative history were inductive themes that emerged as relevant and important from the data (Glaser & Strauss, 1999). Codes and themes were organized and analyzed using NVivo qualitative analysis software.

Case Description

Sage grouse conservation in Oregon followed what the FWS State Supervisor Paul Henson calls a "*three-legged stool*" approach, where efforts were made to balance management on federal public lands, regulation and development of state lands, and conservation actions on unregulated private land. The Supervisor commented that this three-legged stool approach was what allowed him to recommend against a "warranted" decision to FWS Director Dan Ashe—"*The threats are still there, but we're doing something about all of them*" (Interview 21). The SageCon Partnership, the statewide planning effort, focused largely on increasing the regulatory certainty that sage grouse and their habitat would be protected, while the BLM amended its Resource Management Plans to protect sage grouse on public lands. Private lands, which the FWS Supervisor argues are uniquely important considering that most of Oregon's brooding habitat is found there, are largely covered by Candidate Conservation Agreements with Assurances (CCAAs). These subunits of the case study are summarized in Table 2.

Table 2. Features of Case Subunits.

	BLM RMPA Process	SageCon	Harney County CCAA
Goal	Adequate Regulatory Mechanisms	Adequate Regulatory Mechanisms	Regulatory Protection for Landowners
Scale	Regional/National	State	County
Collaborative History	Low	Medium	High

The SageCon Collaborative Partnership

The Sage Grouse Collaborative Partnership (SageCon), Oregon's statewide planning vehicle, began in June 2012, as part of the Oregon Solutions portfolio of projects. Oregon Solutions is an entity that was create through Oregon's 2001 Sustainability Act, with the mission to provide a system and process for collaborative problem solving in the state (Oregon Solutions, 2016b). Since its creation, Oregon Solutions has engaged with over a hundred community-based projects, and, through partnership with the Governor's Office, 60 statewide projects.

SageCon itself evolved from an earlier effort known as REECon (Renewable Energy and Eastern Oregon Landscape Conservation Partnership) that was formed in April 2010 to manage the rapid growth in the renewable energy sector in eastern Oregon in the context of a possible listing for the sage grouse after the FWS' 'Warranted but Precluded' status determination. As the seriousness of the sage grouse issue grew, the rapid growth in renewable energy development in Oregon declined. One participant from the NRCS hypothesized that this was possibly due to the threat of sage grouse, but noted it was more likely due to a combination of the economic recession and the expiration of Oregon's Business Energy Tax Credit (BETC) (Interview 17).

As a result, the effort was reorganized to focus on sage grouse issues statewide, co-convened by the Governor's Office, the Oregon Department of Fish and Wildlife (ODFW), the

Oregon office of the Bureau of Land Management (BLM), and the Oregon office of the Natural Resources Conservation Service (NRCS). Throughout the planning process, the SageCon collaborative emphasized an "all lands, all threats" approach to sage grouse conservation, attempting to streamline local, state, federal, and private conservation efforts (Oregon Solutions, 2015). Specifically, the conveners of the effort (the Governor's Office, the BLM, and the NRCS), noted that the FWS' 2010 "Warranted but Precluded" finding for sage grouse noted that an important consideration in the decision was the "inadequate regulatory measures" in place to protect the species, and thus focused the SageCon effort toward filling those regulatory gaps (Sage-Grouse Conservation Partnership, 2015).

On the SageCon website, dozens of partners are listed, including state and federal agencies and institutions, county governments, tribes, conservation organizations, and industry representatives (Oregon Solutions, 2015). However, many of these participants, although they may have attended meetings or followed SageCon developments, were not heavily involved in the planning process. A smaller "core team" of 17 emerged for planning and advising that met weekly, composed of representatives of state and federal agencies, the Governor's Office, county officials, The Nature Conservancy, Defenders of Wildlife, and Oregon Solutions (the SageCon facilitation team). Similarly, "Federal Family" meetings were held among the federal agencies, including the FWS, BLM, Forest Service, and NRCS, to coordinate information and activities related to sage grouse projects.

The SageCon effort began with a focus on bringing stakeholders together and educating them on different topics related to sage grouse conservation, with presentations from various experts and participants. In 2013, three working groups were formed, one focused on habitat fragmentation, one on wildfire and invasives, and a third on group on mitigation. While these

groups started out quite large (ranging from 10-28 attendants), in time they became smaller groups of 5-10 core members (Interview 19). These groups are where much of the development of the Oregon plan occurred, and eventually the 'big table' SageCon meetings became largely a forum for reporting on updates from agencies and working groups. A Technical Team was created to integrate and manage the project's technical information, and a Policy Team was later put together to begin developing the conceptual framework for the eventual state plan (Oregon Solutions, 2015).

Several participants highlighted the strong leadership displayed by staff from the Governor's Natural Resources Office, as well as that of facilitators from the Institute for Natural Resources (INR) in keeping the effort together and moving forward through the difficulties that arose in bringing together so many stakeholders in an issue with wide-ranging implications (Interview 4, 15, 16,). The outcomes of the SageCon planning process largely took the form of rule-making processes at two state agencies, the Oregon Department of Fish and Wildlife and the Department of Land, Conservation, and Development, which were to be adopted and enforced at the county level to protect sage grouse habitat and create a system for mitigation actions in the event of adverse impact on sage grouse.

The Oregon BLM RMPA Process

As the largest manager of sage grouse habitat, the BLM was placed in a position of making considerable improvements in sage grouse protections in order to avoid an ESA listing in 2015. Compared to the other efforts in Oregon, the RMPA process began with the least history of collaboration as a tool for managing contentious decisions. Several participants, including a few that wished to remain anonymous on this point, argued that the large, intensely rule-based, and

heavily bureaucratic agency rarely expressed interest in collaboration, and even when it did, its rules and top-down management style made it difficult for the agency to truly engage (Interview 6, 10, 13). Mike Haske, Deputy State Director for the Oregon BLM Office acknowledges a large desire within the agency to create plans that maintain consistency across state lines and also admits that the agency is "*in a paradigm shift right now,*" with a growing focus on collaborative process. For him, the biggest challenge in the process was "*being able to show the needs I have [within the agency], but still show local communities that I'm listening. That was the biggest challenge*" (Interview 16).

Soon after the 2010 "warranted but precluded" decision, the Western Association of Fish and Wildlife Agencies held a meeting on the matter in Montana, where it became clear to those involved that sage grouse conservation was an issue that needed to be dealt with collectively, and the RMPA process was initiated in July 2011 (Interview 16). The process that led to the Oregon Sub-regional Greater Sage-Grouse (GRSG) Approved Resource Management Plan Amendment (BLM, 2015c), one of 15 sub-regional planning efforts that composed the BLM's national strategy for protecting sage grouse. This RMPA affected eight eastern Oregon Resource Management Plans with its implementation of conservation measures for the species (BLM, 2015c). Similar to the state's SageCon effort, the BLM's strategy was aimed at creating the "adequate regulatory mechanisms" that the FWS had found to be lacking in its previous "Warranted but Precluded" decision in an effort to avoid a listing in September 2015.

The RMPA process was initiated in December 2011 when notice of the action published in the *Federal Register*. A series of scoping meetings were held around the planning area in January 2012, during which input was solicited from state and local governments, other federal agencies, and various stakeholder groups in terms of the scope of the issue and possible

alternatives for management action. The agency also engaged with its twelve official cooperating agencies designated under both FLPMA and the BLM's Land Use Planning Handbook (H-1601-1), which "*share knowledge and resources to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks*" (BLM, 2015c).

Notice of the Draft RMPA and Draft Environmental Impact Statement, including six alternatives for possible management action, were published in the *Federal Register* in November 2013, which initiated a 90 day period of public comment period. During this comment period, the BLM received 1348 unique letters and more than 4990 substantive comments regarding the draft RMPAs and draft Environmental Impact Statements across the Great Basin planning region (including Oregon, Idaho and southwestern Montana, Nevada and northeastern California, and Utah) (BLM, 2015b). Of those, there were 648 unique letters and 1776 substantive comments directed at the Oregon RMPA (BLM, 2015c). Upon seeing the range of alternatives put forward in the draft RMPA and feeling that there needs were not met, several representatives of local counties worked with the Harney County SWCD to create the "Rural Community Alternative," which they hoped would be included in the BLM's consideration (BLM, 2015a). The final proposed plan was published in July 2015, which did not include consideration of the Community Alternative, which the BLM indicated was too similar to existing alternatives within the Draft RMPA.

The approved plans were issued in September 2015, concurrent with the "not warranted" decision by the FWS. The proposed plan aims to eliminate or greatly limit new surface disturbance in priority habitat and minimizing such disturbance in general habitat areas, through a variety of conservation tools, measures, and strategies (BLM, 2015b). Both ranchers and environmental group representatives expressed concern about the final adopted RMPA, however

both indicated they would wait and see how the agency chose to implement the plans before making their next move (Interview 2, 4).

The Harney County CCAA

The impetus for the creation of the Harney County CCAA Steering Committee resulted from a local Oregon State extension workshop on sage grouse habitat assessment in May 2011, which was interrupted by participating who were ranchers concerned about the impacts of a possible ESA listing on their operations. The ranchers were curious about the benefit of the CCAA (Candidate Conservation Agreement with Assurances) program offered by the FWS, and asked for help exploring their options. As a result, the Harney County CCAA Steering Committee was formed. The goal of the Steering Committee is to develop a programmatic CCAA that would implement sage grouse conservation measures while providing assurances of regulatory protection to local landowners. Key participants in this effort included local ranchers, Harney County officials, local Soil and Water Conservation District (SWCD) staff, and field representatives from various federal agencies, such as the FWS and NRCS.

The Steering Committee worked to develop such an agreement that was mutually acceptable to all and legally defensible in the eye of the FWS (Interview 3). The Steering Committee met for several years and continued developing their CCAA plan while the SageCon process unfolded at the state level. Several participants involved in the development of the CCAA pointed to the community's recent experience in collaboration with the development of the Comprehensive Conservation Plan (CCP) for the nearby Malheur National Wildlife Refuge (USFWS, 2013b) as a critical reference point, where the community was able to build the trust and partnerships that led to the successful adoption of the Conservation Plan (Interview 6, 10, 9).

Playing a major role in the technical development of the CCAA plan was the work on state-and-transition Models (STM) for the sage-steppe ecosystem done at the local Eastern Oregon Agriculture Research Center (EOARC) in Burns, which, with a focus on ecosystem-scale factors, was a different approach than that taken by the BLM and many state plans, that focused on the more detailed Habitat Assessment Framework model promoted by the BLM. This ecosystem-scale approach made it easier to engage with ranchers about how land could be managed in a way that was beneficial for both sage grouse and ranching operations (Interview 5).

Ultimately, the group decided that they had something to offer other stakeholders preparing for a possible ESA listing. Committee members became involved both in the SageCon planning process, as well as an effort led by the Oregon Cattlemen's Association to develop a Candidate Conservation Agreement (CCA) for grazing allotments administered by the BLM (Interview 3). These efforts were successful, and the STM approach they took with the Harney County CCAA became the basis for the Cattleman's CCA and the CCAAs developed by all of the other Oregon counties with sage grouse as well as by the Oregon Department of State Lands.

Sources of Scientific Information

Stakeholders in Oregon benefitted from the existence of a generally-accepted compendium of sage grouse information in the form of the earlier-published ODFW Sage Grouse Management Plan (Hagen, 2011). This existing plan provided a starting place from which discussions could proceed. Similarly, the 2013 Conservation Objectives Team (COT) Report published by the USFWS laid out the threats to sage grouse from the perspective of the Service and representatives from various state wildlife agencies (U.S. Fish and Wildlife Service,

2013). Both of these reports were regularly cited by nearly all participants in the study as being either the springboard for further discussion or the basis for planning decisions and strategies.

Knick's (2013) effort to model sage grouse threats range-wide, as well as his past work on sage grouse (i.e. (B. Walker & Naugle, 2011) received widespread support, particularly among agency experts and decision-making, which may have been due to its clearly drawn analysis and conclusions. Others, while not attacking Knick's work, disagreed with its strong impact on decision-making—particularly the HAF—and argued that its broad-based conclusions were out of tune with the local conditions on the ground. This, perhaps, was the most frustrating part of the BLM's adoption of the HAF for the ranchers that were interviewed—the prescriptions of the HAF disagreed outright with what they were seeing on the ground on their own land. Broad—based conclusions, however, are what some decision-makers were looking for, in order to foster regulations that could be rolled out range-wide across multiple states, ecosystems, and administrative units (i.e. BLM).

The rangeland ecologists at the Eastern Oregon Agricultural Research Center (EOARC) were a source of information that dramatically influenced the approach taken by the Harney County CCAA effort. Aided by an ecosystem-wide perspective toward the major and intertwined sage grouse threats of wildfire and invasive species, the state-and-transition model (STM) approach adopted by several EOARC scientists and others involved in the CCAA effort allowed for conclusions to be made that were friendlier toward local land use than the more traditional habitat framework illustrated by the HAF. The STM approach also illustrates a key factor in the Oregon sage grouse story—that the dominant threats to sage grouse (fire, invasive species, juniper encroachment) in the eastern part of the state are also major threats to the major economy of the region (cattle ranching). As a result, there is the possibility for joint gains for both

conservation and local economies, provided one does not get too far into the weeds—as many suggest the HAF approach does in assessing grouse habitat.

Findings

SageCon

Process

The intent of the SageCon planning process was to protect the bird and its habitat through an "all lands, all threats" framework that would avoid an ESA listing and protect the economic vitality of rural communities where the bird made its home (Oregon Solutions, 2015). The SageCon meetings boasted an impressive number attendees, including the participation of around 40 different agency, NGO, industry, local government, and tribal representatives, and, as BLM Deputy Director Mike Haske commented, "*nobody walked out*" (Interview 16). Many participants were impressed with the undertaking, with one environmental representative calling it "a remarkably ambitious effort" (Interview 14).

Multiple participants referenced the leadership provided through the Governor's Office staff and facilitator Jamie Damon as what kept the effort moving through the complicated issues and contentious discussions (Interview 9, 14, 16, 17). In addition, the State Supervisor for the FWS was cited for being "*willing to stick his neck out a bit further*" in his commitment to the Oregon process. Ron Alvarado, the NRCS' State Conservationist commented:

> *Kudos to the governor's office, to [SageCon leadership] and those guys, from a state perspective, they knew themselves they had to be a player here. And this was a complicated issue. That it wasn't going to happen with us all going down our different silos. We knew we had to come together as a team, as a partnership, to figure out how we were going to contribute to the recovery here. (Interview 17)*

That being said, the "big table" meetings of SageCon were large—as many as 80 people would be in the room during some meetings—and filled with widely disparate interests in how sage grouse were to be managed in the state. As a result, working groups were set up early in the process to function as technical teams to work through the volumes of information and then present proposals to the larger group. At least a dozen different participants specifically pointed to SageCon as creating the opportunity to work collaboratively on sage grouse management, including agency staff, environmental representatives, and ranchers, even if they had smaller complaints about the process. A handful however, resisted the characterization that it represented a collaborative planning effort, arguing that it was too top-down in its management to qualify as collaboration. Dan Morse, the Conservation Director for Oregon Natural Deserts Association, commented:

> *It may be that it was not a collaborative process, but a different kind of process that got to an outcome that's okay—we shouldn't necessarily conflate these two things, one is collaboration and one is policy-advisory process. And I think that is a good characterization of the SageCon meetings over time—they were information-sharing meetings, more often than they were collaborative process and decision-making. (Interview 2)*

The other critics were more frustrated by the top-down direction in SageCon than Morse, particularly those from Harney County. One Harney County participant explained her response:

> *It was frustrating because I personally—and I think many other stakeholders—were making a pretty genuine effort to assist the state in developing a plan that would be doable, effective, all those things—and it seemed like it was still a very top-down process, where at that higher level, they had already in their minds what they intended that plan to look like and were not particularly going to budge from that. It was kind of like—'Thank you for your input, it was nice that we had all these people collaborating, but we're still going to do what we were going to do.' That was my take on it. (Interview 11)*

A half dozen or so participants were frustrated by a perceived lack of organization and direction in the SageCon effort. Some lamented that many meetings seemed to drag on with no

identifiable goal or outcome, while others complained that they regularly felt unsure of their own role in the process. A technical advisor involved in the process argued that frustration over the lack of organization was compounded by secretive side discussions between certain key stakeholders.

> *Sometimes I wish there had been more communication, more public communication, instead of the many conversations that happened on the side [regarding milestones, goals, etc.]. Maybe it's just me, as a project manager, but I want to see where we're going. And if we have to change course along the way, that's fine. And there's enough research—for heaven's sake. We should know that there's some basic things we've got to hit. (Interview 19)*

The occurrence of such side discussions was observed by multiple participants, some anonymously. Some of these acknowledged that the practice could appear negatively, but argued that such side conversations were necessary to keep conflicting parties on board with the process.

In general, despite critiques, there appeared to be general support for the SageCon effort and the products that resulted. In discussing one of those products, the regulations adopted by the ODFW Commission, and whether they adequately considered diverse types of knowledge, Judge Grasty replied, "*Do I think they're fairly considered? No, not at all. I'll say that, on the part of ODFW, the overall philosophy, I think we did pretty well. I think we could have done better…you can always say that. If all of us say we could have done better, we probably did okay*."

Most participants said they would participant in a SageCon-like process again, although usually with some caveats or reservations. Dan Morse from Oregon Natural Deserts Association expressed hesitance regarding whether he'd be willing to participate in such an effort again after his experience with SageCon, given these sorts of frustrations:

> *I think there's a lesson in all sage grouse effort—I was a part of Gunnison sage grouse efforts in Colorado, and then this—that is [organizers] have to be more tightly defined on*

> *the front end with ground rules and expectations, to set them up for success. And the more tightly defined a process was, the more likely I would want to participate. There's certainly other factors, in terms of participating or not, but the better that process is put together at the outset, the more likely we are to invest. (Interview 2)*

Use of Science

In SageCon, science was used "*at every level and almost immediately*" according to Brett Brownscombe, who during the process represented both the Governor's Office and ODFW in different positions, but in general held a coordinating role in SageCon discussions. He pointed to the Conservation Objectives Team (COT) Report (U.S. Fish and Wildlife Service, 2013), which laid the groundwork for identifying habitat needs and what needed to be done for effective sage grouse conservation. The state also put a considerable amount of effort into developing its own data and resources, such as a monitoring program, a decision-support tool that was developed by The Nature Conservancy, and a habitat mapping program developed by ODFW. Brownscombe also highlighted to efforts to understand the potential economic impacts that various sage grouse protections might have, and highlighted the work that staff from the Institute for Natural Resources did to understand those impacts (Interview 1).

Harney County Judge Steve Grasty also highlighted the importance of science to the SageCon process:

> *If we believe that the petitioners had a point in requesting the petition for the protection of the greater sage grouse, you can't start that conversation without looking at the science. Where's the birds, where's the habitat, what's good, and what's bad. So science gave us the framework to start the conversation. And then we tried to figure out, in my mind, how to do the right thing for the bird and the habitat. But, to do it in a way, that we could document that it was scientifically valid.*

That being said, Grasty had his critiques for some of the science discussions at SageCon meetings—"*Many scientists came into the room who were biased . . . [They would say] 'We've got to save the Earth, and by God, I'm going to just prove to you, by using science, that what you're doing is causing a problem,' rather than look for a solution.*" For Grasty, equally as important as labelling something as science is to be clear about who is doing the science, and with what motive, and in his mind, SageCon efforts were not immune to this need (Interview 9).

For Dan Morse of the Oregon Natural Desert Association though, the pre-determined goal of avoiding a listing meant that important factors (in his view) affecting sage grouse habitat such as grazing were given a pass, while too much focus was spent on less important, or even unimportant, factors like corvid predation. Political expedience, from Morse's perspective, was much more important in the development of the Oregon plan than science, and the attention given to corvid predation compared to grazing as a factor affecting sage grouse made this clear (Interview 2). This perspective was shared by Bob Sallinger, the Conservation Director for the Portland Audubon Society (Interview 14). Morse added that the state of the science, as well as fundamental disagreement between scientists, contributed to this outcome.

> *There's basically two camps—there's the folks who think we can actively manage sage grouse populations successfully, and there's the folks who are focused on the extent of impacts from human activity in sage grouse habitat—and they don't really seem to talk to each other much. And so everyone can basically pick a scientist that agrees with their existing viewpoint, and nothing changes. (Interview 2)*

Others disagreed with this argument about grazing. Catherine Macdonald, the Oregon Conservation Director for The Nature Conservancy, commented that by effectively taking the question of grazing off the table early in the process, the FWS made it difficult for anyone to argue otherwise about the importance of grazing impacts. This contributed to a less combative

atmosphere for SageCon, by making room for "*less wheel spinning around grazing*." Macdonald said participating in SageCon was an interesting experience, because there was more room for mutually acceptable outcomes, particularly with the positive buy-in of the ranching community. "*There was not many arguments about the science, not much posturing like you often see in these things,*" she concluded (Interview 13). An agency representative preferring to speak anonymously, who had been involved in several ESA cases, also noted that there was a general lack of "dueling sciences" compared to other processes they had been involved with over the years.

From the FWS perspective, State Supervisor Paul Henson argues that the agency wants to keep ranch land in ranching, because that's more beneficial to sage grouse populations than increased development and habitat fragmentation (Interview 21). In a memo to Oregon FWS employees aimed at clarifying Oregon FWS Office's perspective on the relationship between grazing and sagebrush ecosystems, Henson acknowledges that historically, grazing has had negative impacts on those systems (Henson, 2014). However, he argues that although poorly managed grazing will continue to have negative impacts, well-managed grazing practices can improve habitat and minimize future declines in sage grouse populations. As a result, Henson argues that it is better for the FWS to work with ranchers on a voluntary basis on sage grouse conservation and to maintain positive working relationships with local landowners and communities in order to address the larger, landscape level concerns like wildfire and invasive species (2014).

Other situations pointed to conflicts involved in opening up discussions of the science to a larger audience. Jamie Damon, a mediator who helped facilitate the process, recalled a particular example where a lack of wider engagement with the science among stakeholders had

large potential ramifications. From her perspective, ODFW scientists were so afraid of risking important sage grouse habitat that they were at first unwilling to discuss how conservation actions might be prioritized across core habitat areas. But in an environment where you are asking people to accept more regulations, the participant insists, there needs to be a way to identify what areas are the most important when both resources and patience for regulation are limited:

> *They were very concerned that opening this discussion up would somehow make the whole core area strategy really vulnerable, and that they would lose ground. But ultimately, that's what had to happen in order for us to knit together what we were saying about the potential threats, and the likelihood of those occurring in our most vulnerable, valuable, habitat. We had to have that conversation in order for people to support more regulation, or in order for people to back away from pushing against certain kinds of regulation . . . if we treat it all the same, knowing full well that these areas that are the most precious, the most intact, represent the largest continuous landscapes, and are also the most vulnerable, if we can't prioritize those, we lose it all. (Interview 12)*

Despite such complaints, many other[2] participants, including agency staff, scientists, and representatives from ranching and environmental organizations, complimented the use and presentation of science in SageCon. "*Science was guiding principle, but it came down to what everyone could live with,*" was the conclusion of Jason Kesling, who participated as the Natural Resources Director for the Burns Paiute Tribe (Interview 8). A biologist with the NRCS commented:

> *Earlier on in SageCon, the technical people had gone through a planning effort . . . and said, from a bird's point of view, here's what we need to do. When you brought more people to the table, occasionally the group might drift away from the science (especially regarding disturbance and effects), and so the technical folks would have to bring the group back to discuss the science at the base of the issue. This helped to build more support, and for the most part, the group agreed on most of the science. Where things got a bit more sticky was when*

[2] Thirteen participants total.

> *it came to limiting the human footprint on the landscape…it's difficult to convey just how sensitive the birds are, and that was an area of debate. (Interview 23)*

Oregon BLM RMPA Process

Process

In Oregon, the BLM aimed to complement the SageCon effort with the RMPA process, and to offer "*seamless integration*" between the RMPAs and the statewide plan (Interview 16). However, the BLM is bound by particular federal laws, including Federal Advisory Committee Act (FACA), and this limited the degree to which the BLM could deliver on ideas and input emerging from SageCon meetings, as SageCon was not a federally-chartered advisory group under that law. In addition, the BLM needed to make decisions for sage grouse management at a range-wide scale, not just for Oregon. This led to some tensions regarding decisions about the scale of data collection and implementation, as the BLM felt a need to be consistent across the range of the bird. Despite these limitations, Deputy Director Mike Haske argues for the importance of bringing as many people to the table as possible, and for the BLM's participation in SageCon. As quoted earlier, Haske's biggest challenge in that process was to explain the needs and limitations of his agency, while still showing the local communities that he was listening to their concerns (Interview 16).

Multiple participants, although often sympathetic to the constraints faced by the agency, complained that size and bureaucratic nature of the BLM prevented the agency from a more collaborative process with more public engagement. Jay Kerby, who has been involved with multiple on-going projects with the BLM, explained,

> *[The BLM] struggled, very much, to balance a one-size-fits-all approach versus every district and every office going off in their own direction. Somewhere in there, there's the*

> *right balance, but it's really hard to find. It's hard for them, it's hard for all of us—but I think they especially struggle with the one-size-fits-all edicts from DC, some of which are crazy in some scenarios. But at the same time, it's crazy to have one staff person measuring grouse habitat with method B and another is using method A—they're apples and oranges, you can't tell what's what. (Interview 6)*

For Marty Suter-Goold, the manager of the Harney County SWCD, there was an enormous amount of frustration with that centralized approach. From her perspective, through some combination of personality and agendas, the BLM had specifically turned away from the collaborative approach that so many others were embracing. She argued that with the BLM, it was "*by God, it's my way or the highway. And by God, this is how it's going to be. I'm not interested in what you have to say, this is how it's going to be*." And in response to the participation efforts that were available, she commented:

> *Well, geez. That was a waste of a lot of money, a lot of time, and here we are, and we're going to litigate, because that's our only voice. Whereas, we had several opportunities to have exactly that collaborative discussion, and you were going to use this science, and by God and be damned if you were ever had any other solutions that were beneficial to the greater ecology of the land that you, the Federal Government, is in charge of managing. Nope, it's done.* (Interview 10)

Zola Ryan, the Harney County District Conservationist for the NRCS, echoed this frustration:

> *It was not a collaborative process. It was a completely different, totally different approach. With SageCon, I think, at least sort of attempted to be a collaborative process. But with the RMPAs, there was not even an attempt to be collaborative. So it was hard to know what was going on. We heard from our local BLM folks, that it's not just that other stakeholders weren't really allowed to give input, I mean, you were allowed to give input, technically. You could comment, that sort of thing, but it went nowhere. But also their own staff at the local level were told to stand down . . . The 'why' of that is really hard to understand. We've had conversations, like why would you even take that approach—why would you not reach out and say, help us come up with the best plan we can have, whether it's to your own staff or to your partners? I honestly don't know what drives that, but it was night and day. (Interview 11)*

In trying to understand that difference, Ryan wonders whether some people or agencies avoid collaboration due to a misconception that collaboration means making decisions based on emotions rather than science. This is unfortunate, she says, because:

> *In reality, a true collaboration, and the processes that I've participated in, gives people a place to express their emotion, but honestly you get down to what is the actual scientific or ecological issue that is behind the emotion. It's not just addressing the emotion. It's not, 'Oh that makes you unhappy? Then we won't do it.' It's, okay, but why does it make you unhappy? What is it that you think is going to happen to the environment? Or to whatever else? And then you can deal with that. That's my perception of why a lot of people don't want to go the collaborative route. And I think they're mistaken. (Interview 11)*

According to TNC's Catherine Macdonald, more could have been done to help sage grouse if the BLM had been more open; but from her perspective, the collaborative intent was there even if it was constrained by administrative challenges like the FACA rules (Interview 13). Even so, there were critiques among the conservation community. Dan Morse, from Oregon Natural Desert Association, referenced several state efforts as well as the BLM planning process when he commented:

> *When you have a true collaborative effort, you have good ground rules, stated rules and timelines, so that at the end, the group is comfortable with the outcome, and defends that outcome, individually and collectively. When you have a not-truly collaborative effort, missing those key ingredients…then at the outcome people start to attack the outcome. And that's exactly what we're seeing, on the state level across the West, and with the BLM plans across the West—because it wasn't successful collaboration, people are attacking the outcomes. (Interview 2)*

From the industry perspective, there was concern over the uncertainty involved with the BLM's implementation of its RMPAs, which led the Oregon Cattlemen's Association (OCA) to pursue the development of a Candidate Conservation Agreement (CCA) to operate in a similar manner as the CCAA for private land, but on grazing lands administered by the BLM, in the hopes that this would offer some flexibility with regard to the RMPA. According to the OCA's

president, John O'Keeffe, "*there's some good things to be done there [in the CCAs], but we live and die by the RMPAs . . . ,*" meaning that although they hoped for flexibility as a result of the CCA, it could not provide the same level of regulatory protection as CCAAs did for private landowners (Interview 4).

Use of Science

According Deputy Director Haske, the BLM utilized the most current science available in their planning process, as assembled by interagency technical teams. In particular, he pointed to the FWS' Conservation Objectives Team (COT) Report (U.S. Fish and Wildlife Service, 2013) as a valuable resource that was the product of a collaboration effort between multiple agencies. Further, he pointed to the regular meetings and consultation among the agencies of the "Federal Family," namely the BLM, FWS, and NRCS in order to share information. He also acknowledged a desire to create plans that would maintain consistency across state lines so that the FWS could effectively "score" the various state plans. Haske commented that the big concern for Oregon was the ability to respond to wildfires, and that the agencies had responded with more resources for initial attack against wildfires, including federal suppression forces and support for Rangeland Fire Protection Associations (RFPAs). In addition, the agency had partnerships with The Nature Conservancy and the EOARC in Burns to further developments in seed pillows for establishing native grasses and biocontrol agents for controlling invasive annual grasses like cheatgrass (Interview 16).

Rancher John O'Keeffe offers a different perspective on the use of science by the BLM in the RMPA process. In the absence of an established understanding of wildfire, he argues that the BLM focuses too narrowly on fine-grained monitoring details, such as the guidelines offered

by the BLM's Habitat Assessment Framework (Stiver et al., 2015), without a concurrent understanding of how those guidelines impact fire risk by increasing available fuel:

> *Now we know fire is bad for sage grouse, but we haven't really looked at every interaction as to how to leave 8 inches of stubble on the landscape instead of 5 inches, affect the fire return intervals, affect the chance of a lightning strike turning into a fire event . . . that's all the stuff that we know is there, but we haven't done the science, so the BLM tends to say, 'well, the HAF is this," and they'll give a little verbiage about how we need fire practices, but they don't have the full spectrum, that as we manage towards the HAF, we've also got to manage fuels so that we don't also have problems with the fires.*

O'Keeffe comments that new research is emerging in fire science that shows grazing can be helpful in reducing the severity of fire, but it is newer than the science on which the HAF is based and is still in the building and review process. He argues that not taking this information into account is akin to playing a game of bridge with the scientific assessment: "*You're kind of playing a game of bridge, where you lay down the spades, and you can only play spades—and if you lay down a heart, that's not the trump that was led.*" The BLM, by choosing to favor the established science of sage grouse habitat use over emerging information about wildfire and fuel loads, is playing the spades. From this perspective, a heart has been laid down by developments in fire science, and since those developments don't follow the established course, they are discarded in decision-making. Due to its longer establishment, the habitat guidelines established in the HAF are the trump card in BLM policy—they are prioritized over the newer fire science, despite the fact that wildfire is the dominant threat posed to sage grouse in Oregon (Interview 4).

Another critique of the reliance on the HAF by the BLM suggests that the desire for range-wide consistency mischaracterizes the nature of high desert grouse habitat. From this perspective, the 7-inch stubble height requirement is not useful for a region where it was unlikely to even attain 7 inches of growth. Tom Sharp, Chairman of the Harney County Steering Committee explains:

> *One size doesn't fit all. And there was, and is, a desire by the BLM nationally, to simplify their lives, by having one set of standards that is representative of the eleven states of sage grouse habitat in the West. This region here, in southeastern Oregon—we're high desert. We might get ten inches of precipitation per year, if we're lucky. . . . This goes back to what the best available science is—I think it is the science that is germane and relevant to the regional situation that you are considering. . . . And that we're not so quick to think that we can make our lives simpler by having one national metric that applies to all regions in the habitat area of consideration. That's what made the sage grouse such a complex issue, is because it just encompasses so big of a geographic area—eleven states. It's not a homogeneous landscape to consider, but we have to think of that eleven state landscape and identify different geographic regions and what is possible to achieve in each of those regions based on the local circumstances. (Interview 3)*

These perspectives have some support from the work done at EOARC. An EOARC research ecologist involved in the CCAA planning is emphatic that although grazing may have impacts if done improperly, those impacts matter little if the entire landscape burns in a wildfire. As a result, he argues that the immediate focus needs to be on wildfire and invasive species that are a much more existential threat to sage grouse populations (Interview 5). The Nature Conservancy's Jay Kerby, who worked with EOARC scientists on the state-and-transition model approach, largely concurs. When it comes to grazing and the conservation of sage grouse, he comments "*that conversation was a dead-end road*" if it was approached the wrong way. From his perspective, the STM that were developed are rooted in science, but are a much better communication tool than the traditional indicator approach.

"*By framing the problem through a comparison of plant communities, the conversation is easier to have with the ranchers and isn't as confrontational as arguing about whether grazing is good or bad . . . More or less, the STM models offer a slightly different interpretation of what the problem is and how to address it.*" As he points out, the region is facing a "*wholesale change of the ecosystem*," so it is not about measuring subtle grouse habitat parameters. He offered an example regarding a house party to illustrate the difference in approaches, frequently used by the

EOARC scientist: say you want to have a house party, but there's two problems preventing that—one is that your couch is in the wrong place, and you need to rearrange the furniture. The other is that your house is on fire. "*Both are problems—but one needs to be addressed first*" (Interview 6).

Harney County CCAA

Process

A few dominant narratives emerged from interviews with stakeholders involved with the Oregon process. First, there was the pride and enthusiasm that was common among those who were involved in the Harney County process from the start. Once the idea for exploring the CCAA option emerged, local ranchers met with county officials and other stakeholders about getting involved. These meetings soon developed into several years of meetings in the basement of the Harney County Courthouse with a diverse set of local community members, agency representatives, scientists from EOARC, and representatives from conservation groups.

The Harney County SWCD's Marty Suter-Goold emphasized the importance of welcoming a diverse set of perspectives and allowing stakeholders to share their responses to issues, something that was learned in the development of the 2013 Comprehensive Conservation Plan for the Malheur National Wildlife Refuge that began after decades of conflict in 2008 (USFWS, 2013b). It was an example that many participants shared:

> *We've seen a significant culture change here, in the last 15 years or so, with the Malheur NWR. Fighting with landowners, and water rights issues, the District was suing the refuge on behalf of all these landowners, but nobody talked about the problem. It's just, we're suing you, and we're mad at you—and it took a couple of key individuals with personalities, myself and some other people in the community, to sit down and talk. How did we get here? Is this how we want things to be? What can we do to change it? How can we work together, acknowledging you have your agency mission and goals, and we have our duties? But it's that conversation that all too often, gets completely— [lost].*

> *Well, that's great. Maybe for the short term. For the long term, that's not going to be effective. So really, it's this whole, higher level, policy-science-people [connection]. It's the human, that sociological piece to changing the culture of agencies and looking at collaboration as a critical component to resource management. (Interview 10)*

Steering Committee Chairman Tom Sharp commented that especially early on, it was a challenge to develop that participation, and to overcome the distrust that many local landowners had particularly for the federal agencies.

> *The initial mindset, among the ranchers, was skepticism towards engaging with the agencies, a mindset that portrayed it as an issue that would go away, that it was just another government ploy to get the man off the land, you know, attitudes like that . . . . What we did right, is we started early . . . and kept at it consistently, month after month after month, meeting after meeting after meeting, going out into the rural communities and inviting them to come in, writing, publishing, doing things like that to make awareness that this is an issue that is really not going to go away.*

But from Sharp's mind, the CCAA was an imperative for future business operations, as the provided additional certainty of continued operation necessary for bank loans and other arrangements, and as a result, acceptance for the CCAA model grew over time. What was important was to allow it that time to develop, and he argues that what Harney County did right was to start early and to keep at it persistently until all the meetings and negotiations paid off (Interview 3).

Harney County Judge Steven Grasty commented that eventually, the idea became very popular with the community and attracted considerable participation from local people, but it also attracted some skepticism:

> *There was huge turnout from the community, and conservation groups came a little bit. At the end of the time, they were very wary, and I can tell you—over and over they said, 'But it's voluntary!' I might have heard that 15 times. Really? Step up and put your land in it! (Interview 9)*

The observation that there was less participation from conservation groups was one echoed by multiple participants. "*We tried,*" to get more participation from them, explained Sharp, "*but sometimes they don't show up at the table. But we want them at the table.*" He maintained that they would rather have people who disagree at the table, so that issues can be worked out collaboratively as they emerge, rather than waiting and having litigation force the courts to decide, and "*litigation just degrades the efficiency of efforts of everyone involved*" (Interview 3).

Use of Science

Interview participants frequently spoke of the need for useful science that is applied appropriately to the local context, for a more nuanced understanding of the way science should be interpreted and weighted, and for a flexible regulatory approach that accounts for local conditions and scientific uncertainty. Personal relationships, connection to the local community, and trust were all highlighted as factors that were critical in attaining those needs, and for pushing forward through areas of disagreement. Additionally, this group often repeated the importance of systematic, ecosystem-based planning rather than a more narrow species-specific focus on sage grouse.

This ecosystem-wide perspective is illustrated well by the work of the Eastern Oregon Agricultural Research Center (EOARC), located in Burns, which ultimately framed the approach taken by Harney County in the CCAA planning effort. Dr. Chad Boyd, an EOARC range ecologist, comments that the Harney County CCAA effort demonstrates the competing visions that exist between species-specific habitat requirements for the sage grouse and a more holistic, ecosystem-wide perspective that sees sage grouse as symptom of a larger problem. "*Both are*

important," he reiterates, "*but you have to address one first*." Boyd served as a science advisor for the Steering Committee and estimated that it took around a year and a half for the Committee to gain stakeholder acceptance for this ecosystem-based vision for the CCAA model, but that since then it's become very popular (Interview 5).

According to his colleague Jay Kerby at The Nature Conservancy, the STM's ecosystem-based approach marked a philosophical difference between the CCAAs and the approach taken by the BLM toward sage grouse conservation. The HAF contains about 70 indicators, and is weighted toward precise measurements but is less likely to present an accurate picture. Meanwhile, the STM method is biased toward a more accurate representation of the habitat and less precise measurements. Kerby argues that both bring something of value toward understanding the ecosystem, but a balance is needed between the two. In that vein, he and others are working to try and develop a habitat quantification tool based on STM that the BLM might be willing to accept in place of the HAF later on (Interview 6).

In his evaluation of the CCAA process, Judge Grasty maintained it were not necessarily a good path—they were in fact a gun being held to the head of the local community, and were the only option community members had if they wanted to maintain their livelihoods and way of life. He was willing to work hard and give his time to the project as a way of protecting his community, but he had not bought in to the philosophy per se. What he had seemed to have bought into though, was that the scientists at EOARC for the most part, were trustworthy partners that valued their community. And that was a helpful element in moving through the negotiations involved in various conservation agreements (Interview 9).

While the ecosystem approach to sage grouse conservation championed by the EOARC scientist was generally well-regarded in Harney County, the Fish and Wildlife Service was a bit

more skeptical. "*While it may be based in perfectly good science,*" commented one FWS official, "*in the end it is a sage grouse plan, after all*." The ESA is limited by the species-centric approach to conservation written into the legislation, and the FWS was concerned that the novel ecosystem approach promoted by EOARS and the Harney County Steering Committee would not be legally defensible in the event of a lawsuit. Even for an official well-versed in collaborative management and community engagement, there was a clear presence of the reality of ESA politics and the likely future of legal battles.

Discussion

Each of the three "legs" of Oregon's sage grouse conservation stool identified by FWS State Supervisor sits in fundamentally different contexts, with considerable implications for the degree of collaboration embraced and the use of science in decision-making (See Table 3).

Table 3. Characteristics of Three Oregon Sage Grouse Planning Efforts.

	BLM RMPA Process	**SageCon**	**Harney County CCAA**
Goal	Regulatory Certainty/Legal Defensibility	Regulatory Certainty	Regulatory Protection
Content	Species and Ecosystem Threats	Species Threats	Species and Ecosystem Threats
Scale	Regional/National	State	County
Collaborative History	Low	Medium	High
Process	Consideration of Stakeholder Comments (Adversarial)	Information Sharing and Joint Rule-Making (Collaborative/Unitary)	Inclusive Engagement and Joint Learning (Collaborative)
Use of Science	Instrumental/Political	Instrumental/Political	Instrumental/Learning

The BLM, which manages the vast majority of federal sage grouse habitat in Oregon, is also the largest manager of sage grouse habitat range-wide. In addition, the BLM's decisions are subject to a heavily adversarial policy arena which means that its decisions are almost certain to be challenged in court. Thus, the focus of the agency has been on the legal defensibility of its decisions, which several stakeholders believe the agency has embraced a more conservative approach to sage grouse management and stakeholder collaboration. The HAF, although flawed from some perspectives, is based on decades of established sage grouse biology published by acknowledged experts in the field. The STM approach championed by the Harney County Steering Committee is also scientifically based, but it emerges from the still-developing literature on more complex topics of wildfire and landscape ecology. From its conservative management orientation based in its desire for a range-wide standard that is legally defensible in court, the chance that the STM approach would not be accepted was perhaps too much to risk for the BLM. Considering the anti-grazing perspective of the environmental organizations most likely to sue (Western Watersheds, etc.), the more generous consideration of grazing by STM's landscape analysis made it a likely target in future legal arguments.

The major goal for SageCon was to create an increased level of regulatory certainty for sage grouse conservation, an element that the FWS' COT Report had listed as critical for the FWS to consider a "Not Warranted" decision. With its focus on regulatory mechanisms, the SageCon discussion naturally gravitated toward species-specific disturbance and development threats to the sage grouse. Grazing and ecosystem threats such as invasive species and wildfire were thus an area of limited consideration in the major outcome of the process—the adoption of regulatory rules by ODFW and DLCD to protect sage grouse from habitat fragmentation and

encroachment. The narrow nature of the regulatory goals leads to a narrower, utilitarian consideration of science as well limited avenue for other stakeholders to shape the process and outcome. However, there was still a substantial role for stakeholder input, particularly since these regulations rely on adoption and enforcement by county governments. Similarly, there is enough of a history of collaboration in Oregon that it was clearly important to provide a forum for information sharing and feedback by stakeholders, even if many of those stakeholders perceived that the general shape of the outcome was already known by state officials who needed to make a case for regulatory certainty to the FWS.

Since the dominant goal of the Harney County CCAA was to provide regulatory relief to individual ranchers in exchange for conservation actions to benefit sage grouse, the Steering Committee enjoyed a greater degree of flexibility in how they approached the CCAA's development. The agreements would be voluntary and would not be imposed on anyone who did not agree to them, a stark difference compared to both the BLM RMPAs and the regulatory rules for land use adopted by ODFW and DLCD. Further, the desire to encourage widespread adoption of the CCAA among area ranchers meant that Steering Committee was more likely to be open to an unproven, novel perspective toward sage grouse conservation such as that promoted by the STM approach. Above all, the majority of Steering Committee members shared a vision for their own local community—one that valued the ranching tradition and local economic viability as well as a healthy environment, which bound the group together even as they worked through challenging discussions. These three qualities—a voluntary approach, an openness to new science and analysis, and a shared vision—made it much easier for the Steering Committee to engage in a more inclusive collaborative process that fostered not only thoughtful deliberation but also mutual, shared learning of scientific analysis as well as perspectives.

Beyond this, as several stakeholders pointed out, it was no accident that Harney County was the place where the CCAA effort developed. Harney County, through decades of conflict and experience, has earned a reputation as a place where collaboration works, where stakeholders are willing to put in the time and energy for an outcome that encourages joint gains among disparate interests. Thus, with the addition of the strong leadership displayed by key stakeholders, the Steering Committee could pull from a well of deep experience by many in the area with regard to collaboration and how it is done effectively.

From this discussion, the importance of organizational goals, scale, and collaborative history for how science is used and discussed becomes clear, as well as for the degree to which collaboration is embraced in the planning process. By far, the BLM's RMPA process was the most criticized for its lack of openness as well as its resistance to a more nuanced vision of sage grouse conservation. The BLM also faces institutional responsibilities, threats, and vulnerabilities far beyond what is faced by the SageCon team or the Harney County Steering Committee, though. That in the face of these the agency would retreat to the protection of a more traditional process and approach to scientific analysis is not surprising. However, given the complexity of the issues facing the sage grouse and the sage-steppe ecosystem more broadly, there are costs and benefits to all three approaches.

The collaborative process and efforts to incorporate new and emerging science in a local context pursued by the Harney County Steering Committee are admirable, but they build on a collaborative history and shared vision that are not always present, and a voluntary approach that is not always possible. The SageCon process presents an illustrative middle ground in which attention is focused on a more narrow set of parameters under the strong direction of state leadership, with an intermediate degree of collaboration and information sharing involved in a

context of intermediate scientific and social complexity. Tradeoffs were made to both foster broader stakeholder participation as well as ensure the degree of regulatory certainty demanded by the FWS, which led to criticism of those decisions on the part of various stakeholders, but most agreed that the process was preferable to that employed by the BLM.

Beyond its goal of providing regulatory certainty, however, SageCon also provided a general forum for sage grouse planning efforts in Oregon. Various stakeholders could speak their mind and respond to the plans and decisions made by state and federal agencies, and representatives of various efforts including the BLM and the Harney County Steering Committee. Thus, even though many critiqued the closed nature of BLM decision-making, SageCon provided a direct path for communication with BLM leadership regarding concerns and feedback about the RMPA process. Similarly, once representatives from the Harney County Steering Committee became involved in these statewide meetings, efforts to expand their efforts to other Oregon counties were facilitated, allowing for the eventual coverage of all sage grouse counties with programmatic CCAAs for private land conservation and protection for landowners.

And despite some criticisms from all sides, SageCon led to deeper relationships and creative conservation efforts between divergent stakeholder groups. Perhaps the most illustrative example was the combined effort of the Audubon Society of Portland, the Oregon Cattleman's Association, and Eastern Oregon state legislators to jointly lobby for expanded tax revenues, levied on their own constituencies, dedicated to ESA candidate species conservation, including sage grouse. Although the effort ultimately failed, the joint-taxation plan (including a tax on birdseed and a tax on mineral supplements for ranching operations) points to the surprising solutions that can emerge when such divergent stakeholders pursue the cooperative path in the face of resource conflicts.

Conclusion

As the use of collaboration increases, institutions with different organizational goals, histories, and management scope will encounter each other, and will have divergent perspectives on the degree of collaboration that is appropriate for a given problem, and the openness with which science should be discussed and evaluated. As observed in this case study of sage grouse conservation in Oregon, these differences can lead to conflict when stakeholders expect more opportunities to participate than are offered by the decision-making agency.

In particular, the BLM was the object of considerable criticism for the lack of openness and discussion of evidence in its RMPA process. Despite these complaints, several stakeholders noted that the agency faced a variety of constraints in its ability to be more collaborative, constraints which BLM officials also noted, such as its responsibility to manage sage grouse habitat range-wide. That larger scale-perspective filtered in to the agency's approach toward science, and the hesitance with which the agency engaged in collaborative forums—as an agency with wide-ranging responsibilities, the BLM appeared to fear the chaos that might occur if each region approached sage grouse conservation independently.

SageCon, with its broad stakeholder participation, was better received by many compared to the RMPA process, but that process faced its own shortcomings and limitations—many the result of tradeoffs that the Governor's Office was willing to make in order to accomplish its goals of achieving "adequate regulatory protections" within the state and avoiding a listing for sage grouse. The "half-way" nature of collaboration at SageCon rankled some, particularly those who had experienced a much greater engagement in Harney County, but others noted that it did get the job done. As some participants noted, achieving the high diversity of representation present at SageCon inevitably meant that there would be some degree of compartmentalized

work done in smaller groups—having a nuanced discussion of scientific evidence with dozens of people was deemed impractical.

For many participants, the development of the Harney County CCAA was the star of sage grouse conservation in the state, because of its ability to bridge the long-term distrust between private landowners and the FWS. This was possible in part due to the leadership exhibited participants within the CCAA Steering Committee as well as the Oregon FWS office, but was also facilitated by the strong relationships that were built among participants in the development of the Malheur CCP several years earlier. In addition, the local scale of consideration and the relatively narrow goal of protecting individual landowners from future regulation provided Steering Committee the space to develop a unique and highly collaborative outcome. The collaborative environment that developed was one in which science was not taken in as an end-product to be cut and pasted into the plan, but as fodder for discussion and shared learning among stakeholders, to be interpreted and applied for the context at hand.

As Weible (2008) proposed, in the case of Oregon sage grouse conservation, the more inclusive and collaborative conservation efforts, SageCon and the Harney County CCAA, saw less politicized argument over scientific evidence, and more inclination towards joint learning and instrumental uses of science. In the less collaborative environment of the BLM's RMPA process, stakeholders on both sides felt left out of the decision, and arguments over science exhibited less nuance and mutual learning than exhibited in both SageCon and Harney County.

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Chapter 3

Candidate Conservation Agreements with Assurances: Post-normal science and opportunities for improved conservation on private property

Abstract

Candidate Conservation Agreements with Assurances are an increasingly popular program for encouraging the conservation of wildlife species in decline on private lands. Private lands have long presented a challenge in the implementation of the Endangered Species Act (ESA)—they are often critical for achieving conservation goals, and yet the ESA has been criticized for creating perverse incentives for landowners to undertake conservation actions, by creating a fear of prosecution or increased restrictions in the event species are found on their land. At the same time, the ESA is also challenged by the increasing complexity of threats facing species, where ecological and social factors are often intertwined. For challenges like these, it has been argued that "normal" science is no longer sufficient to inform decision-making, and in its place a "post-normal" model of science should be pursued, in which a variety of stakeholders are involved in deciding how science should be developed, interpreted, and applied in making policy and management decisions. Collaborative governance is a tool that is frequently recommended to help accomplish these goals, with a large body of literature providing evidence on best practices for improving relationships and trust among stakeholders involved. In the case of candidate species conservation, these best practices may be helpful for agency officials and stakeholders navigating the development of CCAAs.

In this study, three cases of CCAA developed for the conservation of the Greater Sage Grouse, a former candidate for ESA protection, are examined. Findings from these case studies suggest that such agreements offer an opportunity for stakeholders and agencies to work together to build wider support for conservation on private lands, but that participants and agency staff must be wary of the challenges of building and maintaining relationships in this process, such as following open communication and decision strategies. From the experiences observed here, while on-going relationships and trust are critical for the successful negotiation of conservation agreements, these can also be supplemented through the inclusion of agencies and organizations that have stronger ties with local communities and their representatives.

Introduction

In September of 2015, state and local government officials, federal agency administrators, a variety of natural resource industries, and rural communities across eleven Western states breathed a collective sigh of relief. In an announcement ten years in the making,

Secretary of the Interior Sally Jewell announced that listing and protection under the Endangered Species Act (ESA) was "not warranted" for the Greater Sage-Grouse(Department of Interior, 2015).

Congress passed the Endangered Species Act (ESA) in 1973 as a comprehensive approach to protecting declining populations of American wildlife. The ESA prohibits the killing or harming of threatened or endangered species, including harm to the critical habitat necessary to their survival. While a considerable amount of ESA implementation occurs on publicly-owned land, private lands are also important. A 1994 analysis noted that over three quarters of species listed as threatened or endangered at the time relied on private land for habitat and that 90% of endangered species utilized some habitat on private land. The same study found that as many as half could not be found on federally-owned lands (U.S. General Accounting Office (GAO), 1994). Although the numbers may be dated, this study points to the general importance of private land for conservation, an importance that has continued to be observed in other studies (Groves et al., 2000; Shogren, 2005). This is certainly the case for the Greater sage grouse. The "not warranted" determination was largely the result of widespread conservation efforts for the sage grouse, including efforts by private landowners throughout its considerably large range.

This study seeks to evaluate the use of one tool in these conservation efforts—Candidate Conservation Agreements with Assurances (CCAAs)—in terms of its ability to address the challenge of private land conservation within the ESA, particularly when scientific information regarding the nature of species threats and the efficacy of conservation actions is contested. Drawing on the extensive literature on collaborative governance, best practices are identified for managing conflict involving contested information. These best practices are then used to

evaluate three programmatic CCAAs, with the goal of identifying key lessons to improve future efforts.

Literature Review

From its first implementation, the ESA has attracted considerable controversy—and unanticipated consequences for listed species—not least due to its impact on private landowners. Many landowners contend that the limitations placed on development by ESA regulations amount to an illegal "taking" of property by the Federal government under the Fifth Amendment. In particular, infamous cases such as the listing of the Northern spotted owl in the Pacific Northwest and the California gnatcatcher in southern California have led to intense political backlash. Candidate Conservation Agreements with Assurances (CCAAs) were developed as an alternative regulatory mechanism that could potentially reduce this backlash when implementing the ESA on private land by offering legal protection to landowners in exchange for taking specified conservation actions.

Considering the importance of private land for the conservation of endangered species, the ability of the ESA to serve as an effective conservation tool partially rests on the effectiveness of tools like CCAAs. This review gives a brief overview of the ESA and its difficulties with conserving species on private land, and then introduces CCAAs and their role in ESA implementation. Next, it addresses how collaborative governance has emerged as a tool for managing broad, landscape-level problems where the ESA has difficulty, specifically with regard to the interpretation and application of science and technical expertise. A “post-normal” perspective towards science is embedded in many collaborative models, and is explored for its

usefulness in assessing the interpretation and application of science in a context of contested values and high system uncertainty such as sage grouse conservation.

The ESA and Private Land

Section 9 vs. 5th Amendment

In the years since the ESA was passed in 1973, one of the most contentious political debates it has spawned is its relationship with the rights of private property owners. Specifically, there is concern among private property owners that its prohibitions on harming endangered wildlife and their protected habitat (Section 9 of the law) interfere with their 5th Amendment rights, which protect citizens from uncompensated property seizures by the government (Rolston, 1990; Scaccia, 2010). There is general agreement that the government has the power to regulate land use to serve the common good (based on its police powers, interpreted here as protecting the public from the harm of biodiversity loss), but to what extent the government may regulate private land is an on-going question (Rolston, 1990).

Perverse Incentives

Although the government may have the authority for regulating private land-use in the context of biodiversity conservation, the outcome of those regulations might lead to unanticipated consequences. Some argue that the ESA's regulatory approach acts to discourage private landowners from managing their land for conservation, as landowners perceive the presence of endangered species as an economic liability (Main, Roka, & Noss, 1999; Wilcove et al., 2004). List et al. (2006) demonstrated that development in potential endangered species habitat accelerates at each step of the ESA process due to landowner fears of penalty. Pre-emptive destruction of potential habitat, or preventing the creation of appropriate habitat, in light

of a species listing has been described anecdotally (Adler, 2011) and described in detail in the case of the red-cockaded woodpeckers in the forests of North Carolina (Lueck & Michael, 2003; Zhang, 2004). Survey results collected by Brook et al. (2003) regarding landowner responses to the listing of the Preble's meadow jumping mouse found that while some landowners may undertake conservation behaviors to protect the species, their efforts would likely be cancelled out by the negative actions taken by others.

ESA Implementation on Private Land

Although fear and anxiety over ESA enforcement on private land abounds, there is limited evidence that it happens very often. While anecdotes of specific enforcement actions exist, there is also indication that for some private landowners, the ESA is not a major factor in their land-use decisions, even when their property occurs within the habitat of endangered species (i.e. Raymond & Olive, 2008). Further, cases have been documented where residents had never heard of a local endangered species and were unaware its habitat might be found on their land, subjecting them to potential regulation (Brook et al., 2003). So while program options and implementation strategies are important, information and outreach about those efforts is also key to reaching the private landowners who might consider participating in conservation programs.

Candidate Conservation Agreements with Assurances (CCAAs)

Candidate Conservation Agreements with Assurances (CCAAs) are voluntary agreements that any non-Federal entity may reach with the FWS, in which a landowner agrees to undertake a set of conservation actions and monitoring efforts for a candidate species in exchange for regulatory relief if the species is eventually listed under the ESA (USFWS, 2013a). As such,

CCAAs are similar to "Safe Harbor Agreements" (USFWS, 2014) which offer similar assurances in exchange for conservation actions, but are different in that CCAAs apply to species that are not yet listed as threatened or endangered under the ESA. Conservation actions in CCAAs may include projects aimed at reducing habitat fragmentation, restoring degraded habitat, controlling invasive or competing species, and reducing disturbance impacts affecting the species. These actions under the terms of a particular CCAA result in the issuance of an Enhancement of Survival Permit by the FWS that prevents the permit holder from facing additional constraints under the ESA, as well as an incidental take permit that protects the permit holder from prosecution under the ESA for actions resulting from regular operations (USFWS, 2013a).

A Programmatic (or Umbrella) CCAA may also be developed, in which a state, local, or Tribal government or other entity enters into a CCAA agreement with the FWS and holds the associated permits, and then can enroll individual landowners within a particular area to participate through a "Certificate of Inclusion" (USFWS, 2013a). A Programmatic CCAA has the benefit of enrolling a wider number of participants without each having to go through the extensive and time-consuming process of creating an agreement.

When a candidate species occurs on both federal and non-federal land, a Candidate Conservation Agreement (CCA) may be developed between federal land management agencies (usually the Bureau of Land Management or the Forest Service) and the FWS to complement a non-federal CCAA. CCAs are similar to CCAAs in that they are voluntary conservation agreements, but they do not come with specified 'Assurances' offered by a CCAA in that no Enhancement of Survival or Incidental Take Permits are issued, because federal agencies are subject to Section 7 of the ESA, which holds them to a higher standard of protection under the "no jeopardy" clause. The goal of the CCA model is not to provide permits or assurances, but to

provide for the conservation of a candidate species so that it does not need to be protected under the ESA (FWS, 2016).

Existing Research on CCAAs

CCAAs in their current form first emerged as a tool for candidate species conservation in the mid-1990s. There was some concern at the time that these and other similar agreements would not stand up to legal challenge (Phelps, 1997), but the FWS has continued to offer and refine the program since that time with apparent success. Langpap (2004), in a study of CCAA participants, found that landowners who were younger, had more recently acquired their land, and who were interested in conservation were the most likely to participate in CCAAs and other incentive programs. Womack (2008) and Sorice et al. (2013) found that landowner participation is affected by factors such as perceived efficacy, trust in the agency managing the agreement, and the level of control they retain over management decisions.

CCAAs and Implementation

Scott (2004) comments that, although CCAAs (and other similar programs) may help to reduce conflict with private landowners, completing the agreement is often a lengthy and arduous process. If not well managed, this can lead to frustration as well as increased distrust as landowners navigate confusing agency policies and processes. Further, Wilhere (2009) observes that the time and expense required for completing the agreements means that most landowners will not participate in CCAAs or similar programs until their financial interests are under threat (i.e. due to an impending listing). He argues that this creates a Trainwreck Paradox, in which

CCAAs are argued to be necessary to avoid a listing, but in order to be effective, listings must occur to elicit participation from landowners in CCAAs (2009).

Taken together, these concerns may partially explain the relatively limited use of CCAAs in conservation planning, despite the promise they hold for private landowners. However, the use of CCAAs does appear to be growing, albeit slowly. Between 1999, when the FWS finalized the rules regarding CCAAs and made the provision of their regulatory assurances standard (J. Clark & Dalton, 1999), and 2008, 17 of the agreements had been put into effect; by 2013 that number had grown to 25 (Donlan, Gartner, Male, & Li, 2013; Womack, 2008). Currently, 34 CCAAs have been approved by the FWS, including the programmatic agreements discussed in this study (FWS, 2016).

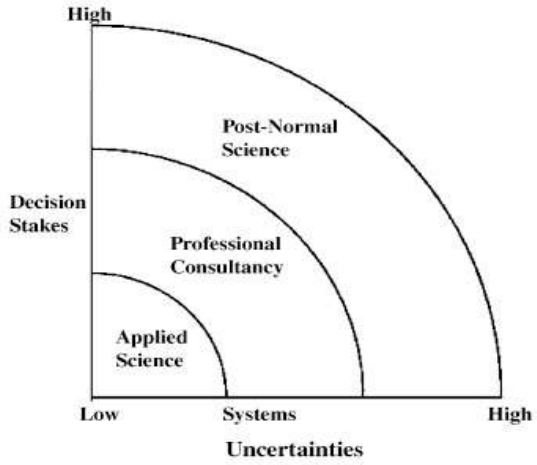
Wicked Problems, Collaborative Governance, and Post-Normal Science

The Greater sage grouse, its threats, and the conservation programs created to protect it demonstrate the challenges involved with addressing what are popularly termed "wicked problems" (Kettl, 2006; Ludwig, 2001; Rittel & Webber, 1973). Sage grouse conservation, like other wicked problems, involves multiple, conflicting sets of values and complex social and ecological issues that cross disciplinary and programmatic boundaries. The ESA was created under the paradigm of scientific management, in which science and professional expertise were the means to solving public problems. This paradigm founders on complex, broad-scale problems, which evade both objective definition and generally agreed-upon solutions (Rittel & Webber, 1973). In its place, collaborative governance and other cooperative models have emerged as an alternative way of managing such problems.

Collaborative governance offers an attempt to create consensus and cooperation among the various stakeholders, officials, and administrators involved in environmental conflict by building policy through participatory processes (Agranoff, 2006; Ansell & Gash, 2008). Collaborative governance models emphasize the importance of diverse perspectives and multiple sources of knowledge in dealing with complex social and ecological problems (Weber & Khademian, 2008), and are aligned with what has been called "post-normal science" (Funtowicz & Ravetz, 1993), "civic science" (Bäckstrand, 2003; Jasanoff, 1990, 2005), and a "stakeholder model" of science (Pielke, 2007), all suggesting a more fluid interface between science and policy/management than has traditionally been assumed in the past.

With the concept of "post-normal" science, Funtowicz and Ravetz argue that in areas of "normal" science, traditional problem-solving methods of applying technical expertise through science and engineering may be sufficient for addressing problems. But for many complex policy issues faced today (i.e. wicked problems), a "post-normal" science is required that addresses the high decision stakes and high system uncertainties involved in public management (see Figure 2) (1993).

Figure 2. Illustration of Post-Normal Science Compared to Applied Science and Professional Consultancy (Funtowicz & Ravetz, 1993, p. 745)



Such a post-normal science, subject as it is to these high decision stakes and high system uncertainties, requires what Funtowicz and Ravetz call an "extended peer community" of diverse stakeholders in order to effectively evaluate the quality and value of the scientific input (1993). According to the authors, this concept of an extended peer community has implications both for society (by increasing the democratic value by increasing participation in technical discussions) and science, by way of improving the quality and applicability of the knowledge that is generated. This expansion of legitimacy created through the extended peer communities, Funtowicz and Ravetz argue, is an entirely reasonable "next-step" in the development of scientific problem-solving originating with "core" or basic science and moving to professional consultancy in areas that require science applied to a specific problem (1993).

Given that technical expertise was the currency of traditional approaches to environmental policy, scientists and the public alike face challenges in bringing science and expanded participation together in a more effective and equitable manner. Weber and Khademian (2008) highlight that the sharing of information within collaborative networks may

be complicated by the different meanings, values, and uses that various stakeholders attach to that knowledge. They also emphasize that expertise can be diverse and varied, and efforts to seek information and understand environmental problems should not diminish practical local knowledge in favor of more formalized expertise. Practical knowledge, or rather the absence of it, after all is what some argue has stymied approaches to scientific management (J. C. Scott, 1998; E. P. Weber, 1998).

In the case of CCAAs, discussion over the nature of species threats and consideration of potential conservation actions could give ride to increased conflict if that discussion is not managed effectively. For the agreements to succeed, they must both achieve positive outcomes for species conservation and be attractive to the landowners involved, which in many cases is likely to be a delicate balancing act for all parties involved. As a result, it may be helpful to consider the "best practices" frequently observed in the collaborative governance literature regarding the importance of trust and relationships for such negotiations.

There is a sizable literature providing guidance for collaboration on the ground (i.e. (Agranoff, 2006; Daniels & Walker, 2001; Leach & Pelkey, 2001; Sabatier, Leach, Lubell, & Pelkey, 2005; E. Weber, 2013). The most consistent themes revolve around diverse representation, process transparency and fairness, and social trust and relationships. Transparent decision processes and clear ground rules are often critical, make it easier for participants to engage collaboratively by increasing trust and by providing a justification when pressed by others to explain their participation (Ostrom, 2007). Daniels and Walker (2001) place much of their focus on the process component through their analysis of collaborative learning and capacity building. They argue that if there is limited trust or ability among stakeholders to

promote deliberative practices, the collaborative process may crumble under the weight of tough decision-making.

Past experiences are also important. In a few cases, successful past experiences in cooperation and negotiation have created a "virtuous circle of collaboration" through expanded social capital that has facilitated collaborative relationships (Ansell & Gash, 2008). However, some cases involving enormous levels of past antipathy have been able to build from those experiences, but those cases often require large efforts to build trust, mutual understanding, and social capital to overcome the "vicious circle of suspicion, distrust, and stereotyping" that was created in past conflict (2008).

Regarding the use of scientific evidence, Weber (2013) argues that a broad knowledge base needs to be integrated with traditional technical expertise, and that stakeholders need to maintain a focus on real world, practical results (2013). As Weber and Khademian point out, such goals require the communication between diverse sets of stakeholders and the ability to communicate effectively is grounded in social and political relationships (2008). Daniels and Walker (2001) list joint learning and fact-finding as one of the key features of the collaborative approach to problem-solving, and suggest that such joint learning fosters increased cooperation. Emerson et al. (2012) call knowledge "the currency of collaboration," noting that collaboration requires the assembly and integration of existing information and data as well as the generation of shared knowledge with which to address the problem at hand. Among his ten lessons for public managers, Agranoff (2006) notes that collaborative agreements are "the products of a particular type of mutual learning and adjustment." As such, collaboration involves joint learning in pursuit of a brokered consensus on the nature of the problem and the appropriate action to take (2006). Further, he argues that the most distinctive activity he observed in a series of

collaborative groups was the efforts these groups made toward knowledge management. Knowledge management requires the integration of both formal and informal knowledge of a system through social interaction, which (2006).

CCAAs and Collaborative Governance

CCAAs do not always meet formal definitions of collaborative governance—some of the CCAA agreements involve only a few parties and may take the form of more simple contractual relationships between enrolling landowners and the administrative agency. However, they share a common root in expanded participation and negotiated decision-making. As a result, the literature documenting best practices and operational guidance for collaborative governance could be usefully applied to successfully developing and implementing CCAAs as well.

Research Goals

Considering the gulf that divides private property owners and conservation under the Endangered Species Act, this study seeks to explore three cases of CCAA development, in order to identify lessons that may be useful for future efforts. As they work within a relatively new and still uncommon program, participants in CCAA development efforts are often working from the ground up, while also departing widely from traditional management structures and roles. As a result, numerous roadblocks exist as participants seek to develop their agreements, which have the possibility of derailing or delaying progress. Specifically, this study focuses on the discussion of scientific evidence, its interpretation, and its application in negotiating CCAA agreements, as well as the relationships between agencies and stakeholders that frame those discussions. These discussions were the basis of frequent conflict in the cases presented here, and are an important

component in the use of CCAAs to improve opportunities for wildlife conservation on private lands.

There is little information available on how decisions were made in existing CCAAs, and how those decisions impacted the success of the agreement. Through case studies of the three states engaged in the development of programmatic CCAA for Greater sage grouse—Idaho, Oregon, and Wyoming—this study seeks to understand what lessons can be learned for the development of these programs as they attempt to bridge the divide between private property owners and the ESA. These lessons may be useful not only for the future use of CCAAs in addressing conservation of ESA candidate species, but in other types of "wicked" problems as well.

Methods

Case Selection

Of the eleven states with Greater Sage-Grousepopulations, three completed programmatic (i.e. "umbrella" agreements) CCAAs as a component of their statewide sage grouse planning efforts—Idaho, Oregon, and Wyoming. Each approached the development of a CCAA in different ways and experienced different outcomes, despite sharing a similar goal: improve sage grouse conservation and protect ranchers and other landowners from future regulation under the ESA. These are the cases selected for analysis in this study. This study does not address individual CCAAs that were developed independently of the programmatic efforts, nor does it address programmatic agreements that were in discussion but not completed at the time of this study—notably the long-standing effort by the Thunder Basin Prairie Ecosystem Association of

eastern Wyoming to create a CCAA that covers multiple area industries and multiple area species, including the sage grouse.

Idaho was the first state to begin efforts for a programmatic CCAA, which focused on the fragmented habitat and sage grouse populations in the West Central region, northwest of Boise. Its approach included a mix of local and state-led development, and although the CCAA was completed in 2009, no landowners have signed up to participate in the agreement to date. By contrast, in Oregon, stakeholders in Harney County followed a bottom-up approach to develop a CCAA, and this program soon spread. The Harney County model was ultimately adopted by each of eight Oregon counties with sage grouse as well as the Oregon Department of State Lands. Unlike in Idaho, a considerable number of landowners have enrolled—at least 53 landowners in Harney County alone have enrolled, with lands totaling about 320,000 acres of habitat ("Oregon Sage Grouse," 2016). In neighboring Malheur County, 55 landowners have enrolled, with an additional total 650,000 acres (Meyer, 2016).

Wyoming was the last of the three to complete a CCAA, largely following a top-down model of development through the state FWS office and leaders of industry associations. This model was followed after an earlier, failed effort by the state Office of Species Protection to create a larger CCAA that would accompany all of the industries affected by sage grouse management. To date, 43 landowners have enrolled with roughly 500,000 acres of habitat (Interview 45).

Sample Selection and Data Collection

With the aid of newspaper reports, government websites, and available planning documents, a case overview was developed for each case, and major actors were identified. A

panel of interview participants was then selected from each case based on their involvement and role in the CCAA and its development (i.e. agency staff, scientists, industry representatives, and other local officials). Additional participants were identified through the recommendations of existing interview participants. The goal was not to identify a random sample of participants, but to create a panel of those most active in each case as well as those who represent important stakeholder groups involved in the process.

A total of 35 interviews were conducted across the three cases—13 interviews in Idaho, 13 interviews in Oregon, and 9 interviews in Wyoming. In each case, interviews were conducted with stakeholders involved in or otherwise knowledgeable about the planning process for the relevant CCAA agreement, including ranchers, environmental organizations, state wildlife agencies, and federal agencies such as the FWS, NRCS, and the BLM. The breakdown among cases and participant identity is found in Table 4. Each interview lasted between 44 minutes to two hours and 45 minutes, with an average of 75 minutes. The semi-structured interviews (see Appendix A for interview protocol) covered topics such as the process involved in developing a CCAA, the role of science and technical expertise, and the nature and resolution of any conflicts that emerged. The interviews were recorded and analyzed in NVivo qualitative analysis software.

Table 4. Participants in Research Interviews in Idaho, Oregon, and Wyoming.

Case	Number of Participants
West Central, LWG (Idaho)	**15**
Environmental Group	1
Federal Agency	3
Rancher	2
Scientist/Consultant	6
State Agency	3
Harney County (Oregon)	**11**
Environmental Group	2
Federal Agency	2
Local Official	3
Rancher	2
Scientist/Consultant	2
State of Wyoming	**8**
Federal Agency	4
Local Official	1
Rancher	2
Scientist/Consultant	1
Total	**34**

Data Analysis

A codebook was developed based on the themes that emerged from participant responses regarding their experiences in CCAA development, as well as themes from the collaborative governance literature surrounding the use and application of scientific evidence and expertise (see Appendix B).

Collaboration and negotiated agreements involve complex processes, which can have a variety of political, social, and environmental outcomes—and assessment of all of these is beyond the scope of this analysis. In the context of this paper, the success of a CCAA is measured by the number of participating landowners and the total number of acres enrolled in the program. This measure of success, although not perfect or complete, is used to provide a structure for comparing which factors are important in gaining the trust and participation of the

private landowners to whom the CCAA program is aimed. Similarly, the topic of collaboration can encompass an enormous range of areas for discussion, many of which may be relevant to the discussion of scientific evidence and expertise. In order to provide a point of focus for this study, relationships among agencies and stakeholders were selected as the main theme emerging from participant reflections on their experiences in the development of CCAAs.

Study Limitations

Since the aim of this project is not to generalize to a larger population, it does not aim to achieve a representative sample of study participants. Instead, the goal is to identify some of the variation that occurs in how stakeholders respond to a new tool in wildlife management, and to identify lessons that can be applied in future cases. Although the individuals studied may not be representative of the broader population, the way that they respond to the process may be indicative of that experienced elsewhere, as CCAAs increase in number and spread. As examples of collaboration, the lessons learned from these cases of CCAA development may be applicable to other situations where agencies, affected industries, and other stakeholders find themselves working together to address complex problems in resource management.

Findings

Case Studies

Idaho

In Idaho, the West Central Local Working Group (LWG) had the benefit of substantial financial and logistical support from the Idaho Office of Species Protection and the Idaho

Department of Fish and Game. The Office of Species Protection hired a local forestry consultant, Joe Hinson, to lead the process, a move that was seen as ideal by some participants due to the consultant's family connections to the local ranching community (Interview 53). It was hoped that these connections would help bolster efforts to encourage participation among ranchers in the CCAA. Further encouragement was found in the participation of Royce Schwenkfelder, a leading rancher in the area who was enthusiastic about developing the agreement, as well as a popular local US Fish and Wildlife service employee. Planning meetings of the West Central LWG were initially well attended by ranchers, and participants expressed enthusiasm for the collaborative process (Interview 61). In time, however, some of the landowners felt that the process was being taken over by a variety of agency officials and participation declined; those remaining commented that they were outnumbered by agency representatives (Interview 61).

In what turned out to be a critical decision, the Local Working Group decided to begin work on the first Site Specific Plan (SSP) while they completed the overall programmatic CCAA. Schwenkfelder volunteered to be the "guinea pig," and work began. As both the CCAA and the SSP neared completion, financial resources began running low and the two of the consultants involved (Joe Hinson, the lead consultant and a second, Alan Sands working with Idaho Fish and Game and The Nature Conservancy) rushed to complete the agreements. In this rush, a series of drafts for the SSP were written, and the discussions regarding those drafts at various meetings led to confusion and miscommunication about what the final SSP should and should not include. The SSP went out for internal review with the Idaho and regional offices of the Fish and Wildlife Service, and then out for public comment. After this review period, the Fish and Wildlife Service decided to modify certain features of the agreement, including ones which the rancher involved had said he could not agree to (Interview 59, 54).

In the continuing rush to complete the agreements, Hinson (who was now working without pay since money had run out) reviewed the changes and did not consider them problematic enough to bring to the attention of Schwenkfelder (Interview 59). When Schwenkfelder discovered this, he felt that he could no longer trust the process, and walked away (Interview #54). Due to his influential role, other landowners that had been considering enrolling walked away as well (Interview 53, 61). Despite the CCAA being completed and signed in 2009, it remains without any enrolled landowners.

Oregon

The impetus for the creation of the Harney County CCAA resulted from the interest of several ranchers concerned about the impacts of a possible ESA listing on their operations, and curious about the benefit of the CCAA program offered by the FWS (Interview 3). Along with other local stakeholders and with the help of a local Oregon State University Extension agent, they formed the Harney County CCAA Steering Committee, with the aim to develop a programmatic CCAA for landowners in the county. The group spent several years developing such an agreement that was mutually acceptable to all, and legally defensible in the eye of the FWS. Key participants in this effort included local ranchers, Harney County officials, local Soil and Water Conservation District (SWCD) staff, and field representatives from various federal agencies such as FWS and NRCS.

Research done at the Eastern Oregon Agriculture Research Center (EOARC) in Burns played a key role in how the plan was approached and developed. In particular, the range ecologists at EOARC promoted the use of state-and-transition models as a tool to monitor and evaluate sage grouse habitat within the CCAA over the BLM's more standard Habitat

Assessment Framework. This led to some conflict and uncertainty, as it departed from the standard operations of FWS with its ecosystem-based approach to sage-grouse conservation. Similarly, FWS officials were hesitant to accept the proposal that the local SWCD act as the permit holder for the programmatic agreement—they had recently rejected a similar proposal in another state and worried about being perceived as playing favorites (Interview 7). Ultimately, the Steering Committee was able to convince FWS to accept the state-and-transition model approach and allow the SWCD to hold the permits, assisted by the support of FWS State Supervisor Paul Henson (Interview 5, 10).

Later, as the September 2015 listing decision drew nearer, the Steering Committee decided that they had something to offer other stakeholders preparing for a possible ESA listing. Committee members got involved both in Oregon's statewide sage grouse planning process as well as in an effort led by the Oregon Cattlemen's Association to develop a Candidate Conservation Agreement (CCA) for grazing allotments administered by the BLM. Ultimately, these efforts were well-received, as the model they developed for the Harney County CCAA became the basis for the Cattleman's CCA on federal lands as well as the CCAAs developed by seven other Oregon counties with sage grouse and the Oregon Department of State Lands (DSL).

Wyoming

In Wyoming, with an economy largely dependent on oil and gas, sage grouse efforts in the state mostly focused on mitigating the impacts from that industry. After the failed initial effort by the state to develop a CCAA that covered multiple industries, including oil and gas, the effort was handed over to the Wyoming FWS office, which redirected the effort to focus on the grazing industry (Albert, 2013). The renewed CCAA effort in Wyoming began in 2009, and

involved multiple agencies as well as the Wyoming Stock Growers Association and the Wyoming Wool Growers Association. The effort, led by the FWS office in Cheyenne, brought representatives of these groups together for regular meetings over the course of several years. They worked to develop a suite of conservation actions that would most effectively avoid and minimize threats to sage grouse based on available science with the assistance of Pat Deibert, the FWS' range-wide Sage Grouse Coordinator, who was based in Cheyenne.

Once the agreements were drafted, the FWS worked with the Stock Growers Association to hold a series of workshops across the state in order to get the word out about the agreements and to collect input from the concerned stakeholders. In terms of the general public, input was limited largely to the formal NEPA (National Environmental Policy Act) process for the agreement. In general, reception of the CCAA was perceived to be largely noncontroversial, as few submitted formal comments. Beyond the opportunity for conservation on private land provided by the CCAA program, an associated Candidate Conservation Agreement (CCA) for public land was developed in order to accommodate landowners who grazed on both private land and public allotments and who wanted their conservation efforts for sage grouse to be documented and noted.

Although only about 40-45 landowners have enrolled in the program, the Wyoming FWS office sees the program as a success, not only because a considerable amount of land is involved (roughly a half million acres of private land and about 1 million acres of public land has been covered under the CCAA), but also because it demonstrates that they were able to achieve buy-in from of a number of private landowners.

Since the completion of the grazing CCAA, the FWS has moved on to focus on a CCAA in development with the Thunder Basin Grasslands Prairie Ecosystem Association, which would

function as a holistic agreement in the Thunder Basin region—bringing in participation by multiple industries including grazing, oil and gas, and mining, and covering multiple species. This CCAA has been in development for almost ten years, complicated by its inclusion of multiple industries within a specific geographic zone in eastern Wyoming.

Threats and Conservation Actions/Monitoring

Once a CCAA planning process begins, the largest tasks for those involved is to build agreement on the nature of the threats affecting the species, identify appropriate and effective conservation actions, and to agree on a monitoring plan. This forms the "meat" of CCAA, and the nature and tone of these discussions may have considerable impacts on the success of the eventual agreement.

Wildfire and Invasive Species

The two primary threats to sage grouse populations, most participants in all three states agreed, are wildfire and invasive annual grass species such as cheatgrass and medusahead. Together, these two threats reinforce each other, ultimately leading to widespread, systemic changes in the landscape. However, aside from invasive species control efforts and fire suppression strategies, these landscape-level threats are difficult to fully address on individual properties. When Dr. Steve Knick, a USGS sage grouse expert in Idaho, was asked about the biggest challenge facing conservation efforts, he pointed to the difficulty maintaining sagebrush in a state that is needed by sage grouse and other sagebrush obligate species. "*We don't know how to deal with issues of wildfire and sagebrush, like the Soda Creek fire [a 2015 Idaho wildfire]—"and I don't know that we have control over it*" (Interview 56) Although wildfire and

invasive species continue to be the most complex issue scientifically speaking, they are also ones that impact both sage grouse and ranch operations. As such, the conservation actions like cheatgrass eradication, reseeding of native grasses, or juniper removal were generally uncontroversial—implementing them would often benefit landowners as well as sage grouse.

With two of the primary threats facing sage grouse being generally accepted, many discussions in the CCAA planning efforts focused on other (but often related) threats, such as overgrazing, predation, and expanded development. That being said, given that wildfire and invasive species often threaten ranchers' viability as well, sometimes these have provided a useful synergy between conservation and economic interests.

West Nile Virus

In the West Central area of Idaho, West Nile came up as a concern due to the area's generally wetter conditions compared to most areas with sage grouse, thus making it more susceptible to the mosquito-vectored disease. The West Central CCAA observes that West Nile Virus had been observed in the area, and notes that at least two dead sage grouse tested positive for the virus (Northwest Natural Resource Group, LLC, 2010). Due to the small and isolated nature of the West Central sage grouse population, the impacts of an outbreak of West Nile could be devastating to the population.

West Nile virus was a big thing in the West Central area, said Joe Hinson—"*There were a couple of years where we didn't have any magpies*" (Interview 59). Biological consultant Alan Sands also noted the impact of the virus on the local sage grouse population. "*The West Central area has more moisture than most sage grouse habitat, which is probably why that population was so badly hurt by West Nile,*" he commented (Interview 53). There was a lot of concern about

creating mosquito habitat when developing the plan, especially when it came to stock tanks, but this was largely avoided from due to rancher resistance, he said. Still, some ranchers were also concerned about the impacts of West Nile. "*In our entire area, there haven't been any new farming practices, no new chemicals, nothing has changed in operation that would impact the sage grouse, yet they disappeared,*" observed area rancher Steve Sutton (Interview 61). He thinks West Nile was the culprit. "*I don't know all the scientific facts, but they were just there forever and then they were gone,*" he said.

Grazing

Since the CCAAs discussed here largely address private lands managed for grazing, it is not surprising that grazing practices and ranch management were common topics of discussion. Ranchers bristled at the idea that grazing in and of itself was a threat to sage grouse, and argued that history and past experience showed that sage grouse and cattle could coexist. Further, they maintained that grazing could be used as a tool to minimize the larger threats of wildfire and invasive annuals.

According to Royce Schwenkfelder, the common public perspective says that grazing is a threat to sage grouse, which he argued is problematic when you have a high degree of private ownership in some areas of sage grouse habitat and need landowner buy-in for conservation to succeed. Further, he held that grazing can also be used to help address invasive species and wildfire if you can keep ranchers involved (Interview 54). Another West Central rancher, Steve Sutton, concurred, "*If you had a [ruler], we had a ten inch problem in the middle that was West Nile, and we were nibbling off the inch at either end with grazing rotations, etc. and things that didn't make a huge difference in the survival of the bird.*" Sutton felt that since federal agencies

had no control over West Nile virus, they were relying on ranchers to change the things that could be controlled, even if they were largely ineffective (Interview 61).

The ranchers were not the only ones who felt this way. USGS scientist Steve Knick has seen the grazing conversation go both ways, and has himself faced criticism when he expressed what some considered to be a defense of grazing. From his perspective, grazing could easily play on both sides of the sage grouse question. He noted that in some cases, grazing can suppress the spread of invasives, but in others overgrazing leads to negative impacts on the system. This is made more difficult, Knick points out, because conditions and impacts can vary at the level of individual grazing allotments (Interview 56).

The FWS official leading the Wyoming CCAA effort also agreed that the anti-grazing narrative was unfair when it came to sage grouse, and that managers and other stakeholders needed to be clear that they did not incorrectly characterize grazing:

> *Grazing per se is not a threat—it's mismanagement of grazing that's a threat—and that's what the best available science tells us. Landscape wide, grazing has been an important part of the ecosystem . . . but intensified, localized grazing was not part of that ecosystem, and that's what this is about. (Interview 45)*

And ideally, the CCAA should be a tool for encouraging better grazing practices on the ground, he said. The official described his agency's approach to grazing "*we worked through that very carefully and honestly . . . and again, we got to a point, where all of our partners said they could live with it in the end*" (Interview 45).

In Oregon, FWS Supervisor Paul Henson argued that ranching needed to be acknowledged as a long-term presence in the region, and for ranchers to be engaged with directly on conservation plans (Interview 21). This was not only due to that long-term presence, but because effective sage grouse conservation depends on volunteer actions to protect summer

brood-rearing habitat, which is predominantly found on private lands. Henson points to a 2014 memo he sent to Oregon FWS employees explaining and affirming this stance (Henson, 2014). In this memo, he acknowledges both positive and negative effects of grazing on grouse species documented in the scientific literature, and notes that there is disagreement within that literature regarding the relative magnitude of those effects.

This complexity forms the basis of Oregon FWS decisions, Henson explained, but those decisions are also informed by other factors important to sage grouse as well as healthy grazing and intact rural communities—including the provision of quality habitat, local knowledge, services and infrastructure, and positive working relationships with landowners that foster long term conservation (2014). He pointed to research documenting the tendency of landowners to see ESA-related species as a legal liability, which may prevent them from working collaboratively with the FWS despite having strong personal stewardship ethics—with serious implications for conservation. As a result, according to Henson, "*maintaining healthy, viable, locally managed private rangelands and ranching operations is integral to achieving sage-grouse conservation in Oregon. . .* " (2014).

Henson's findings encouraged him to be very supportive of the CCAA efforts in Harney County, and according to some stakeholders, provide the flexibility and the political cover for the local FWS staff to move forward in developing the agreements (Interview 5). Not everyone appreciated this approach, including environmental groups in the state who argued that grazing was receiving too much of a pass in terms of its impacts on sage grouse, a move they argued was based in political expedience rather than what science said was good for the bird. Although the CCAA would likely have some benefit, there was concern about the precedent and long-term implications of relying on voluntary agreements for conservation outcomes (Interview 2, 14).

Predation

One area of discussion that was observed to be one of the most persistent and occasionally heated areas of disagreement in all three states was the impact of predation on sage grouse populations, and the role that predator control might have in sage grouse conservation. According to Joe Hinson, in the West Central LWG:

> *That's where ranchers feel like nobody's listening to them. They're out there seeing this stuff, and I agree with them. Ravens are intense predators, and there's a lot of them. Well, for the biologists, that just flies in the face of biology, where they evolved together, so they should be getting along, more or less. . . . I think that's a huge factor, and that the scientific world overlooks it, or chooses to ignore it.*

Hinson also observed that when something dies on a ranch, "*you drag it out somewhere and let nature take its course,*" a practice that, along with increased development and habitat fragmentation, has been subsidizing populations of sage grouse predators like ravens. He noted that a few ranchers had privately conceded that point, but that it was not something that would be brought up in management discussions—possibly because alternatives like burying the carcasses are expensive and time-consuming (Interview 59).

While some managers and scientists expressed considerable frustration with some of the ranchers' focus of on predation, a few were more receptive. Chad Boyd, a range ecologist at EOARC, grew up on a ranch in Texas where most of the predators had been removed. He has seen the consequences of overzealous predator control—stunted, starving deer and devastated native plant communities. However, he has also observed that the heated politics surrounding potential control actions have affected the ability to discuss management options:

> *I'm not big on predator control. But at the same time, when I'm driving down the highway and I see all these corvids, I know what the effects of corvids are. I know*

> *that they eat sage grouse chicks, and I can't help but wonder—if we could take the politics out of the predator control situation, what would we be doing, from a management standpoint? And I think it would be something very different from what we're doing now. . . . It's difficult for me to imagine how they're not having a significant impact on sage grouse populations [given the numbers] . . . but frankly that debate will take away from things that* ***we can do*** *politically, like CCAAs [emphasis original]. So you have to figure out which basket you want to put your eggs into. (Interview 5)*

State Supervisor Paul Henson for the Oregon FWS similarly acknowledged that predators were likely having some impact on sage grouse populations. He emphasized, though, that humans "subsidies" that have allowed predator populations to increase. In his career, particularly during past work in Hawaii, he has done lots of predator management, and although it is a tool he is willing to use, he cautions that it is not the answer to sage grouse that some people want it to be (Interview 21).

Jay Kerby, the Southeast Oregon project manager for The Nature Conservancy, agreed that the issue of predators was the biggest challenge in the CCAA planning process:

> *Predators! Here's where there was a lot of disagreement about the science, with competing scientific evidence that folks would cling to dependent on their perspective. But there's no doubt there's been a big increase in the numbers of predators, and that predation can account for up to half of chick mortality—so is predator control a tool to consider for management? And that fits right in with the ranching perspective, when they are used to seeing adverse impacts from predators as a problem.*
>
> *But an increase in predator numbers is a symptom of a larger problem of an altered ecosystem, not the problem itself. If we cull crows and ravens, there's just going to be more where those came from, and you can cull predators forever and not really address the underlying problem. With the CCAAs, we spent a staggering amount of time arguing about this.*
>
> *So you end up saying, okay, predator control can be considered as a management tool, but only in specific, limited circumstances within a narrow timeframe—not as an on-going management program. [We] didn't get to real agreement, but maybe a bit of a 'white flag' ceasefire situation. But we had to get through that to move forward. (Interview 6)*

All three efforts ultimately agreed that predation impacts and predator control needed to be discussed and opinions needed to be aired in order to move forward with the planning process. As EOARC's Chad Boyd said, "*I've talked to some ranchers—you can't really talk to them until you've heard their predator spiel. And I don't mean that in a negative way*" (Interview 5). From this vantage point, trying to quickly gloss over the concerns that ranchers expressed about the relative impacts of predation versus grazing was counter-productive—it was an immediate test of how much agencies and other stakeholders were willing to listen and consider the ranching community's perspective.

The Wyoming FWS official agreed that predation was an issue that pitted worldviews against each other:

> *The best available science says, on a localized scale it may be important—but range-wide it does not appear to be the main threat. It's the infrastructure associated with development that tends to attract more predators. The lack of clear scientific answers makes predation a point of controversy—it would be great to be able to say something more definitive about the impacts of coyotes and ravens, but there just haven't been a lot of good scientific studies that can speak to that issue. So that tends to be something that people talk about from their own gut feeling, whether you're a rancher or an environmentalist.*

As a result, the official referenced multiple difficult conversations with representatives of landowners and the grazing industry. He summarized his general response as saying, —"*We hear what you're saying, but that's not what the best available science tells us. That being said, on a localized scale, we can work with you . . . .*" At the end of the day, he commented, they didn't agree with each other, but ranchers understood the Service's perspective. They were not happy with the answer, but could accept it as fair (Interview 45). The perspective from Jim Magagna, of the Wyoming Stock Growers Association, was slightly different. "*They steadfastly refused*" to consider predation as a threat, he said of FWS. Eventually, the response they settled with after

discussions was FWS acknowledging the threat, but that the lack of science precluded emphasis in the CCAA. Magagna said WYSGA did not agree, but "*we knew we weren't going to get anywhere with it*," and did not see it as a reason to not support the CCAAs as one tool that was available to landowners (Interview 47).

Conservation Actions

> *The other thing that's interesting about sage grouse is you can't make sage grouse habitat. You can preserve it, but what's out there is all that's out there. That's very different from say, pheasants . . . there's not a rancher around who doesn't know how to make habitat better for pheasants . . . . [Sage grouse] are landscape-based . . . they're like grizzly bears. (Interview 59)*

Once the threats to sage grouse had been established, the discussions moved to what could be done about them on a voluntary basis, in exchange for the regulatory relief provided by the CCAA. The landscape needs of the sage grouse have made designing conservation actions difficult to conceptualize and to put into place. The measures begin with simple ranch changes like placing ramps in watering tubs (so that grouse can escape if they fall in) and marking fences (to prevent the birds from flying into them and getting caught in the wire). They also include altered grazing schedules, removal of invasive or encroaching species, and avoiding infrastructure development. This is where the most difficult conversations happened in all three cases, and where trust and relationships became critical for keeping landowners on board.

Royce Schwenkfelder, from the West Central LWG, illustrated his frustration about these discussions:

> *So how do we address grazing for sage grouse?*
> *'Maybe avoid spring grazing'—but then, what do you feed the cow?*
> *'When sage grouse are nesting, they need to hide from predators'—can we do something about the predators?*

'No, they're protected. Instead, you've got to keep a 7-inch stubble height to reduce loss to predators.'
So those affect you as a grazer . . . are [the conservation actions] scientifically proven? No. (Interview54)

This illustration shines light on one feature that is persistent in sage grouse planning—uncertainty about the likely results and efficacy of conservation actions. Some of the proposed actions, like fence marking, are based on limited observation and research, meaning solid answers about their efficacy are nearly impossible, and occasionally depending only on the judgement of sage grouse experts. For ranchers balancing the economic viability of their business with sage grouse conservation, this can seem like agency officials are coming up with plans based largely on opinion. As Schwenkfelder put it:

'[The expert] says XYZ' . . . well, should we do that?
'No activity before 9am, and you have to flag your fences.'
Okay, is it going to help?
'We think so, maybe . . . .'
We accept the idea that these guys are smart, but a lot of this stuff has never been peer-reviewed. It's just what [the expert] thinks, and you can't argue with [the expert]. (Interview 54)

1. *7 Inch Stubble Height*

The '7-inch stubble height' points to the most pervasive point of frustration expressed by stakeholders in all three of the cases studied. Stubble height is a measure of residual vegetation left over after a grazing period has ended. When the topic was brought up, it pointed to a range of confusion and miscommunication that varied widely across CCAA/CCA stakeholders. In Oregon, rancher Tom Sharp suggested that range-wide metrics such as a stubble height requirement were a troubling proposition:

This region here, in southeastern Oregon…we're high desert. We might get ten inches of precipitation per year, if we're lucky. Metrics that represent the stubble height that is representative of what's going on in our landscape may be different

> *than the achievable metrics in Wyoming. Or Colorado, or Idaho, or Nevada. (Interview 3)*

John O'Keeffe, President of The Oregon Cattleman's Association and a rancher from Lake County, has worked to develop Candidate Conservation Agreement (CCA) covering public grazing allotments with the BLM. He agrees that the stubble height requirement was a concern, and worried that it could be used inappropriately in a way that was counterproductive for sage grouse conservation as well as ranch productivity:

> *The BLM has bought off pretty heavily on the Habitat Assessment Framework, which the bulk of that work was done in more productive country than this part of the Great Basin. You don't get the type of vegetation that they got where they did that work. And the BLM recognizes it, but they still put that in there as how they want to manage.*
>
> *If they want to manage in a fashion that those types of attributes can exist and we can move towards those attributes, you know, we can probably go out there and do some good things. If they go out there and say, we don't have 7 inches today, so we're going to use less livestock out here—they're going to increase the fire risk, and they're going to have less tools to work with the annual invasives and the juniper, and ultimately they're going to lose ground. (Interview 4)*

In Wyoming, ranchers similarly worried about the implications of agencies using the idea of 7-inch stubble height as a metric for sage grouse impacts. According to the WYSGA's Jim Magagna, this was not discussed much during the development of the CCAA, but noted that this was largely the basis for WYSGA's on-going lawsuit against the BLM and Forest Service over their revised management plans. Like O'Keeffe in Oregon, Magagna argued that this level of residual plant growth is not generally achievable in a lot of Wyoming (Interview 47).

Joe Hinson, the West Central consultant, explained that there was actually no stubble height requirement in the West Central CCAA, despite the complaints of the ranchers involved.

He recalled how the stubble height issue seemed to develop among ranchers involved with the plan's development:

> *At the end, it was painfully clear when I did sit down and write [the plan], the ranchers didn't read it. My brother in law didn't read it. They would take somebody's thought about what might be in it, and pass it along as pure gospel. They swore up and down that the guidelines required a 7-inch stubble height. Nowhere does it say that. It says that there should be 7-inches during the nesting season. For some reason, people interpreted that as at the end of the grazing season. As some people pointed out, sometimes they don't even get 7-inches of growth. It was completely false, it was never in there like that. Not a week would go by . . . that used to drive me absolutely crazy. It was fixed in their heads and you couldn't get it out. (Interview 59)*

When asked about the concern among ranchers regarding the stubble height metric, two of the sage grouse experts interviewed largely concurred with Hinson. USGS biologist Steve Knick responded simply, "*that's the difference between a guideline and a rule . . . . The important feature is the nesting cover. If you have that, you have sage grouse*" (Interview 56) suggesting that what the ranchers and some agency personnel got wrong was that the 7-inch stubble height was not a requirement, but a recommendation and a goal to strive for—similar to what rancher John O'Keeffe argued for in the BLM's implementation.

Jack Connelly, another sage grouse expert, recently retired biologist from Idaho Fish and Game Department, was quick to correct the assertion that any of the guidelines even recommended a 7-inch stubble height, and that agencies needed to get the story straight in order to prevent alienating landowners.

> *It's not stubble height, which is left over after cattle are done grazing at the end of the season, the requirement is for a 7-inch herbaceous layer in late May during the breeding season. If you look closely, it's in the Idaho [state sage grouse plan], and to my knowledge it's the only state plan where the ranchers put it in there. There's discussion and confusion over that all the time. There's confusions in the federal agencies over what that 7 inches represents . . . it's an educational process. What it reflects is the average height in breeding habitat in late May and*

in early June. The measurements were made in lots of different places, and it's held up. (Interview 60)

It is not clear how much of the conflict over the 7-inch stubble height results from misinterpretation by ranchers and other stakeholders or by agency staff and officials. However, the perspectives toward the subject expressed by ranchers and by the scientists who contributed to this or similar work appear to be quite similar.

2. *Infrastructure Development and Fair Share*

In the West Central, a sticking point emerged based on the historical development of the region. Compared to the rest of Idaho, there is a lot of private ownership—62% according Royce Schwenkfelder—and an agricultural history that lead to widespread changes in the original habitat (Interview 54). As a result, there is little high quality habitat available for sage grouse, and the population that persists is small and largely isolated from others further to the south. Those habitat and population factors make sage grouse conservation in the West Central difficult to manage, and ultimately influenced the failure of the West Central CCAA.

Steve Leonard, a range consultant for the West Central CCAA, pointed to the "fair share" model, which was aimed at addressing the threat of future development and the lack of high quality sage grouse habitat, as the factor that caused the effort to break down completely (Interview 48). The model, which is based on the size of a ranch's operation, was intended to provide an "*objective minimum standard for habitat restoration*" (Northwest Natural Resource Group, LLC, 2010) which would ensure maintenance of the West Central sage grouse population. By assessing the total amount of potential habitat on a ranch and then multiplying that by anticipated losses of habitat in the West Central from wildfire and rural development, a "fair share" is calculated for each property. This is the amount of habitat that a landowner must

agree to restore to native sage cover in order compensate for those habitat losses and to qualify for enrollment in the CCAA (Northwest Natural Resource Group, LLC, 2010). "*That was one of the final straws, and I don't know of any scientific basis for that,*" explained Leonard. But, he said, the FWS was intent on it being part of the plan (Interview 48).

If the fair share model had Schwenkfelder on edge, then the topic of infrastructure development such as wind turbines and cell towers kicked him right over it. The possibility of infrastructure development had been a topic of concern during the negotiation of the plan. The FWS representatives wanted the agreement to limit the potential for wind power development that might disturb sage grouse, and Joe Hinson explained his perspective,

> *They don't have wind power, and there's not a lot of potential for wind power . . . how can it be a threat [to sage grouse] if we've never had it? All you're doing really is foreclosing a potential opportunity without justification. So there were fights over that. It was not a smooth process. (Interview 59)*

Eventually, it had been decided to drop the wind power component from the agreement, but as with the Fair Share requirement, it was added back in after internal and public review. Hinson summarized the process:

> *At finalization of agreement, there were a few very serious mistakes that were made . . . . And I blame myself for that. We were out of money, and [the FWS] was working on it. There were a few changes between the last draft that anyone saw and the final that was adopted. . . . That damn windmill language got put back in, and [the FWS] added the fair-share component. (Interview 59)*

In a decision he later regretted, Hinson decided not to interrupt the process in order to review the changes with the landowner, and the changes remained in the final plan (Interview 59). When he later saw the final plan, Schwenkfelder commented that he needed to comb through the document line by line in order to catch the changes. And when he found out about them, and that Hinson had known about them, he was angry. He exclaimed, "*And he's the guy*

I'm supposed to trust on this?!" He had argued that having the option to host wind or cell towers on his land was a necessary option to maintain the economic potential for his property, and that a thirty year commitment to not do so was asking too much. "*I've got to make sure my kids don't shoot me for [signing on to the agreement],*" he explained. And seemingly, the agencies had agreed and removed the prohibition—but it was back again (Interview 54).

"*The trust exploded . . . [it] just destroyed the whole effort,*" lamented Sands, the biological consultant. Sands noted that Hinson was unable to manage the backlash from the incident, or to keep other ranchers from following Schwenkfelder's lead (Interview 53). For Schwenkfelder, the event was evidence that those involved in planning the CCAA could not be trusted to work for the best interests of his operation or those of other local ranchers. He worried that if he signed onto the agreement, others would follow his lead and then blame him if they found themselves in trouble. The CCAAs "*had the endorsement of my name,*" which was not an idea that he took lightly (Interview 54). Looking back after the fact, Joe Hinson lamented that the effort "*was a huge and colossal failure.*" "*In a few years, I'll be out of therapy,*" he joked. And in the end, "*I can't argue against the ranchers on this . . . but it was hard when you work several years on something and have it come to nothing. When push comes to shove, I think the ranchers were right*" (Interview 59)

Habitat Assessment Framework and State-and-Transition Models

The topic of grazing in discussions of the Harney County CCAA Steering Committee took place largely in the context of what perspective and mode of analysis should be used to evaluate habitat and monitor grazing impacts. A key development in the Committee's approach to the CCAA's development is what Tom Sharp, Marty Suter-Goold, and others specifically

called "the Chad question," after EOARC ecologist Chad Boyd—"*Do we have a species problem or an ecosystem problem?*" (Interview 3, 5, 6, 10) This was a question the group spent a sizable amount of time considering, and which eventually formed the backbone of the plan's novel, ecosystem-based approach.

At the same time, in an effort to develop a range-wide method for data collection and assessment regarding sage grouse habitat, the BLM adopted the Habitat Assessment Framework (HAF), which was being adopted as the monitoring tool of choice in many programs, including CCAAs. There was resistance to this methodology among the ranchers that were interviewed as well as several other Harney County interview participants. From this perspective, this range-wide "one-size-fits-all" approach to habitat assessment fundamentally mischaracterized the nature of high desert grouse habitat.

Of particular concern was the perceived requirement for stubble height necessary to maintain grouse habitat discussed earlier. Participants questioned the wisdom of requiring such a fine-grained monitoring assessment for grazing land, when even improper grazing was considered to be only a secondary threat to ecosystemic threats like wildfire and invasive species. Tom Sharp, a rancher and member of the Harney County Steering Committee explained his perspective:

> *"What we found . . . is that nationally-devised metrics, such as HAF . . . are going to differ by region of the country. One size doesn't fit all. And there was, and is, a desire by the BLM nationally, to simplify their lives, by having one set of standards that is representative of the 11 states of sage grouse habitat in the West. This region here, in southeastern Oregon . . . we're high desert. We might get ten inches of precipitation per year, if we're lucky. . . .*
>
> *This goes back to what the best available science is—I think it is the science that is germane and relevant to the regional situation that you are considering. . . . And that we're not so quick to think that we can make our lives simpler by having one national metric that applies to all regions in the habitat area of consideration.*

> *That's what made the sage grouse such a complex issue, is because it just encompasses so big of a geographic area—11 states. It's not a homogeneous landscape to consider, but we have to think of that 11 state landscape and identify different geographic regions and what is possible to achieve in each of those regions based on the local circumstances" (Interview 3)*

In Harney County, these issues were addressed by the CCAA Steering Committee, and after a year of discussion resulted in the adoption of a state-and-transition model (STM) methodology for habitat assessment. Chad Boyd, the rangeland ecologist at the EOARC, is a proponent of the more systemic approach to sage grouse management presented by STM than he claims is found in the HAF. Boyd said that compared to some places, Oregon does not have a sage grouse problem—it has an ecosystem problem that impacts sage grouse, and of which sage grouse declines are only a symptom. And to successfully manage the landscape over the long term, Boyd argued, you need to deal with it as an ecosystem, not as a habitat for a single species like the sage grouse the way the HAF model does. That way, the model can be easily adapted when future needs and information change (Interview 5).

Boyd illustrated his point with a series of photographs from one of his academic papers that encompass a state-and-transition model. Pointing out the differences between so-called "good habitat" and more damaged habitats, Boyd argued that a focus on herbaceous plants (such as in the HAF) is misplaced, because they are a fundamentally ephemeral component of the system, and it is difficult to tie their presence to specific management treatments. Instead, Boyd suggests that the focus should be on sagebrush itself, as well as the perennial bunch grasses that are in danger of being crowded out by invasives, which can then threaten the sagebrush. By concluding that sagebrush is the key rather than herbaceous plants, according to Boyd, you can effectively remove grazing from the conversation—it is just not that important from an

ecological perspective. Instead, by focusing on what is more important—the invasion of annual grasses, to the detriment of both sage grouse and cattle—you can bring unlikely supporters to the table.

Boyd argued that in the end, an ecologically-based approach to landscape management is what is going to save sage grouse populations when they are faced with ecosystem problems. Some places, he pointed out, have sage grouse problems, which regulation can fix—like the placement of oil wells, which is much more of an issue in the Rocky Mountain states like Wyoming. There, you can impose a regulatory approach to management. "*But we don't have those here—we have an ecosystem in transition, and it's a transition that we would prefer to avoid. So we need to deal with the ecosystem ecologically, not one species at a time*" (Interview 5).

Jay Kerby from The Nature Conservancy, who worked with Boyd on the STM approach, agreed. When it comes to grazing and the conservation of sage grouse, "*that conversation was a dead-end road*" if it was approached the wrong way. From his perspective, the state-and-transition models that were developed are rooted in science just as much as the HAF, which was used in the West Central CCAA, but are a much better communication tool. By framing the problem through a comparison of overall plant communities instead of detailed habitat measurements, the conversation was easier to have with the ranchers. He explained:

> *'More State A, manage away from State C' makes intuitive sense and isn't as confrontational as arguing about whether grazing is good or bad. More or less, the State-and-Transition models offer a slightly different interpretation of what the problem is and how to address it.*

As Kerby points out, the region is facing a "*wholesale change of the ecosystem,*" so it is not about measuring subtle grouse habitat parameters. Kerby offered a "Chad" example

regarding a house party to illustrate the difference in approaches: say you want to have a house party, but there's two problems preventing that—one is that your couch is in the wrong place, and you need to rearrange the furniture. The other is that your house is on fire. "*Both are problems—but one needs to be addressed first*" (Interview 6).

While the ecosystem approach to sage grouse conservation championed by Boyd and Kerby was well-regarded by the Harney County CCAA Steering Committee, the FWS was more skeptical. "*While it may be based in perfectly good science,*" commented one FWS official, "*in the end it is a sage grouse plan, after all*" (Interview 7). The ESA is limited by the species-centric approach to conservation written into the legislation, and the FWS was concerned that the novel ecosystem approach promoted by Boyd and Kerby would not be legally defensible in the event of a legal challenge. Even for this official, well-versed in collaborative management and community engagement, there was a clear concern about the reality of ESA politics and the likelihood of future of lawsuits.

Stakeholder Relationships and Trust

The CCAA model requires a reconfiguration of the relationship between the public agencies and stakeholders involved, as well as the ability to build and remain trust. In all three cases, the long-standing distrust of federal agencies, and of the Fish and Wildlife Service in particular, was a consistent theme for many participants. Since the creation of the ESA, the Fish and Wildlife Service (FWS) has been seen as a regulatory entity to be either feared or ignored rather than as a local partner in wildlife management. While many landowners are familiar with their local BLM or NRCS office, most do not have a personal connection with the FWS. The CCAA model pushes for more of a direct relationship between the agency and landowners,

whether the landowner is participating in a stand-alone private agreement with the FWS, or is enrolling in a programmatic agreement, since they must still develop a site-specific plan. According to the Wyoming CCAA official, the biggest challenge in the CCAA process was gaining the trust of local landowners and convincing them to participate—

> *FWS is not viewed favorably, necessarily, by the agricultural industry, and the stock growers, because our mission really is very conservation focused. So gaining the trust of those people, and getting their representatives to sit down with us in an honest effort to try to create a document that was actually something that landowners would want to sign onto, and they would have confidence enough in us that it would be implemented fairly, and that there would actually be a real benefit to them . . . that was the biggest challenge. (Interview 45)*

Given the challenge that this role change created for the FWS, the involvement of agency staff that already had strong ties and good working relationships with the local community was very important when encouraging landowners to participate in the CCAA. Bringing in other trusted institutions, like NRCS, SWCDs, and EOARC also contributed to positive outcomes. In both the West Central and the Harney County processes, the presence of such relationships, and the trust they were able to create, were factors identified by local stakeholders for their willingness to give the FWS a chance on the plans, despite their uncertainty about the agency itself.

West Central, Idaho

For the West Central LWG, one of the FWS biologists was seen was someone who understood the local community, and who they could work with. *"[The biologist] was the best one for [the LWG] to work with, [they] came from a ranch family—wore cowboy hats and shoes. They liked them,*" explained Joe Hinson. However, Hinson said that the biologist received criticism from the Service for being "*too close to the ranchers*" (Interview 59). When asked

about the role science and scientists played in the process, rancher Steve Sutton gravitated immediately to the various agency scientists involved, including the biologist described by Hinson. That biologist was the only one mentioned by name, with Sutton commenting that the individual was "*real resourceful*," and "*meant what they said*." This seemed to contrast with his opinion of the group of agency scientists as a whole—

> *A lot of it was the scientists, you know biologists—they of course know more than we do. And I think they were part of the problem. There's not much of a relationship there, it's more of a regulatory presence. I'm sure there's a little bit of mistrust there, you can't know what their motivations are. (Interview 61)*

In Idaho, Steve Leonard, the West Central LWG's range consultant, reflected on the comparative success seen in the Oregon CCAA and noted that in Oregon, the Soil and Water Conservation Districts (SWCDs) and the Natural Resources Conservation Service (NRCS) served as intermediaries to the FWS. For landowners, he said, it's much easier to work with the SWCDs and the NRCS because those agencies have much more experience in the communities and are more trusted by landowners (Interview 48). Rancher Royce Schwenkfelder echoed this sentiment. "*It's an ominous world dealing with the agencies . . . it's hard to find people with perspective,*" he said of his experiences with the FWS. Schwenkfelder maintained that unless a ranch is able to remain economically viable, there is no room for voluntary partnerships —and the FWS did not necessarily understand this. As a leader in his community, he felt the eyes of the ranching industry on him in the CCAA process, watching to see if he would sign the agreement before they considered it for their own ranches. From his perspective, there were so many unknowns about how the agreements would be implemented, and he did not trust the FWS enough to sign on and signal to others that it was a good deal. He contrasted this uncertainty with his appreciation for the NRCS as a positive force for change in his ranch operations—"*They're*

the doctor, I welcome them . . . I need [their] science and their expertise to help me make [his ranching operations] better" (Interview 54).

Joe Hinson discussed the suspicion with which area ranchers viewed the FWS, particularly the agency's biologists, and vice versa. "*The ranchers never felt like the biologists gave them any credence for what they knew, and the biologists felt like the ranchers weren't making an effort to learn what they knew. So there was a failure to communicate.*" Further, the level of detail that went into the agreement seemed to point to an unbalanced perspective. Hinson uses the length of the plan as an example: "*From the ranchers' perspective, here's eighty pages that defends what I can't do, but only a page that explains the benefits that I get*" (Interview 59).

Harney County, Oregon

In Harney County, members of the CCAA Steering Committee had the benefit of learning from the experience of the West Central LWG and their failed CCAA—both the organizations involved as well as several individuals had connections across both communities, including the FWS, The Nature Conservancy, the Harney SWCD, and area ranchers. As a result, they had different ideas about how the process should go. Echoing Joe Hinson, Judge Steven Grasty points out the comparative complexity of the West Central agreement, the result of heavy involvement by FWS scientists—"*there was an effort to create a CCAA in Idaho that failed . . . it was that thick*" he says, gesturing with his hand and indicating a sizable volume, "*and way too complex, around 300 pages.*" He continued:

> *I said at the first meeting that if it's more than five pages, we've got it wrong, guys. Well, it turned out to be twenty, plus some attachments, but well done. No one's reading a document 300 pages long—I've got 2000 pages of sage grouse stuff on the federal side! (Interview 9)*

Further, the group decided early on that the permit holder for the CCAA should be the County's SWCD, and involved the local NRCS office in negotiating the agreement, both of which had stronger relationships with local landowners. "*At least partially, this was a response to the experience in Idaho,*" observed Steve Leonard, the range consultant from the West Central LWG who has also worked with the Harney County SWCD, and provided advice on their CCAA effort. "*Oregon negotiated conservation measures with SWCD and NRCS as an intermediate to FWS. It is much easier for NRCS to work with landowners, they are used to working with NRCS, that agency has more experience and more local trust,*" he explained (Interview 48).

Another relationship that stood out in the case of Harney County was the close ties described between the community and the scientists at EOARC in Burns. These ties provided a window into the scientific evidence involved in sage grouse management, as well as advice and suggestions for the development of the CCAA that Steering Committee members felt they could trust. Judge Grasty stresses on importance of the community's relationship with the EOARC, particularly when that community is trying to balance wildlife, quality of life, and economic development:

> *[Those are] what we're trying to figure out how to balance, and it's why I think so much of our ARC. It's the only way we have to go into the room and be credible when there's a bunch of '-ologists' in the room—and I don't mean that derogatorily. (Interview 9)*

Grasty describes a discussion regarding the removal of juniper as an example—a native tree whose invasion of high desert habitat has been a thorn for both sage grouse conservation and ranching interests. When members of the Steering Committee began attending the statewide Sage Grouse Conservation Partnership meetings, there were those among the conservation community who complained that removal programs might target old-growth juniper stands along with the younger invading ones. This frustrated Grasty, but was amazed when the EOARC

scientist present agreed that the concern was valid and worth looking into, allowing the discussion to move forward. When he later asked about this, the scientist assured him that there was no need for concern, since "*we can win that battle scientifically.*" He assured Grasty that as none of the areas where they hoped to remove juniper stands had any historical evidence of juniper, there was no reason that the removal programs would be threatened. The presence of the scientist, and Grasty's trust in his judgement, allowed the discussion to move forward without getting caught up in an unnecessary argument. "*The dynamic is workable, but it comes down to relationships*," Grasty concluded (Interview 9).

Tom Sharp agreed that discussions about the science involved in the planning of the agreement went smoothly due to the people involved:

> *That communication was easy, but it's because of the individuals. The scientific community lives here, they're part of the community, and they do what the people do. Many of those same scientists, they hang up their PhD at the end of the day and they put on their boots and their wranglers and they go out to deal with their cattle, ride their horses, and so on . . . they're out there. And so, we're fortunate, that we had this kind of perfect storm in Harney County, of individuals, and the ability to collaborate with those individuals.*

In Harney County, Sharp explained, the population is relatively homogenous, which makes things like planning the CCAA easier—"*it doesn't matter if they're a rancher or a scientist, we all kind of understand what each other does, and we work with each other for the benefit of the community.*" When asked about the EOARC, he responded positively. "*Our USDA [ARC] here . . . they do wonderful things*" (Interview 3). Marty Suter-Goold, the manager for the Harney County SWCD, agreed with the sentiments expressed by Grasty and Sharp. "*In my humble opinion, I really believe the value, the receiving of the information from the stakeholders—in particular the landowners that we represent—went very well. Because, there is a foundation of trust, they had existing relationships,*" she says. According to Suter-Goold, those

relationships facilitated communication between the scientists and the landowners, and allowed for a natural feedback between the work of the scientists and the personal experiences of those who had been working the land their whole lives, and increased the respect that landowners had for the scientists (Interview 10).

Suter-Goold admitted that heated discussions occurred as the plan was developed, but explained that the foundation of respect and trust she described kept those discussions constructive, even when they became difficult. Further, participants felt more engaged with the science when they were given the chance to discuss it in a safe environment, and to learn how to interpret scientific findings more effectively through interaction with local and trusted scientists (Interview 10). That being said, the effort was not immune to conflict. The FWS biologist, when asked about low points in the process, noted that when they were almost done with the CCAA, a new Oregon Department of Fish and Wildlife official was brought in, who noticed that there was no conservation measure for hay mowing in the plan. "*I knew it was a threat . . . but it was just one of those things that got overlooked*" in the process, said the biologist. "*I thought, 'oh, this won't be a big deal at all, we'll just add it in, they're not going to care.*" Instead, they explained, the response was "'*we've been haying forever, and you're not going to come in and tell us how to do this, and why didn't you think of this before?' And then there were several heated conversations.*" In the end, there was no specific measure for haying in the CCAA, but instead, if hay mowing was found to be a problem on a specific site specific plan, it would be addressed there. "*We didn't go back and add another one, because [the ranchers] were like, 'it's too late,'* said the biologist. "*And I felt really bad for this new person that came in and dropped this bomb, because that's not at all what they intended to do*" (Interview 7).

Improving Stakeholder Relationships

In order to address the lack of trust in the FWS, several participants commented on the need for the FWS to be open to engaging more meaningfully at the community level and openly addressing the distrust. The FWS CCAA official in Wyoming said that this need makes a collaborative approach even more valuable: "*we often don't understand ranching and range management . . . sometimes we just get it wrong, so it was helpful to . . . get that perspective*" (Interview 45). Steve Leonard, the West Central range consultant, concurred that overcoming distrust and engaging in relationship building was critical before attempting to bring landowners into the fold of an agreement. "*People have to know how much you care, before they care how much you know,*" he said, quoting the motto of an acquaintance (Interview 48).

In Harney County, Tom Sharp echoed the need to spend time on relationship building, and notes that one of the successful pieces of their CCAA was that the effort started early, and kept working until people began to trust each other more—

> *The initial mindset, among the ranchers, was skepticism towards engaging with the agencies, a mindset that portrayed it as an issue that would go away . . . that it was just another government ploy to get the man off the land . . . attitudes like that. Some of our ranches here in Harney County, they're entering into their 5th or 6th generation of family ownership . . . so, older attitudes towards things like this persist. So there was a mixture of reception . . . to taking the issue seriously, to coming to the table in a collaborative process where you have other stakeholders there that you may not be comfortable with, those were big challenges.*
>
> *What we did right, is we started early, relatively early, in 2011, and kept at it consistently . . . month after month after month, meeting after meeting after meeting, going out into the rural communities and inviting them to come in . . . writing, publishing, doing things like that to make awareness that this is an issue that is really not going to go away. (Interview 3)*

A FWS official in Oregon commented that it took time to build the relationships that made the Harney County CCAA possible, and required the agency to think differently about how

the process should work and who would have control of the agreements. From FWS's perspective, the structure of the CCAA and the role of the SWCDs made the plan much better, since from a staff and resources viewpoint, it would have been nearly impossible for the agency to to effectively implement the agreements on its own. Besides, the official pointed out, the way to get things done in the long run was through collaboration and more open stakeholder relationships:

> *I truly have always felt that the collaborative process was the best way to work . . . the regulatory, top-down approach, especially in an issue that is this diverse, it's not very comfortable. And even with listed species, collaboration ends up being the tool that gets the work done on the ground. You see it with our forest species that are listed—like the spotted owl issue on the Deschutes. Our agency biologist has a great working relationship with the Forest Service, and there's a forest collaborative, and that's how things get done . . . in an open, or much more open process—letting stakeholders have involvement and empowering them in the decision-making process. (Interview 7)*

Since an investment of time is required to build collaborative relationships, the involvement of other agencies like NRCS and SWCDs that are more experienced with working with landowners and that have more established trust on the ground was a strategy supported by the experience in Oregon and Wyoming. In Wyoming, the Stock Growers Association was wary about monitoring procedures involving federal officials, "*which is distasteful to many of our members,*" said Jim Magagna, WYSGA's Executive Vice President. WYSGA and FWS ultimately reached agreement that monitoring protocols for the CCAA could be done by a private organization or state agency or the NRCS. "*NRCS is a federal agency, but they are trusted by the landowners,*" Magagna observed (Interview 47).

Outcomes

Idaho

After the failure of the West Central CCAA, responses to the experience varied. Lingering anger and resentment were exhibited by some of those most closely involved, as well as frustration at putting in so much time and effort into a project that ended in failure. When first asked about his experiences with the West Central CCAA, rancher Royce Schwenkfelder responded that it left "*a real bad taste*" in his mouth (Interview 54). Alan Sands, the biological consultant, expressed similar feelings, and lamented the interactions that led to the downfall of the agreement. He compared this outcome to the success he saw in Oregon. "*The reason that the Oregon CCAA worked was that there was so much common ground over juniper encroachment, which made it possible for there to be a win-win scenario,*" he explained. That common interest was missing in Idaho, he pointed out (Interview 53).

According to Dustin Miller at the Idaho Office of Species Protection, the collapse of the West Central "*came down to trust and personalities*." He continued, "*Nobody had done this before with sage grouse, so they didn't know how to go about it.*" Miller referenced another negative experience in the state with the CCAA program: "*The CCAA for slick spot peppergrass was problematic as well. It was geared toward livestock grazing. It was for such a small area, and it was a robust plan, but the FWS came back and listed it anyway due to wildfire and invasives concerns.*" As a result, of these two experiences said Miller, "*CCAAs are not that palatable right now in Idaho*" (Interview 50).

For the FWS in Idaho, the West Central CCAA effort was described as a useful experiment that unfortunately did not work out. According to a FWS biologist, the area was "*one of the few places we could demonstrate the gains that were possible on private lands, since other*

areas are so dominated by public lands." Further, it was a place where something new could be tried without affecting other projects in the state, since "*the overarching recognition was that these areas are relatively unimportant habitat for the state.*" Despite the outcome of the plan, the biologist maintained that there were positive results as well:

> *There was an exorbitant amount of time spent at peoples' coffee tables, and those relationships that were developed are still maintained, despite the overall failure of the CCAA. The project stemmed from a desire in the local area to do something proactive. The tough part was that the threats are not as parallel between the bird and private landowners as they were in Oregon—it's not always so win-win. The relationships are different in the West Central, and there's a lack of sagebrush due to historical conversion. There's less juniper and it's a wetter area, which is fairly unique in Idaho. (Interview 57)*

Range consultant Steve Leonard took a similar view. There were challenges that maybe could have been resolved if they were approached differently, he admitted, but argued it was a learning experience that others were able to benefit from, particularly the Harney County CCAA Steering Committee. He also suggested that some of the landowners might be following through on conservation measures and documenting them, but acknowledged that it would be difficult to pull that information together without the structure of the CCAA. The biggest challenge of the whole process, he said, came down to people—"*If we could get people to sign up, we could have done good. But we tried too much. If you can't compromise and start, you won't get anywhere. There was a lack of compromise, which led to frustration, and then people walked away.*" Overall though, he puts a positive spin on the experience: "*I'd like to think that we sort of pioneered and contributed to the success of these other states if they're having any," he says. "We got to point that it was almost fill-in-the blank for site plans—how different are they going to be?*" (Interview 48).

Oregon

Considering the comparative success in the Harney County effort, perspectives on the agreement's outcome tended to be more positive. SWCD manager Marty Suter-Goold pointed to their success in completing the CCAA for Harney County, and then assisting with its ultimate adoption by all of the remaining sage grouse counties as well as the Department of State Lands. As she excitedly observed, "*We were able to deliver a significant regulatory mechanism for 1.5 million acres of private land!*" Suter-Goold continued, "*it's way better doing a small, localized effort for working out the kinks rather than attempt to do so at the state level*," where you have to deal with many more personalities and jurisdiction concerns (Interview 10). Rancher Tom Sharp pointed to the spread of the Harney County CCAA to the other sage grouse counties in Oregon as evidence of the plan's success:

> *The other counties heard the buzz that was building, and saw the Harney CCAA as a tool to provide some greater protection and certainty in the face of a potential listing. Within 90 days of the Harney CCAA signing, all seven of the other counties had repurposed the original Harney County document for local contexts and were ready for the NEPA process, and had been signed by the end of 2014.*

This expansion of the state's CCAA coverage happened very quickly compared to the intensive efforts that went into developing the original in Harney County. This was possible, from Sharp's perspective, "*because they had the right tools. And it made sense to them also—they got it that managing for ecosystem health made a lot of sense, not only for the sage grouse, but for all the other species.*" He continues:

> *"They got it that what's good for the bird could also be good for the herd. They got what the state-and-transition modelling was about, and that these conservation measures were just the mitigating actions to move from a degraded state of ecosystem health to an improved state.*

> *They got it . . . and the constituents in their counties, they understood it as well—it just made sense to them. And they were able to move forward . . . such that we have all eight counties, that have sage grouse habitat, they were able to offer to their private landowners protection and certainty under CCAA agreement. And, all of those landowners that might be livestock producers that have permits on BLM rangelands in Oregon—they could also participate under a voluntary CCA on the BLM public lands to protect sage grouse as well."*

Sharp proudly points out that in her speech following the not-warranted decision in 2015, Interior Secretary Sally Jewell included a reference to the number of acres signed up under CCAAs, and Oregon accounted for around 75% of the total. "*I think Oregon was the leader in what we did. I know it sounds very provincial, but I think the facts, the statistics, might indicate otherwise,*" says Sharp. Other states didn't follow the same path that Oregon did, and Sharp attributes that both to the domination of private land in Oregon's planning strategy (almost half of Oregon's sage grouse habitat is on private lands, compared to 39% range-wide, by his estimate) as well as the strong inclusion of rancher and community input into planning efforts. "*So you won't be successful unless you deal with private land. We understood that in Oregon, and that's why we did what we did.*" This was the root of Oregon's success, from his perspective, that good-willed and patient engagement with private landowners made it possible for the state to achieve outcomes that were in the interest of both ranchers and sage grouse. He elaborates:

> *"We're the stewards of the landscape, we're the boots on the ground . . . we're closest to where the sage grouse are . . . and, oh by the way, yeah we have a vested interest because we like to graze livestock out here too. We get it. What's good for the bird is good for the herd.*
>
> *We're willing to step forward and participate, voluntarily, in these conservation agreements to do boots on the ground action to protect the sage grouse. And we did. Unfortunately I've not heard that in other states, that they've organized the private landowners to do it the same way.*
>
> *That's the pride . . . that's where it gets a little provincial sounding on my part . . . . I think that if you dig that a little deeper with the FWS folks, they might substantiate that." (Interview 3)*

Judge Steven Grasty is more mixed in his opinion. He argued that the program was still, as with the ESA in general, a one-sided demand that left rural communities with few choices. From his perspective, the CCAA gives landowners an out, but only a very limited one, while still holding them against the wall of the ESA:

> *The value in it is, it's a conservation agreement that really allows our ranchers to continue the activities they've been doing for generations anyway. So that was the value for them. . . . So, is that an assurance that's of any value? No . . . but the USFWS thinks it's huge. The value is, we document that what practices landowners are doing as valid, and science backs them up. It says 'yeah, you're grazing appropriately.' If you go out, you won't find a feedlot that's three feet deep in manure . . . but there aren't many of those left. People have moved on from that. (Interview 9)*

State FWS Supervisor Paul Henson recognized the concerns expressed by many on both sides regarding the CCAA. Still, he saw the CCAAs and other efforts to engage with private landowners as critical to the conservation of sage grouse and the high desert landscape in general. "*People want certainty more than financial aid,*" he observed, and CCAAs are one way the FWS can address that. He admitted that there are fair legal questions about implementation and accountability, but also pointed out there are logistical and political limitations to traditional enforcement as well. For him, the goal of pursuing "*net conservation outcomes,*" as well as scientific analysis, drove the CCAA process in Oregon. "*Our ultimate position was, let's give this a shot—it's not going extinct tomorrow*" (Interview 21).

Wyoming

In Wyoming, the discussion surrounding the statewide CCAA appeared muted in comparison to Idaho and Oregon. Several respondents in both Oregon and Wyoming, pointed out

that the main feature of Wyoming's CCAA effort was that it was much more top-down and administratively focused (Interview 10, 26). This strategy was confirmed by the Wyoming FWS CCAA official, who explained, "*In terms of active, engaged participation, we tried to keep it at the agency level.*" In addition was also consistent engagement with landowner representatives, including the Wyoming Stock Growers Association, the Wyoming Wool-growers Association, and the Wyoming Association of Conservation Districts. The official also added that there were no environmental organizations that expressed interest in participating, but that they regularly attended the meetings of several groups in order to provide on-going updates on the progress being made (Interview 45). "*The experience was pretty positive all around,*" said Jim Magagna, of the Wyoming Stock Growers, who noted that the local FWS understood that landowners were not going to sign on to something that was not economically feasible for their operation (Interview 47).

Multiple participants, both inside and outside of FWS, noted the limited numbers of landowners who signed up to participate in the CCAA. "*Once the not warranted decision was announced, it took the emphasis off CCAAs for both landowners and the FWS,*" commented Magagna, who explained that the Stock Growers Association was now focusing its efforts on other landowner tools like conservation credits and conservation banking that, unlike CCAAs, offer monetary incentives for landowners to participate (Interview 47).

According to one FWS official, "*Landowners are not that interested*." The official also noted that on the other hand, some of the landowners who were participating were highly enthusiastic about the program, a sentiment echoed by other agency personnel. Further, the amount of land enrolled in the program played a role in the "not warranted" decision, and that was one of the goals after all (Interview 39).

Among the four ranchers that were asked about the Wyoming CCAA, perspectives were mixed. One was positive about the program—he had enrolled his private land, and had a CCA on his BLM allotment—and saw it as a good insurance program in the event of a future listing. He admitted surprise that the program was not as popular as he thought it would be, and attributed that to the extent of federal land in his area, and the perceived lack of protection for permitees in the CCA program on public lands. He added: "*Also, some folks probably thought it would be more painful than it was—it was actually a pretty painless process*" (Interview 25).

Another, a state agency employee whose family owns a ranch, commented that they were working on a CCAA site plan for their ranch, which contains one of the state's largest sage grouse leks. The family sees the program as a hedge against the event of a listing, and he notes that they were using the template provided by WGFD to develop their plan (Interview 34). A third was in the midst of developing a separate CCAA agreement with the FWS as part of the Thunder Basin Prairie Ecosystem Association, an agreement which would address the unique habitat features of eastern Wyoming and incorporate all of the area's land uses into one agreement (Interview 26). The fourth was not involved with the CCAA, saying he did not trust the capacity of the agencies to change. "*The downside is that you are trusting the feds to honor the assurances, and they don't have a great track record,*" he explains (Interview 31).

When asked about the outcomes of the program and whether he saw the CCAA as a success, the lead FWS official involved was positive:

> *There are ½ million acres on private and nearly a million on public land that have been enrolled in the CCAA and the associated CCA. Even if it's only 40-45 people, that shows that to some extent, we were able to put together a plan that is reasonable and attractive to landowners. We were able to get a good number of people—including some big ranches with a lot of habitat. Based on workshops, the input of people, the willingness to participate, I think it's a success. (Interview 45)*

The FWS Field Supervisor for Wyoming, Mark Sattelberg, agrees. "*The FWS is interested in conservation on the ground,*" he says, and the CCAA, although it took a long time to develop, had good reception at meetings with local landowners. Sattelberg sees the effort as a success, and as a shift for the implementation of the ESA—the landowners are realizing that they can have input into decisions through agreements like a CCAA. This leads to some workload issues, and so they haven't been able to get through the enrollments as quickly as they'd like to, he admits. But, Sattelberg points out, "*the more conservation on the ground, the better*" (Interview 36).

Discussion

Increasingly, the problems that face ESA candidate species are "wicked" problems, in which problem definition and solutions are a matter of perspective in the context of uncertain and developing scientific understanding. Traditional tools of regulatory enforcement are often ill-suited for resolving these problems, and in their place, CCAAs and other cooperative conservation agreements are increasing in popularity. However, there are challenges and pitfalls that await landowners and agency officials who seek to utilize these tools. In this analysis of CCAA development efforts involving the Greater sage grouse, lessons emerge regarding those challenges, and how they might be managed for successful implementation on the ground. The main areas of concern involve trust and relationships, which can either hinder or help efforts at finding agreement on species threats and conservation actions.

Trust and Relationships

As the literature on collaborative governance indicates, trust and on-going relationships are often paramount in achieving successful outcomes. In line with the findings of Womack (2008) and Sorice et al. (2013), importance of positive relationships and agency trust can be seen in both the failure in the West Central CCAA and the success of the Harney County CCAA concerning conservation of the Greater sage grouse. In the West Central area of Idaho, a collaboration between the West Central LWG and state and federal administrative agencies fell to pieces after a breach of trust impeded further communication and negotiation that might have saved the effort, leaving hurt feelings and residual anger in place, even years after the fact. In the case of Harney County in Oregon, key relationships and flexible FWS officials helped to build a foundation for further success, and helped to keep the effort on track when conflict emerged near the end of the CCAA's development. Connections between the local community, agency staff, and researchers from the EOARC helped to further provide a bulwark against the divisive tensions of disagreements and negotiation over the terms of the CCAA. It should be noted of course, that the effort in Oregon was also substantially helped by the opportunity for mutual benefit as a result of juniper removal programs.

What is clear from these examples is that strong, on-going relationships between program participants is an important factor in developing a successful agreement. In circumstances where those relationships are lacking, agencies and participants must be all the more careful to manage disagreements and negotiation of agreement terms through open communication to avoid the resentment and frustration that can emerge if trust is broken. As Scott (2004) observed, the development of CCAAs can be a lengthy and arduous process for all involved, and so the opportunity for frustration and distrust to develop is substantial, even with otherwise positive

relationships among stakeholders. Care must be taken when approaching divisive issues, and they should be managed as openly as possible. The conflict that emerged at the end of Oregon's CCAA development had the possibility of becoming much larger, as the somewhat similar late-stage conflict in the West Central did, but it seems that the relationships that had been developed over time were strong enough to help push the group to an acceptable solution, rather than derailing the agreement.

While these disagreements can be frustrating, they may also be building blocks that lead to greater trust over time, making the time and resources spent on them an investment in the ability to manage future conflicts. Assembling a collaborative group of stakeholders to work together on a plan is a useful first step in developing agreements such as CCAAs, but the work to build and maintain those relationships must continue throughout the process. A certain "boosterism" has been created around collaboration in recent years, which has the potential to obscure the sizable challenges such efforts face. Promoters and participants of collaborative planning efforts should be clear regarding the odds of success and the roadblocks that must be addressed to improve those odds.

Perspectives on Threats and Conservation Actions

Species that are candidates for protection under the ESA face a variety of challenges, with varying degrees of complexity and contention involved in those challenges. In particular, conserving species like the sage grouse that face landscape-level threats and widespread ecosystemic shifts such as wildfire, invasive species, and climate change means engaging with areas of under-developed and uncertain scientific understanding.

In Wyoming, the desire to develop one agreement that could cover all industries proved fruitless due to this complexity involved in addressing threats from so many angles and juggling various industry interests. Instead, the state FWS office redirected, choosing to focus on plan for ranching first, and following a simplified course by relying on input from agency staff and industry representatives rather than working with individual landowners. With that experience and several more years' worth of research advances, it will be interesting to see how the agency moves forward with the long-standing, highly complex effort in eastern Wyoming to incorporate multiple industries into a single, regional CCAA for multiple species with the Thunder Basin Prairie Ecosystem Association.

In the case of Oregon's CCAA, it seems clear that limiting the regulatory emphasis on grazing as a potential threat in the agreements was at least partially a political choice—to keep ranchers at the table and to avoid political backlash. First, as Paul Henson and John O'Keeffe both pointed out, in order to properly protect sage grouse, private landowners needed to be part of the plan, given that high quality brooding habitat was largely located on private land. Second, as Jay Kerby and Chad Boyd pointed out, some grazing practices may have impacts on grouse habitat, but that point is moot if the whole landscape burns. In the face of more immediate and more expansive threats to the sage grouse's future from invasive species and wildfire, this perspective sees more sense in viewing ranchers and landowners as partners rather than target them with a heavy load of detailed habitat targets.

With much of the prime sage grouse habitat located on private lands, the opportunity to enlist ranchers into common cause with sage grouse conservation should be a priority. In such an environment, the division between ecological and social variables is fuzzy and dynamic, and any attempt to neatly separate them is likely a futile effort. It would be just too difficult to separate

the ecological components from the social and economic needs of the ranchers—each is a function of the other. The successful efforts in Oregon and Wyoming recognized this, and made efforts to integrate habitat needs with social and economic viability. Both seem to illustrate the importance of a post-normal view towards science, where it is understood that scientific assessment on its own is not entirely neutral, and thus diverse perspectives are necessary to fully understand how to best implement scientific evidence on the ground. The willingness, particularly, of the EOARC scientists to work through the scientific evidence about threats to sage grouse with the Harney County Steering Committee, and to incorporate community perspectives and social parameters into their analysis, seems to exemplify the concept of the "expanded peer community" as discussed by Funtowicz and Ravetz (1993).

A different dynamic is evident in the case of the West Central CCAA in Idaho. Disagreement over the threat of infrastructure development occurred in an environment where ranchers already perceived that their interests were not being taken seriously. Instead of a negotiated outcome that balanced rancher and agency interests, a lack of clear communication caused the agreement fall apart and the West Central population was largely abandoned by both the FWS and the Idaho Department of Fish and Game. In an area deemed unlikely to see much in the form of future wind development or other large infrastructure by lead consultant Joe Hinson, it was exactly this potential threat that doomed the larger agreement. Further, the plan required the ranchers to not only account for the threats on their own land, but to make up for the impacts of habitat loss and fragmentation elsewhere as well. This "fair share" model was not a component in either the Oregon or the Wyoming CCAAs, yet in Idaho the FWS felt that it must be included. In a program meant to encourage voluntary conservation from an already-skeptical

audience, this seems to have been a critical error in the shape of letting the perfect be the enemy of the good in terms of conservation outcomes.

The predation discussion is very similar to that surrounding grazing, although with the proponents and opponents of doing something about it are reversed. Predator control fits in with the ranching perspective as Jay Kerby points out, but flies in the face of the values held by environmental groups such as Oregon Natural Desert Association as well as many federal biologists. Restricting grazing to protect sage grouse populations fits in with the perspective held by many environmentalists, while it threatens the economic viability of ranching. Similarly, both increasing predator populations and a detailed focus on habitat metrics with relation to grazing (i.e. HAF) take aim at what might be considered "secondary" threats in the context of sage grouse in Oregon, where the dominant challenge is the interconnected threat of invasive species and wildfire, which threaten both sage grouse and the ranching industry.

What is interesting about the experiences with the predation discussion is the observation of several scientists and agency representatives involved, especially in Oregon and Wyoming, that although frustrating, it was a discussion that needed to happen in order to move forward and achieve other goals. With this perspective, predation and predators are deep and frequently emotional concerns for many ranchers, and are an ecosystem factor that they have observed regularly as they worked their land over time. For environmentalists and agencies to immediately discount such concerns and knowledge may be a hazard to the process, as doing so could be a red flag for landowners that they and their input will not be taken seriously. If this is how the process begins, the potential for distrust and disagreement is magnified.

To a certain extent, it may appear that the debate over the Habitat Assessment Framework and the state-and-transition model approaches to monitoring and habitat assessment

represents a "choose your expert" scenario often observed in environmental conflicts. However, it also reflects very real concerns about the best ways to address large-scale environmental management. As Tom Sharp pointed out, sage grouse inhabit a startlingly large area of the country, over which there are dramatic shifts in climate, geography, and land-use, making it difficult to implement a uniform set of guidelines for habitat assessment. Meanwhile, the federal agencies involved find themselves in a politically charged situation in which every move the agency makes is potentially the basis for a lawsuit, and thus must be made with legal defensibility in mind. Further, they must find a way to conserve species across diverse landscapes in an efficient and fair manner in a context of limited budget and staff resources.

Conclusion

The experience of the West Central LWG's CCAA effort was an unfortunate challenge for everyone involved. The participants had the ingredients of a potentially successful collaboration—an enthusiastic community leader, strong community ties, financial and technical support provided by the state, and positive relationships with some FWS staff. But these were not enough to overcome the challenges that arose from competing perspectives toward the nature and extent of the threats to sage grouse, as well as toward which conservation actions were necessary to address those threats. Increased flexibility and willingness to engage in more mutual learning and joint fact-finding possibly could have helped improve the situation.

In Harney County, the CCAA Steering Committee was able to learn from what happened in Idaho. Relatively independent from other sage grouse conservation efforts in the state, the Steering Committee was able to leverage Harney County's strong community ties and generally trusting relationships with local and state FWS officials together with the administrative

resources of the SWCD and technical support provided by the EOARC. This resulted in an agreement that was acceptable to most and worked for the needs of ranchers in the area, despite several opportunities for conflict.

The case of the second Wyoming CCAA effort presents a "middle of the road" example of collaborative CCAA planning. CCAA developers at the Wyoming FWS did not experience the same rush in enrollment that was seen in the highly inclusive Harney County CCAA, but they did put together a plan that convinced many landowners to participate in the program. Instead of seeking broad participation from individual landowners, the Wyoming FWS office chose to operate mainly in cooperation with other state and federal agencies and the leadership of grazing industry organizations, where there were already existing relationships. They ran into many of the same arguments and topics of debate as were encountered in the West Central and Harney County, but worked through them with a cadre of professional staff and industry representatives who were familiar with negotiating policy agreements. The goal was to create a plan that provided an option for grazers to protect their operations in the event of a listing, and the effort accomplished this. Further, given the impact that staffing limitations had on processing landowner enrollments, the program seems to have reached its capacity in the period prior to the 2015 "not warranted" decision. Given the stated intention of FWS to return to the sage grouse decision in 2020, the success of the program may be more effectively gauged closer to that time, when participating landowners can share their experiences with other prospective enrollees.

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Chapter 4

Competing Visions of the 'Best Available Science' in Environmental Management

Abstract

The phrase 'best available science' is nearly ubiquitous in discussions of environmental management and policy. Its use as a metric of quality decision-making reflects a long-standing technocratic belief that better information will yield better decisions. Perhaps infamously, it is the standard upon which decisions in several environmental laws, particularly the Endangered Species Act (ESA), are required to be based upon, despite ambiguity over the nature of the term and its application to policy problems. The role that technical expertise should play in such policy decisions is one of considerable debate, and has been challenged in recent years by the growing popularity of collaborative governance regimes and other cooperative management programs, which bring diverse stakeholders into the decision-making process in order to collectively interpret evidence and make policy choices. This study seeks to assess how the stakeholders involved in a particular area of environmental management—conservation efforts for the Greater sage grouse—define 'best available science,' and what these various definitions may suggest for the implementation of decisions based on the 'best available science.'

Participants in collaborative management planning efforts for sage grouse in three states (Idaho, Oregon, and Wyoming) were asked to explain how they defined the concept of 'best available science' in the context of contentious management decisions such as the possible ESA listing of the sage grouse. Results indicate that must of the stakeholders agreed on a few key themes regarding the nature of the 'best available science'—including the importance of technical validity of information considered, that diverse sources of information be considered, and the importance of human judgement and a diverse set of perspectives in evaluating and applying information to the specific problem and context at hand. A tension seemed to exist, often within the same individual's responses, between the dual needs of technical and political credibility in management decisions. This reflects what appears to be a general awareness among stakeholders that management decisions, while they may be based in science, are inherently political and need to incorporate diverse perspectives and sources of information into account in order to effectively interpret and apply technical information to the context and problem being addressed.

Introduction

The role that science plays in public policy and what role it should play remains an issue of considerable debate (Jasanoff, 2005; Pielke, 2007; Steel, Lach, & Warner, 2009; Steel, List, Lach, & Shindler, 2004). Many have criticized the top-down, "science-based" approach to policy

making, arguing that this ignores the values embedded in privileging science over other types of knowledge and subverts the democratic process (Beierle & Cayford, 2002; National Research Council, 1996, 2012). The federal Endangered Species Act (ESA) is one highly visible law in which science-based decisions are required by its legislation—and as a result has long been one of the most popular tools for environmental advocates as a method for holding agency officials accountable to the Act. Reflective of the many complaints that critics make against science-based decision making, however, the ESA remains one of the most controversial environmental policies in the United States, and ESA conflicts have been characterized by stakeholders seeking the "scientific high ground" in order to advance their preferred outcomes (Doremus, 2004).

In recent years, major concern emerged around the case of the Greater Sage Grouse—a small, chicken-like bird of the high desert that was being considered for protection under the ESA. The sage grouse, as a resident of the arid shrub-steppe habitats of the inter-mountain West, depends on habitat that overlaps with traditional economic powers in these regions—including ranching, mining, and energy development. And, as in many places, the anticipated local impacts of global climate change—such as changes in wildfire regimes and expansion of invasive species—create additional levels of scientific uncertainty in management decisions aimed at conserving the species. The wide range of areas likely to be impacted by an ESA listing—eleven states and multiple industries—suggest that the sage grouse had the potential to become the "spotted owl of the desert"—a bitter and contentious conflict over divergent values and future livelihoods couched in the language of science-based decision-making, much like the case of the Northern Spotted Owl in the Pacific Northwest (Dietrich, 1992).

The intent of this research is to understand how different stakeholders define the term 'best available science,' and how these responses reflect these challenges in the use of science in

making policy choices. While many point to the political maneuvering often described in environmental conflict as a reason for creating greater protections for scientific integrity and further separating science and politics, others suggest they also indicate the need for an evolving understanding of the nature of scientific evidence in political decision-making—that science represents only one type of knowledge that needs to be at the table when making decisions about complex issues. This points to the frequent claim in the collaborative governance literature that instead of separating science from politics, a diverse group of stakeholders is more effectively able to navigate the complex relationship between the science and politics of management decisions. Such a perspective may run counter to the beliefs of some involved in policy debates regarding the nature of science and how it should be used in decision-making, but is a perspective that is growing with the expansion of collaborative governance regimes aimed at addressing the conflict entrenched in environmental management systems.

Literature Review

The Positivist Model of Science

The traditional, or positivist, model of science at the foundation of science-based decision-making was a product of the scientific revolution and the Enlightenment in Europe, and can be described by seeing the scientific method as providing an objective and powerful understanding of the world through quantitative causal models (Steel et al., 2009). A completely positivist view is rare today among scientists (Bechtel, 1988), and the human role of judgment in the scientific enterprise is often acknowledged (Jasanoff, 2005; National Research Council, 1996). However, even as post-positivist and postmodern interpretations of the relationship of

science and society abound, elements of the positivist model of science lingers as a dominant thread throughout social and scientific discourse (Bechtel, 1988).

Acceptance or denial of the positivist worldview can lead to different expectations of what the role of science in decision-making should be. Steel et al. (2004) compared attitudes toward science (i.e. acceptance or not of positivist statements) with preferred roles for scientists among various participants in environmental policy in the Pacific Northwest. The authors found that scientists and resource managers were the least likely to support positivist ideas and an active role for scientists in decision-making, while interest groups and the public were more supportive of positivism and a more active role for scientists and expertise in making decisions about environmental policy.

Critiques of the Positivist Model

Proponents of science-based decision-making might argue that relying more on the scientific evidence involved in a debate will lead to better decisions. However, some have argued this relationship has not been observed reliably (Sarewitz, 2000). The public administration literature shows that decisions are shaped by multiple influences and cognitive biases, and that purely rational decisions are impossible even in the rare cases of "perfect information" (Frederickson, Smith, Larimer, & Licari, 2012, pp.165-193). Further, looking at decision and policy making through the lens of the governmental politics model proposed by Allison (1971) reveals that final outcomes are often the result of bargaining or competing political efforts rather than a single, rational decision-making process (Denhardt, 2010, pp.84-86).

Instead, many policy arenas appear to operate under the incremental or "muddling through" method, where policy decisions are made in a limited resource environment

(information, time, money) and are cognitively and politically constrained by past decisions and existing procedures (Lindblom, 1959, 1979). In this way, policy decisions focus on limited, incremental changes rather than changes focused on extensive rational analysis. This mode of decision-making is also referenced in the substantial literature on adaptive management in the realm of natural resources. In managing such resources, it is generally accepted that you will be operating under constraints of limited information and uncertainty regarding the effects of management actions. As a result, practitioners of adaptive management are encouraged to make decisions based on what information is available through research and consultation with stakeholders, while continuously monitoring outcomes and reassessing management strategies and goals (Holling, 1978; Walters & Holling, 1990; Westgate, Likens, & Lindenmayer, 2013).

As the National Research Council notes in its report, “Using Science as Evidence in Public Policy,” "some mixture of politics, values, and science will be present in any but the most trivial of policy choices. It follows that the use of science as evidence can never be a purely "scientific" matter..." (National Research Council, 2012). Values and beliefs about the objectivity of science has considerable implications for the way in which individuals respond to expert knowledge within the policy realm, as well as how they communicate with the scientific experts involved (Rykiel, 2001). As a result, the use and privileged consideration of scientific data in determining policy outcomes can lead to intensifying conflict (Wynne, 1992) as well as the development of "competing" sciences and interpretations of scientific data (Pielke, 2002; Rykiel, 2001).

In an earlier report, “Understanding Risk: Informing Decisions in a Democratic Society,” (1996) the National Research Council examined many of the challenges facing the use of science in decision-making, and concluded that in order to effectively inform decisions, technical

analysis must be complemented by open and participatory deliberation. By reviewing the many steps in which technical assessment involves acts of judgment, such as how the problem is formulated, which options for action and resulting outcomes are analyzed, and how information is gathered and interpreted, the NRC makes it clear that in debates with multiple interested stakeholders, a purely technical assessment of evidence is impossible. As a result, the NRC argues that it is critical to design processes that reduce conflicts by explicitly involve a variety of stakeholder perspectives.

Collaboration, Trust, and a Post-Positivist View of Science

Considering the potential for politics, values, and science to mix within the policy arena, it is important to consider how science is received and whether it is trusted by those involved within a policy debate. As a social institution, science and scientists enjoy a substantial amount of public trust. However, in the last few decades, many have expressed concern that society is experiencing a crisis of confidence regarding science and its role in our public policies (Mooney, 2006). In a study of public confidence in science, Gauchat (2012) found little evidence of a systemic decline in public trust, but did identify such a decline among politically conservative groups—similar to the claims made by Mooney (2006). Gauchat argues that this decline may be the result of a perceived expansion in science's cultural authority (i.e. Jasanoff, 2005), particularly in regulatory use, into already polarized political issues where conservatives see the expanded power of scientific authority pushing against strongly held values (2012). Wynne (2006) also argues that the growing cultural authority of science suggests that such declines may be an issue of framing—rather than a loss of previously held trust, they may indicate a resistance to giving additional trust to a social institution that increasingly affects daily life.

In any case, many efforts are seeking to restore or expand public trust in science (i.e. Bäckstrand, 2003; Haerlin & Parr, 1999) as a result of these concerns, including the rapid growth of participatory and collaborative environmental management policies. Proponents of these policies argue that these tools are a much stronger fit than hierarchical, traditional science-based approaches, considering their ability to work across political, social, and ideological boundaries (Beierle & Cayford, 2002; Schneider, Scholz, Lubell, Mindruta, & Edwardsen, 2003). The argument states that by pulling conflicting stakeholders into the deliberation process to work jointly through the existing scientific evidence and develop solutions, these processes build a sense of community, trust, and cooperation among participants, thus leading to policy results that, once reached, are more effective and less costly to implement (Beierle & Cayford, 2002; Lubell, 2004; Schneider et al., 2003). Through greater inclusion in the policy process as well as an emphasis on deliberative methods, collaborative methods are argued to improve the democratic nature of environmental governance as well as the effective use, interpretation, and application of available information (Abelson et al., 2003; Beierle & Cayford, 2002; Daniels & Walker, 2001; Kasemir, 2003; Reed, 2008; Schneider et al., 2003; E. P. Weber, 2003; E. P. Weber & Khademian, 2008).

The ESA's 'Best Available Science' Mandate: A review of the existing literature

One of the legal responsibilities within the ESA is the requirement that many decisions be based on the 'best available science,' sometimes specifically excluding other social or political considerations from influencing the decision. The term 'best available science' is notoriously vague and comes with no legislative guidance in terms of its definition or application, leaving an opening for conflicts among the competing interests involved (Doremus, 2004; Ruhl, 2004).

In a legal review of the ESA's 'best available science' (hereafter BAS) mandate, Doremus evaluated the possible purposes and observed effects of the requirement, ultimately concluding that the policy's most substantive effect is not on the consideration of science, but instead limiting the "open reliance" on other, more political factors and in encouraging a "hard look" in the judicial review of decisions (2004). From this perspective, the required use and consideration of the science in decision-making was already in force as a result of the standards for formal rule-making contained within the Administrative Procedures Act (APA) of 1946. Doremus cites J.B. Ruhl, who argues that there is an absence of evidence that would suggest the BAS standard has led to decisions different from those that might have resulted from the requirements of the APA or other legislative limitations on agency rule-making (Ruhl, 2004). The challenge for the BAS requirement, Doremus cautions, is not whether ESA decisions are effectively making use of science, but to repair the credibility of the agencies making those decisions. To do so, Doremus advises that the agencies must be more open about the limitations of science in making decisions under the ESA, and how professional judgement was used to navigate those limitations (2004). This fits with the growing support for collaboration, which allows for stakeholders with diverse perspectives to evaluate the scientific evidence considered in a decision, and to debate how decisions should be made in light of that evidence.

Recognizing the ambiguity of the BAS concept in making policy decisions, the American Fisheries Society and the Estuarine Research Federation created a committee to review and evaluate the topic. Sullivan et al. (2006) summarized the results of this work, starting with the acknowledgement that science can have multiple meanings depending on context and purpose. The authors list the various sources of scientific information as the peer-reviewed literature, the gray literature, expert opinion, and anecdotal experience, with each reflecting varying levels of

innovation, quality, and accessibility. They note however, that given the diversity of sources and applications for scientific information, that no one type of information can be designated as the "best" in all circumstances. Like Doremus, Sullivan et al. suggest that for science to be truly helpful for informing contested policy decisions, scientists, policy-makers, and other stakeholders alike need to understand the factors affecting science and its limitations, and be open about them (2006).

Green and Garmestani (2012) lament the policy developments that, in their view, have rendered the BAS mandate an effectively redundant version of the decision-making practices of the APA, particularly with regard to judicial interpretations that do not require the administrating agencies to generate scientific data beyond what is available. They argue this limits the conservation capacity of the act, especially considering the already piece-meal approach the ESA represents toward biodiversity loss that is increasingly recognized as operating at a landscape or ecosystem-level scale. To address these weaknesses, the authors recommend a definition of BAS that requires decisions to be based upon the principles of adaptive management (2012). They suggest that the iterative nature of adaptive management and its processes for engaging with scientific uncertainty make it well-suited to the challenges faced by the ESA in carrying out its mission, and argue that by creating an infrastructure for continuous learning and monitoring will make managers better equipped to respond to changing circumstances in complex ecosystems (Green & Garmestani, 2012).

Chen et al. (2013) did not seek to define BAS, but instead evaluated the post-wildfire management practices of the USDA Forest Service as a case study to understand the ways in which the characteristics of agencies and science can lead to "disconnects" between the BAS and the decisions made by management officials. The authors found opportunities for such

disconnects on the management side (such as direct financial incentives, budget constraints, and political pressure), as well as on the side of science (such as science that is insufficient, unavailable, inaccessible, or poorly synthesized for management purposes), and a combination of both (such as variations in time and spatial scale between scientific analysis and management needs) (Chen et al., 2013). Such disconnects in both science and management ends of a decision again point to the value of a diverse, collaborative perspective on the use, interpretation, and application of science in decision-making.

The case of a the potential listing of the Greater Sage-Grouse under the ESA presents a useful opportunity to see how stakeholders in collaborative planning and management define BAS, and evaluate their perspectives of BAS as a metric for decision-making. Because sage grouse inhabit a wide and diverse landscape in the western United States, questions regarding their management involve a similarly wide and diverse set of stakeholders—whose thoughts and perspectives on the nature of science and its role are likely to be diverse as well. Additionally, the level of potential conflict surrounding management decisions means that those stakeholders who participated in this study had dedicated a substantial amount of time and energy to participating in various planning and management efforts over the course of several years. Thus, participants were able to offer thoughtful, nuanced perspectives about the relationship between science and management decisions, since these were questions they had been navigating throughout their involvement.

Methods and Analysis

Data was collected in three states engaged with participatory programs regarding sage grouse conservation. These states were selected for inclusion in concurrent studies of the use of a

FWS programmatic agreement with private landowners (CCAAs) in Oregon, Wyoming, and Idaho, and each additionally was involved in collaborative planning efforts surrounding sage grouse management at the state level with the aim of avoiding a listing under the ESA.

A total of 63 interviews were conducted—24 in Oregon, 25 in Wyoming, and 15 in Idaho between October 2015 and August 2016. Each interview lasted between 45 minutes and 2.5 hours and took place at a location convenient for the interview participant. The semi-structured interviews (see Appendix A for full interview protocol) covered topics how to define the 'best available science,' the appropriate role of science and technical expertise in environmental management, and the nature and resolution of any conflicts over science that emerged. The interviews were recorded and were analyzed in Microsoft Excel and NVivo qualitative analysis software. Interview notes and recordings were coded in order to organize participant responses into analytic themes (e.g. Lofland & Lofland, 2006). Codes and themes were generated from participant responses as patterns emerged from the data, and were not previously assigned from existing theory (Glaser & Strauss, 1999). Similar codes were clustered into broader themes, and these themes and their frequencies are reported in the results.

Responses were compared across participant groups of federal agency officials (19), environmental organizations (6), affected industries (ranching, oil and gas, and mining—11), local government and tribal officials (4 local government and 1 tribal wildlife official), scientists (8), and state officials 15. There is considerable overlap amongst these groups, and group assignment is determined by an individual's primary role leading to involvement with sage grouse management. One individual was jointly employed by a state wildlife agency and an environmental organization, and is included in both of these groupings to more accurately reflect the diversity of responses in both groups.

Federal and state agency staff were grouped as "scientists" rather than officials if their main duties relevant to sage grouse involved the collection and/or analysis of data rather than program implementation. Consultants and facilitators hired by state government officials or agencies were grouped as state government if their contributed expertise was program or process-related, and as scientists if their role was to provide scientific advisement. The tribal wildlife management official was grouped together with local government officials due to proximity in size and relationship with federal management agencies. Each participant may have referenced multiple theme areas, as well as multiple specific response codes within each theme.

Findings

Participant responses regarding the definition of BAS were coded according to content, and then clustered into five major theme areas: 1) determining the technical validity of scientific information, 2) the diversity of information that should be considered, 3) the application of information, 4) policy considerations involved, and 5) concerns regarding the use of BAS as a measure for decisions.

Responses that addressed the technical validity of scientific information came up in 48 out of 63 total interviews, followed closely by those addressing policy considerations about using BAS (47), then the diversity of information considered (39), the application of information (33), and concerns about the use of BAS as a measure of decision-making (29) (Table 1). Among all of the groups, the distribution of responses across the theme areas was similar to that seen for the group as a whole (Table 5). These results were then broken down into finer detail in order to examine how these groups compared across specific response codes within each theme cluster.

*Table 5. Distribution of comment topics among participant groups when asked to define 'best available science.' *One participant was a biological consultant jointly contracted by a state agency and an environmental organization, and is thus included in both groupings here. **Agency staff were listed as scientists if their main duties relevant to sage grouse projects involved the collection and/or analysis of data rather than program implementation.*

	Participants	Technical Validity	Diversity of Information	Application of Information	Policy Considerations	Concerns
Agency	19	14	9	11	13	6
Environment	6	5	3	1	4	2
Industry	11	7	6	5	9	7
Local Official	5	4	3	2	4	1
Scientist	8	8	8	5	5	5
State	15	10	10	9	12	8
Total	**64**	**48**	**39**	**33**	**47**	**29**

Technical Validity

Among responses involving the technical validity required to be considered BAS, participants most commonly mentioned that such work must be rigorous and credible (42 total responses). These comments included variations such that the work must be scientifically and statistically valid, and methodologies must be reliable and repeatable. Formal systems of peer-review, as well as the comparison of a single study's results and conclusions to the wider scientific literature and community consensus, were the next most frequently cited, mentioned in 22 responses each (see Table 6). That a scientific report was published (16), or was conducted by a trained scientist and/or following the scientific process (16) was referenced as being acceptable for consideration as BAS by many respondents. Thirteen participants identified that information should be unbiased, or that the source of information should at least be taken under consideration. Advice of scientific experts was necessary for identifying BAS according to 9 participants, while 6 specifically noted that a vetting procedure other than formal peer-review would be acceptable for inclusion as BAS.

In general, the responses among specific groups of participants mirrored those in the general trend, indicating that a specific research study needed to be peer-reviewed or otherwise

considered methodologically rigorous and credible in its analysis being the top assessments of technical validity. Less than half of the federal agency officials however, and few of the state officials (3 of 15) and industry representatives (2 of 11), identified peer-review as being a necessary component, while none of the five local officials specifically referenced peer-review. Perhaps not surprisingly, all of the scientists (8 of 8) addressed peer-review as an important consideration, and most (7 of 8) referenced publication, especially in academic journals, an indicator that was not frequently addressed by other groups. Federal agency officials sometimes (6 of 19) suggested scientific training and that a particular study followed some sort of scientific process as a general indication of what could be included as BAS.

A sage grouse expert from the Idaho Department of Fish and Game described the reliance on peer-reviewed, academic science this way:

> *What reflects the peer-reviewed literature [is the BAS]. The system is not perfect, but that is where we have the best chance at getting at something close to the truth. If we have multiple studies that are saying the same things, we can be pretty confident. You might have studies that disagree, and that might be the best available, but you have to do what you can. (Interview 60)*

Others were not so sure that peer-review was the appropriate system for assessing quality, especially in issues of land management where so much knowledge was held locally by the people who live and work in the area every day. The Executive Director of the Wyoming Wildlife Trust and the Chairman of the state's Sage Grouse Implementation Team (SGIT), explained this perspective:

> *Call it a vetting process, because peer review is so specific. If that's what you want, that's fine. But I get livid when people discount anecdotal information, because it is absolutely valuable. What my parents see on a daily basis at Big Piney has as much bearing to me as what the biologist counts in January, for deer. What I see when I'm out there, about body condition, how many fawns with does, I have a pretty good idea from year to year in that place, which I know very well, where things are going. We need that feedback. And the good biologists get that, and it's incorporated. (Interview 33)*

Many stakeholders and state and federal officials felt a similar concern for defining the concept too narrowly, which was also expressed in responses addressing the diversity of information that should be considered.

Table 6. Participant responses regarding the technical validity necessary for consideration as BAS.

	Participants	Rigorous and Credible	Peer-review	Scientific Literature and Community	Published	Scientific Process and Training	Expert Advising	Unbiased Source	Other Vetting
Agency	19	10	8	7	4	6	5	2	2
Environment	6	5	3	4	2	1	0	2	1
Industry	11	7	2	1	1	1	0	1	0
Local Official	5	3	0	3	0	2	0	2	0
Scientist	8	8	6	2	7	3	1	2	1
State	15	9	3	5	2	3	3	4	2
Total	**64**	**42**	**22**	**22**	**16**	**16**	**9**	**13**	**6**

Diversity of Information Considered

After criteria to assess the technical validity of BAS, many participants would specify that a diversity of information needed to be considered in order to fully understand the issue at hand (Table 7). Specific responses under this theme include, in order of frequency: the need to integrate diverse information (20), consider all of the information available (12), include local knowledge and anecdotal information (13), consideration of information pertaining to human dimensions, such as economics (7), agency reports and monitoring data (7), management experience (5), industry science and available technology (4), evidence from multiple disciplinary perspectives (4), and the identification of unknown information (4).

Within participant groups, industry representatives (6 of 11) and state officials (6 of 15) were the most likely to emphasize the need to integrate diverse types of information, followed by federal agency officials (4 of 19), and scientists (2 of 8). The need to include local knowledge

and anecdotal information was brought up by scientists (4 of 8) as well as state (4 of 15) and federal (3 of 19) officials in addition to an industry representative and a local official. As one biological technician explained, local knowledge helps you to understand how to apply the BAS effectively in a particular place and context, which improves your understanding of the system as a whole. "*If you don't take that local knowledge and put it in the mix of the BAS, you're not going to come up with a good product,*" he pointed out (Interview 62).

A few respondents specifically commented that new and emerging science needed to be considered in addition to older, more established bodies of work when defining BAS. These last two topics were brought up at several different points of various interviews in addition to the present discussion of how to specifically define BAS, particularly when it came to understanding some of the conflicts that emerged over sage grouse management decisions. In particular, a common point of concern in these responses was that agencies were sometimes possibly over-reliant on older, more established scientific evidence (such as habitat assessment, exemplified for many by the BLM's Habitat Assessment Framework, or HAF) at the expense of the more complex, emerging knowledge of wildfire science and management.

The President of the Oregon Cattlemen's Association explained what he thought a BAS selection strategy ought to entail:

> *Okay, they've got this highly developed HAF, they've got this less developed fire science, but it's here. Well, we take the best of the habitat assessment, and we take the best of the fire—and we don't say the fire stuff isn't as good as the HAF—we say, knowing what we know, and suspect how it'll interact here, we're going to make our decisions based on these factors. (Interview 4)*

Both of these perspectives—the need to include local and anecdotal knowledge in assessing the BAS as well as considering emerging science from diverse disciplinary perspectives, feed in to the general sense among many that those evaluating BAS for decision-

making should be bringing together diverse types of knowledge and integrating them for a fuller, more nuanced understanding of the situation.

Table 7. Participant responses regarding the diversity of information that should be considered as BAS.

	Participants	Integration of Diverse Information	All Available Information	Local and Anecdotal Knowledge	Human Dimensions Concerns	Agency Reports and Monitoring Data	New and Emerging Science	Management Experience	Industry Science and Technology	Multi-disciplinary Perspective	Identify Unknowns
Agency	19	4	2	3	0	2	1	1	0	0	1
Environment	6	1	2	0	1	0	0	0	0	0	0
Industry	11	6	4	1	1	0	2	0	1	2	0
Local Official	5	1	0	1	2	1	1	1	1	0	1
Scientist	8	2	1	4	0	4	1	1	0	0	1
State	15	6	3	4	3	0	2	2	2	2	1
Total	**64**	**20**	**12**	**13**	**7**	**7**	**7**	**5**	**4**	**4**	**4**

Policy Considerations

Policy considerations for applying the concept of BAS were commonly on participants' minds (Table 4), and were closely connected to how these individuals defined BAS. The most commonly cited consideration, brought up by 33 participants, was the availability of the information needed for a given decision—if there was little information available, then what is available becomes the BAS, even if it does not meet the technical standards one prefers. As one FWS official observed, "*'Best' and 'Available' are different things*" (Interview 20). A project manager from The Nature Conservancy, pointed to fence collision by sage grouse as an example, where the evidence for the problem was largely based on a single study done by a graduate student in Idaho, combined with observations of fence collision in other grouse species. "*The NRCS grabbed that and used it as the basis for the region-wide Sage Grouse Initiative strategy. It might be right, and it might end up being confirmed by more studies later, but we really have no idea. But it's what we have to work with,*" he explained. When making such decisions, he

says, "*you have to separate the 'Best Available' from 'Good,' because what you have available might not be the best, but it's what you have*" (Interview 6).

Other common responses included the need to take decision needs and requirements into account when defining the BAS (21 participants), the need for adaptive management practices to account for future changes in scientific understanding (19), that professional, human judgement is necessary to consider how to incorporate BAS into policy decisions, and the importance of considering diverse perspectives when making those decisions (11). Less common responses included the need for the BAS to make sense or pass "*the straight-face*" test (5 responses), be legally defensible in court (3), and be able to have measurable impacts on the issue of concern (2).

The two groups most likely to bring up the availability of information were state (10 of 15) and federal agency (8 of 19) officials and scientists (5 of 8), although this concern was addressed by all groups. Less common but still frequent responses such as the need to consider the specific decision or policy requirements was spread across all groups, as were support for adaptive management practices and recognition that policy decisions required human judgement, that science could not make our choices for us, only inform them. The concept of legal defensibility, as regularly discussed as it is in issues of environmental management (including elsewhere in these interviews), was rarely addressed in participant responses regarding the definition of BAS.

Regarding potential divides between the needs of decision-makers and the changing nature of science, the Conservation Director of the Oregon Natural Deserts Association comments, "*that's the classic policy-making versus science as a pure effort conundrum, because science has to continue, and to continue to answer questions, and there is no absolute. Whereas*

policy-making has to happen." He continues: "*to some degree, that's not resolvable, but to a lesser degree, we shouldn't make policy-decisions on anything that doesn't meet those three criteria of replicability, applicability, and peer-review*" (Interview 2).

Others look at this divide between the needs of decision-makers and the continuing evolution of science and take a different approach to its implications, including officials at the FWS. "*[BAS] includes peer-review literature and grey literature from agency reports. Sometimes assumptions would be made and circumstantial evidence would be used because that was the best information available. So there was an adaptive management component to the process,*" explained one biologist at the agency. That being said, the biologist continued:

> *We should be able to get a decision and an interpretation of the science from an entity that is able to have the appropriate expertise without a conflict of interest with the decision at hand. Different agencies and landowners can look at the same bit of information and interpret it different ways, so that's why it's important to have scientists there to weigh in on its interpretation. (Interview 45)*

One local government official in Wyoming explained his support for adaptive management when available information and decision needs do not align: "*Sometimes science is seen as etching things in stone . . . you need to be flexible about changing understanding. This brings you to adaptive management and the use of hard and soft triggers. A hard trigger would be something like a rapid population decline*" (Interview 31).

This was a perspective that matched those of some of the scientists who advocated for an adaptive management element in their definition of BAS. One sage grouse expert at the Wyoming Game and Fish Department describes that there are challenges in basing decisions on science, even for a species as well studied as the sage grouse. "*We always want more [information*]," he explains. *"There's a huge body of science on sage grouse . . . it's one of the most studied species on the planet now . . . but there's still a lot of questions.*" But, he cautions,

this lack of information can be used as a red-herring avoid making decisions. "*That's why there's an important role for adaptive management,*" he concludes (Interview 42).

Integrating multiple types of information and applying them to a problem in order to make a decision requires human judgement, an element that many overlook when arguing about the BAS. One state official in Oregon explains:

> *Science often doesn't tell you an answer. It can negate a hypothesis or give support for a hypothesis, but I think a lot of people believe that science is just going to tell you the answer, and what you should do. I think a lot of people are saying, even those who do the research, that's not what science does.*

The official continues, "*Somebody has to sort that out…it's a tough thing to do. But it's a better intention to have in making policy than ignoring the science. So you make decisions based on your best professional judgement*" (Interview 1). Because of this necessary element of human judgement, several respondents emphasized that complex and incomplete information required the input of diverse perspectives to have a fuller understanding of the issue. "*Scientific principles suggest that knowledge will evolve over time,*" comments a representative of the oil and gas industry in Wyoming, who continued:

> *A broader set of metrics is needed. The intent was and is necessary, but there has been gross misinterpretation. If we limit ourselves to institutionalized science without multiple perspectives, we do ourselves an injustice. What worked in Wyoming was rigorous scientific approach from multiple entities. (Interview 28)*

A rancher and former President of the Idaho Cattle Association agrees that including multiple perspectives is key in decision-making, and suggests that "*the best thing is to sit down with the people involved, and letting them make that call.*" For him, this is "*a far better scenario than what we've been doing through the courts and having a judge make that decision.*"

Although he also acknowledges that those with extreme positions may not accept such a collaborative arrangement, he addresses this with a jab at the politics surrounding the 2016 presidential election: "*I think you end up in a room with a bunch of people—let the fringes run for President—and let the people in the middle figure something out. . . . It's important that you find that common middle ground, and then start from there*" (Interview 49).

The Chairman of Wyoming's Sage Grouse Implementation Team (SGIT) agreed that having diverse perspectives involved in reviewing the science was critical:

> *One thing about this collaborative process, which I think is never stated, but is incredibly powerful—is that having all those eyes on what is called the science is so valuable. Because you take people that, they may not be a botanist, but they have the analytical ability to look at the statements and throw the BS flag, and go 'whoa, whoa, wait a minute.' (Interview 33)*

Beyond being helpful in reviewing the evidence, those diverse perspectives are important for understanding how BAS might be interpreted and applied. Even once you have the BAS, and you know it was done correctly, "*that doesn't mean there aren't a range of options within that,*" comments the sage grouse expert at Wyoming Fish and Game. "*[BAS] gets tossed around as a black and white answer . . . it's not, it requires interpretation,*" he explains (Interview 42). A BLM official concurred: "*Science legitimacy is important, but the decision itself needs to be sustainable,*" and that is an important reason for having stakeholders at the table. "*Multiple Use is not for wimps,*" he added, and then quipped "*I should get a t-shirt made with that*" (Interview 16).

Table 8. Participant responses regarding the policy considerations relevant to discussions of BAS.

	Participants	Availability of Information	Decision Requirements	Adaptive Management Practices	Judgement Required	Diverse Perspectives Considered	Makes Sense	Legally Defensible	Impacts Measurable
Agency	19	8	6	5	5	3	1	1	1
Environment	6	2	2	3	2	1	0	0	0
Industry	11	4	2	1	1	3	2	0	0
Local Official	5	4	3	5	0	0	2	1	0
Scientist	8	5	3	2	2	1	0	1	0
State	15	10	5	3	5	3	0	0	1
Total	**64**	**33**	**21**	**19**	**15**	**11**	**5**	**3**	**2**

Application of Information

Addressing how BAS was applied in a management context was mentioned by at least half of the respondents as necessary for defining the concept (Table 9). Even if information was technically accurate, if it was not applicable to the problem and purpose at hand, it was not going to be helpful in making policy decisions (34 responses). According to 13 respondents, the BAS needs to match the ecological context of management in terms of chosen parameters and the scale of analysis, while 14 respondents cautioned that interpretation was required in order to understand how to apply BAS to the situation at hand.

More than half of the state (9 of 15) and federal agency (12 of 19) officials and scientists (6 of 8) addressed the idea that the BAS needed to be applicable to the specific problem and purpose being considered, and a small handful of these same groups commented that once you had BAS, it still needed to be interpreted for its application to the decision being made and evaluated to see if it appropriately matched the ecological context in scale and scope. The number of responses from industry representatives and local government officials was lower on this theme area, despite likely being an important consideration from their point of view—that decisions take into account local variation in context. In other sections of the interview, this was

a topic often addressed, but for some reason it did not come up for these participants when trying to explain the meaning of BAS,

The biggest issues that emerged on this front had to do with available nesting cover for sage grouse, and guidelines commonly referred to as the "7-inch stubble height" that ranchers worried would be applied too stringently in a landscape that was highly variable—where in some places they may not be able to grow seven inches of grass in the first place, let alone have that much left over after grazing to provide nesting cover. One Wyoming state official explained that in order to ensure that scientific evidence was being properly applied to the local context, that:

> *It's important for us to dig into that science, and to understand what it really says and make smart decisions out there, and have the right people at the table to help you make those decisions against all of the science. Because, one piece of science may suggest one thing, and put up against another landscape or another issue, it may be the wrong thing for the bird, or for that landscape. And we have to be sensitive to that. (Interview 38)*

The Director of the Thunder Basin Prairie Ecosystem Association was also critical of science that might be well done, but not well-suited for the practical purpose of making a decision:

> *Where it is important to the decision, [science] better be the best you can do. But whether it can help is another thing. For example, the sagebrush cover map—use the "best available" information, but best available for what purpose? There's the LANDFIRE series, which is locally flawed, but is probably the best available from a national perspective. But in terms of prescribing management in northeast Wyoming, it's not great. (Interview 26)*

An official from Wyoming Game and Fish Department highlighted that often, scientific studies could also be so narrow in scope as to preclude its usefulness in decision-making: "*there are a lot of pretty narrow studies that don't consider integrated systems. For example, the*

National Technical Team report. [That] report was helpful, but you need a landscape perspective" (Interview 41).

The official continued with another example—the controversial provision in Wyoming's sage grouse plan to maintain a 0.6 mile buffer around leks to protect the lekking males, instead of the much larger 4-mile nesting and brood-rearing buffer promoted by the BLM. Those involved with the Wyoming plan are quick to point out that it includes a separate 5.3 mile buffer to protect nesting and brood-rearing females—that the different buffers also contain different requirements that make the various versions largely equal in the protection they offer (Interview 33). Responding to this, the Game and Fish official comments that the Wyoming plan protects around 85% of the birds, and that "*we struggle with absolutes.*" Ground-truthing, she says, is critical for figuring out how to develop the most appropriate regulations. She summed it up as "*it's about using your brain to make decisions,*" (Interview 41).

Table 9. Participant responses regarding the application of BAS.

Participants	Applicable to Problem and Purpose	Interpretation Required	Ecological Context
Agency	19	12	3	2
Environment	6	1	0	0
Industry	11	4	3	1
Local Official	5	2	0	1
Scientist	8	6	3	3
State	15	9	5	6
Grand Total	**64**	**34**	**14**	**13**

Concerns

Many participants expressed specific concerns about policies requiring decisions based on the BAS. Some of this is captured by the diversity of information that participants suggested should be included when considering the BAS in decision-making (summarized in Table 7).

Other items of concern (Table 10) included the existence of bad science, misinformation, and bias (14 responses), political influences (9), the conceptual ambiguity of BAS (7), that the BAS requires careful consideration to identify and apply properly (5), that decision-makers needed to avoid continuously "changing the goal posts" for management regulations (3), that the volume of scientific information is difficult to keep up with (2), and that the BAS is a poor measure for decision-making (2). No particular patterns emerge in the distribution of these concerns across participant groups, which, considering the low number of total responses within this theme overall (29), is not surprising.

The possibility of bias or poorly developed science swaying management decisions was the dominant area of concern. As NRCS biologist observed that "*science isn't completely free of people's biases . . . so you have to take what you get in that arena, combined with the practical knowledge, what we've learned on the ground that can't be quantified, and that's a lot*" (Interview 23). This perspective seems to suggest that, by pulling from a diversity of sources, the impacts of embedded bias could be reduced. Not everyone shared that seeming optimism. The BAS "*ought to mean that there is a rigorous search for scientific information. . . . But that's not how it works in practice. It's whoever is more aggressive putting their science in front of the agencies involved that will influence the direction the agency takes,*" says the Executive Vice President of the Wyoming Stock Growers Association (Interview 47). So conflicting interest groups contest the science, and fight to have their evidence and their interpretation of the issue be selected by management agencies. "*There's a lot of bad science out there,*" agrees an official with the Wyoming Oil and Gas Conservation Commission, and pointed to collaborative groups like Wyoming's SGIT as a critical tool for assessing the validity of information (Interview 34).

Table 10. Participant responses regarding concerns about the use of BAS in decision-making.

	Participants	Bad Science, Misinformation, and Bias	Political Influences	Ambiguity of Concept	Careful Consideration	Avoid Changing Goal Posts	Volume of Information	Poor Measure
Agency	19	3	3	0	2	0	1	0
Environment	6	0	1	1	0	0	0	0
Industry	11	3	1	3	0	0	0	1
Local Official	5	1	0	0	0	1	0	0
Scientist	8	2	2	1	1	0	1	0
State	15	5	2	2	2	2	0	1
Total	**64**	**14**	**9**	**7**	**5**	**3**	**2**	**2**

Discussion

Because of the technical nature of scientific information, it is not surprising that most respondents answered the question 'how do you define the BAS?' with some consideration with technical validity, and these were often the most immediate responses. Similarly, the fact that almost as many respondents followed up with reflections on the policy considerations related to BAS is understandable given that all of the respondents were involved in management efforts related to the ESA, and the law's reliance on BAS in decisions.

Commonalities

Comparing responses among groups was interesting partially due to variation between the groups, but also because of the general agreement on the technical requirements of what should be considered the BAS—two-thirds of those responses cited something along the lines that BAS required the use of rigorous methodologies and credible analysis, while a third specified formal peer-review as the hurdle that BAS must clear. However, it is very possible, and even likely, that despite wide agreement on the general definition of BAS, participants would disagree on whether a particular study or piece of information should count as the BAS. In addition to the perceptual filters and biases that influence everyone to a degree, this is because,

as most respondents suggested, there is more to the idea of BAS than technical validity. One must also address whether the information is applicable to the problem at hand, whether it operates at the appropriate scale and ecological context, and whether multiple disciplinary perspectives were considered and consulted in seeking out the BAS, or if the information that is needed is even available.

Further, as many respondents pointed out, it is impossible to remove the BAS from the decision context in which it is sought, and so the concept, for many, is a policy (and politics) oriented one as well as technical. One must interpret the information and apply it to the problem in the interest of addressing that problem. The quality and rigor of that information, in a technical sense, is only one part of that equation, and one where scientific expertise and the opinion of the scientific community is useful in addressing its credibility. The interpretation and application of the information, are at least partially policy decisions, and so require political credibility. This was addressed by the 26 participants who either commented that using and applying BAS requires human judgement (15) or that diverse perspectives must be considered (11) (Table 4). Having diverse perspectives at the table to help inform that judgement when the BAS is being considered, interpreted, and applied, helps to create that sense of political credibility, as well as providing an opportunity for faults, biases, or errors in the BAS to be noticed and discussed in a shared forum.

Some of those policy and political considerations were in evidence in many participant comments that did not directly assess the technical validity of information, such as the many comments that brought up the diversity of information that should be included in the description of BAS (Table 3). The top three responses in this category were that the BAS should include the integration of diverse types of information (20), that it should include all available information

(12), and that it should include local knowledge and anecdotal information (13). These ideas are somewhat in conflict with the ideas expressed regarding the technical validity of BAS seen in Table 2, and many participants across all stakeholder groups included both types of comments in their responses. This suggests a tension between traditional, technocratic visions of what the BAS might be, and a more nuanced and practical perspective that sees multiple types of information as important for forming a decision. Listing decisions under the ESA are supposed to be made based on BAS, but exist in a management environment in which many types of information are useful and important.

Similarly, most ESA decisions are made with little available information about the species in question, a point identified by more than half of the participants (33, Table 4) who said the availability of needed information was an important consideration in determining what BAS is for a given decision. The sage grouse, as referenced by one of the participants, is one of the most-studied species we have, and critical information is still missing. Decisions must still be made, both under the ESA and elsewhere, whether such information is known or not, which is addressed in the support vocalized for adaptive management practices, which is spread across stakeholder groups (19 responses).

Stakeholder Differences

It is notable though, that while all of the scientists pointed to peer review as the bar for BAS to clear, only half of state and federal officials did so, and none of the local officials recommended using this metric (Table 2). Combined with the responses regarding policy considerations (Table 3), in which concerns about the availability of the desired scientific information were most often brought up by state and federal agency officials, it is possible that

this group had experience enough to recognize that peer-review may be too rigid of a bar in many cases in which there is little information to go on. That being said, several respondents maintained that peer-reviewed science must be the basis for decisions, whether from a quality control or a political interest perspective, it is difficult to assess. Overall, the general theme for many other participants, including state and federal officials, scientists, and local government, was that decisions needed to be made using the information that was available, while maintaining flexibility to incorporate future advances in scientific understanding—that complex decisions involving a high degree of uncertainty needed to include an element of adaptive management, as noted above.

Conclusion

While there is general agreement regarding measures to assess the technical validity of scientific information, there was also substantial discussion among participants regarding the nature and limitations of the BAS concept. It was clear that for many, the idea of basing policy decisions on BAS was a valuable start, but insufficient when those decisions are inherently political. A more detailed study of these ideas would likely find more variation among stakeholder groups regarding opinions about BAS and BAS-based policy decisions, but this analysis finds that there is widespread acknowledgement that the use and application of science and evidence is not a purely technical matter, and requires consideration diverse types of information and knowledge, the specific decision and policy context, and a host of specific concerns about bias, bad science, policy outcomes, and political influence.

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Chapter 5—Conclusion

The goal of this dissertation was to evaluate how proactive, collaborative conservation efforts aimed at avoiding an ESA listing addressed the use of science across three major challenges in the implementation of the Act. Those challenges were the use of collaboration to manage conflict across diverse institutions, the use of voluntary conservation programs to address the alienation of private landowners under the ESA, and the implications that diverse interpretations of the "best available science" standard have for conflicts about science in ESA issues.

Diverse Institutions and Collaboration

In Oregon, there were three large efforts aimed at conserving sage grouse and avoiding an ESA listing: the Governor's Sage Grouse Conservation Partnership (SageCon), the Oregon BLM RMPA process, and the development of the Harney County CCAA for private landowners. The institutions that lead these efforts vary widely in their goals, operational context, and approach toward collaborative processes. These variations contribute to the different responses stakeholders expressed toward the manner that discussions about scientific evidence regarding threats to sage grouse and possible conservation actions were approached in the three efforts. The efforts of both SageCon and the BLM aimed to provide the regulatory certainty of protections for sage grouse that the FWS noted was missing in the COT report (U.S. Fish and Wildlife Service, 2013), but the BLM faced a much more adversarial legal context, and thus legal defensibility was a high priority in its approach to developing the RMPAs. As a result, the agency was wary of experimenting outside of established operating procedures, and based its

planning on the more established science underlying its Habitat Assessment Framework. Further, the BLM, as the largest manager of sage grouse habitat range-wide and operating within a regional and national context, needed to address a broader suite of both ecosystem and habitat level threats to sage grouse, and did not have the luxury of avoiding the topic of grazing impacts in the same way that SageCon could. Further, its size and national scope meant that the BLM was more limited in the level of flexibility and involvement it could offer local stakeholders on the ground when it came to discussion of scientific evidence and analysis.

SageCon, operating at the state level, chose to focus its efforts on creating a regulatory framework to address habitat disturbance created by infrastructure development and mitigation of such disturbances. As a result, SageCon was able to largely avoid topics like grazing and predation. This approach angered some stakeholders, who felt that the state unfairly limited the scope and direction of discussion, but several others saw the SageCon effort as a success for focusing on what stakeholders had in common rather than what divided them. This more confined approach to sage grouse management also led to a narrower, utilitarian consideration of science and therefore there were fewer opportunities for stakeholders to engage in more active discussions of the scientific evidence being incorporated into the plan.

The goal for the Harney County CCAA Steering Committee in developing their CCAA was aimed at providing protections for landowners in the community, where ranching was a dominant industry. With a local history of collaboration stemming from the Malheur National Wildlife Refuge's 2013 Comprehensive Conservation Plan, members of the Steering Committee were able to combine positive working relationships, the administrative resources of the local SWCD, and technical assistance from the Agriculture Research Center in Burns into a creative solution that satisfied both area ranchers and agency staff. The local focus and voluntary nature

of the agreement meant that the Steering Committee, aside from a few roadblocks, was free to engage in an in-depth review of sage grouse science and be open to different perspectives on the issues, as well as to experimental approaches that could work in the ranchers' favor. Over time, and it did require time, the group was able to develop a shared understanding of the science and develop a plan that applied that science to the local ecological and social context. When conflicts inevitably arose, the relationships established appeared strong enough to work through those conflicts and then move on in completing the plan. Partially, this success resulted from the inclusion of additional organizations, including the Harney SWCD and NRCS offices and the EOARC, which could act as trusted intermediaries between ranchers and the FWS, as well as the flexibility offered by the Oregon FWS office in support of the agreements.

Encouraging Voluntary Conservation on Private Land

In reviewing the experiences of those involved in the development of the three programmatic CCAAs in Idaho, Oregon, and Wyoming, relationships and trust were found to be critically important in negotiating the scientific evidence regarding species threats and possible conservation actions for inclusion in the agreements. The West Central LWG's experience in Idaho serves as a valuable cautionary tale for the difficulties of creating a CCAA. When already-strained relationships reached an impasse over conservation actions and trust was broken, the effort fell apart. At least partially, this appears to have been the result of divergent goals for the agreement on the part of ranchers and FWS officials, as well as miscommunication in the final steps of the agreement's development.

As was also found in the case of the Harney County CCAA in Oregon, a positive development for the Wyoming FWS' statewide CCAA was the decision to allow other, more

trusted agencies to work with landowners on SSP development and implementation. The CCAA itself, once narrowed to focus on livestock grazing, was developed with relatively little conflict. Partially, this was the benefit of a comparatively closed process—the Wyoming FWS office led plan development, but actively sought out input from other agencies as well as grazing industry organizations. Grazing industry representatives do not appear to have engaged deeply when it came to the scientific evidence, but instead made it clear what could and could not work for their members—advice that the Wyoming FWS appears to have taken seriously in their plan development.

While a variety of factors were involved in the variable outcomes of these CCAA development efforts, it is notable that the effort with the most open negotiation of scientific evidence in discussions of threats and conservation actions—Harney County—also saw the most success in terms of landowner enrollment, while the least successful effort in West Central Idaho fractured under the pressure of similar discussions when landowners lost trust in the administrating agencies. Meanwhile, the moderate success experienced by Wyoming suggests that in some cases, established trust and on-going consultative relationships can stand in for wider participation in plan negotiation—although it may not achieve the same level of buy-in on the ground level.

Defining the "Best Available Science"

While initial analysis demonstrates a considerable amount of agreement regarding the importance of technical validity of scientific information among participants, the most consistent response was the general agreement by most that scientific and technical information is not enough to fully inform policy and management decisions. While many participants would

probably disagree on how to interpret a specific piece of information, they acknowledged the value of having multiple perspectives present at the decision making table in order ensure that the information is appropriate to the specific context at hand. Allowing for the consideration of such a diversity of perspectives, or an "extended peer community" in the language of post-normal science, also ensures that if there are conflicts about bias or political influence in the interpretation and application of scientific information, these will be raised and potentially addressed in advance.

Cross-Study Themes and Management Implications

Some themes and patterns became apparent across the three studies included in this dissertation. If the results here are any indication, stakeholders in environmental management decisions are increasingly moving beyond traditional inform-and-comment procedures and demanding a role for collaboration. And in those collaborative environments, the discussion of how to evaluate, interpret, and apply scientific evidence is different than it is in other contexts. Room must be made for diverse perspectives to be considered, even if they are not a part of the decision in the end—and having diverse perspectives reviewing evidence increases the likelihood that the ultimate decision is grounded in a reasonably accurate interpretation of the available evidence. The themes below present a set of "lessons learned" from the cases studied in this dissertation, which could help improve the odds for future efforts in proactive conservation.

Collaboration and Post-Normal Science

In order to be applied to a problem, science must be first evaluated for technical validity and interpreted according to the parameters and constraints of the problem and

context. To do so successfully in the context of broad, "wicked" problems requires consideration of a diverse set of values, perspectives, and knowledge from the stakeholders involved. To successfully integrate these considerations together with a multi-disciplinary scientific analysis in the context of limited and uncertain information, and of contested values and competing policy agendas requires trusting relationships, effective communication and facilitation are required, as well as flexibility on all sides. The value of such "extended peer communities," as promoted in the practices of post-normal science, lay in the opportunity for conflicts and disagreements about scientific evidence to be placed in the open for all to weigh and debate. The increase in trust contributes to stronger long-term relationships among stakeholders, and a greater ability to withstand conflicts in the future.

Goodwill, Trust, and Relationships

Managers have come to recognize that stakeholder participation and collaboration is critical to effective and successful decision-making, but the skills and resources to accomplish these have yet to catch up in practice. These case studies demonstrate that the science behind sage grouse management decisions, though substantial compared to many other species considered for ESA listing, is not complete and uncertainty is high with regards to several important system components like wildfire and invasive species. With goodwill and established trust among stakeholders, it is possible to work through the scientific evidence and develop a mutual understanding and basis for shared action, as seen especially in the case of the Harney County CCAA Steering Committee. However, while such trust and goodwill can help stakeholders to weather some conflicts, they are

also fragile, as and require on-going care if they are to persist, as was discovered in the West Central LWG in Idaho.

Goals, Context, and Shared Understanding

Identifying the goals and context for decision making is also critical. Doing so helps to set the bounds of what topics and information might be considered, and limit the potential for conflict. SageCon, while it had its critics, was able to set its focus on a specific goal after a period of ambiguity. Taking its lead from the Oregon FWS office, SageCon's conveners stepped around the controversial issue of grazing by focusing efforts on developing regulatory measures to limit disturbance and development near leks and other sensitive habitat areas. It is possible that there may have been less conflict if the conveners were able to identify this focus from the beginning, and made it clear to everyone involved, but they were successful in accomplishing their goals.

In the case of the West Central LWG, it appears that the ranchers and agency personnel involved had different perspectives toward the goals of the CCAA, and what the ultimate focus of the agreement should be. While ranchers were mostly concerned with protecting their future operations, FWS staff saw the agreement in terms of addressing systemic habitat threats. Both factors are important for a voluntary conservation agreement, but the lack of a shared understanding of the problem prevented the ability to find common ground.

The most helpful comparison for the West Central CCAA is perhaps not the Harney County CCAA, which had the benefit of a history of successful local collaboration, supportive leadership from the state FWS office, as well as the opportunity

for joint gains through juniper removal programs. Instead, it may be more appropriate to look to the experience of the Wyoming CCAA. In Wyoming, the development of the CCAA was less collaborative in terms of deep participation by stakeholders, but the state FWS office was able to incorporate feedback from ranching organizations in order to create an agreement that balanced both landowner needs and conservation goals. As a result, conservation actions were undertaken and documented on thousands of acres of sage grouse habitat, and landowners had access to regulatory protection under the ESA—despite lingering disagreements regarding some of the threats facing sage grouse.

Institutional Identity

For the federal agencies involved in proactive sage grouse conservation and management, the process exposed entrenched differences in institutional identities and capacities for collaborative engagement. The FWS, in its role of implementing the ESA, has historically been viewed with suspicion by stakeholders as a regulatory presence. This is not helped by the agency's lack of historical relationships on the ground in local communities, but greater support for proactive and collaborative management efforts for at-risk species may help to change this in time. In the meantime, the experiences in Oregon and Wyoming showed the value of partnering with the much more popular NRCS, which in addition to long-standing community relationships also has access to funding mechanisms available through the Farm Bill.

Between the BLM and the Forest Service, the two federal land management agencies responsible for large areas of sage grouse habitat on public lands, the BLM featured more prominently in these case studies. Compared to the FWS and NRCS, the

BLM was more heavily criticized by stakeholders for its lack of collaborative engagement in Oregon as well as by those involved with developing CCAs for public lands in Idaho and Wyoming. Some interview participants expressed sympathy for the agency's constraints, and suggested that its large size, entrenched bureaucratic identity, and vulnerability to legal challenges made it more difficult for the BLM to engage as freely in experimental collaboration. That being said, it is clear that stakeholders involved with land management decisions are beginning to not only consider collaboration as an option, but to expect it to be a part of the decision process. In Oregon, stakeholders are well-versed in collaborative engagement, and often participate in multiple projects at once, both locally and at the state level. The relative absence of such opportunities in the RMPA process was noticeable for these stakeholders, and was a consistent object of criticism.

While the Oregon BLM office made efforts in this area, it was still constrained by the agency's regional and national agenda, a factor that did not go unnoticed by the other members of SageCon and the ranchers involved with the Oregon Cattlemen's Association effort to create a CCA for public lands. The pressure for increased flexibility and participation in decision-making seems likely to increase, and as the Oregon BLM's Mike Haske pointed out, the agency is in a state of transition toward collaboration. It is possible that the sage grouse experience will be for the BLM what the spotted owl was for the Forest Service—a harbinger of widespread changes in institutional identity and operational practices.

Communication

Effective communication is key in order to avoid unnecessary conflict. Considering the relatively recent inroads that FWS has made into more collaborative, proactive conservation work, it is not surprising that the agency has and will continue to make mistakes. Agency staff members confided that although they believed in collaboration as a concept, they felt ill-prepared for the social and political complexities involved in sage grouse planning efforts. This aligned with the critiques that stakeholders had for some of the agency's actions—they could understand why FWS would say or do something in the context of sage grouse conservation outcomes, but were flustered by the way agency staff approached stakeholder relationships or plan negotiation. This was the case for Royce Schwenkfelder in the West Central LWG in Idaho, who complained that the FWS would not accept that after a certain point, landowners would not see the value of participating in a CCAA agreement if you asked too much from them. The details of his own site specific plan aside, the lack of any participation by landowners in the West Central CCAA after years of development and communication is troubling. In addition, the residual anger and frustration observed in multiple participants in the West Central suggests that any future efforts at collaboration in the region will face an uphill battle when it comes to restoring or improving stakeholder relationships.

Trust and Relationships

Building trusting relationships takes time and effort. It requires effective communications and agencies that are able and willing to engage with stakeholders in an open and flexible manner about the nature of the problem, the constraints involved in

addressing the problem, possible actions that could be taken, and the potential consequences of those actions. It requires taking the experiences and perspectives of diverse stakeholders seriously, and giving them fair consideration. That does not mean that decisions must be universally supported by all stakeholders, which is not feasible in cases with competing values and policy priorities. However, although some stakeholders may not be happy with a particular decision, most should be satisfied that their needs and interests were taken to account.

Use and Limitations of Science

Scientific evidence and expertise is critical in discussions of land and resource management. It provides information about the current state of resources, the nature of environmental challenges, and the potential impacts of management decisions on the larger ecological system. However, as has often been said, while science can inform a complex and controversial decision, it cannot make the decision for us. Such decisions, in addition to science, require considerations of diverse sets of values and priorities and therefore involve professional judgement. And, in the cases of incomplete or contested science that are the norm in environmental management, the role for such judgement only increases. Acknowledging the role of professional judgement makes decisions that are often portrayed as technical or "science-based" concerns will not eliminate controversy or even contested information—but it will help to bring those controversies and debates about information into the open where differences in policy preferences can more be more readily addressed.

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Appendix A: Interview Protocol

1. Can you tell me about your experiences with the state's sage grouse conservation efforts?
2. How has science and/or technical expertise been used in this process? Can you tell me about the way scientific information is discussed?
3. What challenges were there in using available information?
4. Have you worked directly with any scientists as part of these efforts? Who? In what way? What did you think of those experiences? Have these experiences affected the way you view the issues involved? What about other participants in the process?
5. Have there been any disagreements about scientific information or the way it has been used in the process? Can you tell me about any specific examples?
6. Do you think that diverse types of knowledge and information have been fairly considered and discussed in the process? Are there any specific examples that you can think of?
7. Based on your experience, what is the appropriate role for science and/or technical expertise in an issue like this?
8. What was the biggest challenge in these efforts?
9. What were the high and low points of this process for you? Would you participate in a similar process in the future?
10. What does using 'the best available science' mean to you?
11. Is it practical for management decisions, such as those regarding sage grouse conservation under the Endangered Species Act, to be purely based on science? Why/why not?
12. If there were 1-2 individuals that you would recommend as being crucial to talk to in this study in order to get a complete picture of the process, who would they be?

Appendix B: Analytic Codebook

Chapter 2 Coding Themes: *Science, Collaboration, and Sage Grouse: Proactive conservation efforts in Oregon*

CODE	DEFINITION	EXAMPLE
Goals		
Regulatory Certainty	Planning goal is to address lack of regulatory protections for sage grouse--identified by the FWS as a critical consideration for the listing decision.	*Main concerns: How to provide documentation for FWS that adequate regulatory mechanisms are in place to prevent disturbance.*
Legal Defensibility	Planning goal is to make decisions that can be defended against legal challenge	*At the end of the day, you better be defensible in a court of law.*
Regulatory Protection	Planning goal is to provide opportunities for individuals avoid increased regulatory burden in the event of an ESA listing.	*We have all eight counties, that have sage grouse habitat, they were able to offer to their private landowners protection and certainty under CCAA agreement.*
Content		
Species Threats	Threats to the availability of necessary cover, food sources; loss to predators, habitat disturbance, etc.	*While it may be based in perfectly good science,*" commented one FWS official, "*in the end it is a sage grouse plan, after all*.
Ecosystem Threats	Threats to landscape-level ecosystems, including wildfire, invasive species, encroaching conifers, climate change	*We have an ecosystem in transition, and it's a transition that we would prefer to avoid. So we need to deal with the ecosystem ecologically, not one species at a time.*

Scale		
County	Activities and responsibilities primarily relate to the county level	*The other counties heard the buzz that was building, and saw the Harney CCAA as a tool to provide some greater protection and certainty in the face of a potential listing. Within 90 days of the Harney CCAA signing, all seven of the other counties had repurposed the original Harney County document*
State	Activities and responsibilities primarily relate to the state level	*Oregon has the luxury, if you want to call it that, of only caring about Oregon.*
Regional	Activities and responsibilities primarily relate to the regional level	*There were lots of meetings and communication among the "federal family," lots of desire for consistency across state lines.*
National	Activities and responsibilities primarily relate to the national level	*So the BLM, it's really challenging for them, because they've got to roll up whatever we do here across the range, and then across the nation, the same with the FWS.*
Collaborative History		
Low	Little/no experience with collaboration, reliance on inform/comment model	*We're in a paradigm shift right now, with the growing focus on collaborative process…*
Medium	Some limited experience with collaboration	*In 2010, the Oregon Governor's office and the BLM's Oregon office began convening meetings in response to growth in renewable energy development and sagebrush conservation . . . The partners were driven by the need to develop a coordinated picture of ongoing and projected efforts . . . to address threats not just to sage-grouse conservation but to rangeland and rural community health.*
High	Extensive participation in collaboration	*To me, we've lived and breathed collaboration on several fronts, not just sage grouse. We know what it looks like…it's difficult, it's challenging, there's lots of meetings, lots of time, but we know it…we see the beauty and the benefit of it.*

Process (Derived from Weible, 2008)		
Unitary	Single authoritative decision maker, limited opposition	*It was frustrating because I personally—and I think many other stakeholders—were making a pretty genuine effort to assist the state in developing a plan that would be doable, effective, all those things—and it seemed like it was still a very top-down process, where at that higher level, they had already in their minds what they intended that plan to look like and were not particularly going to budge from that.*
Adversarial	Single decision maker, competing coalitions	*When you have a not-truly collaborative effort, missing those key ingredients…then at the outcome people start to attack the outcome. And that's exactly what we're seeing, on the state level across the West, and with the BLM plans across the West—because it wasn't successful collaboration, people are attacking the outcomes.*
Collaborative	Shared decision authority, joint gains sought	*When you have a true collaborative effort, you have good ground rules, stated rules and timelines, so that at the end, the group is comfortable with the outcome, and defends that outcome, individually and collectively.*
Use of Science (Derived from Weible, 2008)		
Political	Using information to legitimize previous decisions or preferences	*Predators! Here's where there was a lot of disagreement about the science, with competing scientific evidence that folks would cling to dependent on their perspective.*
Instrumental	Traditional rational ideal of using information to structure decision-making	*Where's the birds, where's the habitat, what's good, and what's bad. So science gave us the framework to start the conversation. And then we tried to figure out, in my mind, how to do the right thing for the bird and the habitat. But, to do it in a way, that we could document that it was scientifically valid.*
Learning	Long-term evolution of policy preferences, development of shared understanding among stakeholders	*But the CCAA was an open process. We made a point of tackling ticklish situation . . . we did a lot of "what-if" scenarios down in the basement. Well, what if you put a pivot in (i.e. for alfalfa)? Is that going to be allowed under the CCAA? And then the landowners and the FWS would go over and try to figure out where the answer to that question was.*

Chapter 3 Coding Themes: *Candidate Conservation Agreements with Assurances: Post-normal science and opportunities for improved conservation on private land*

CODE	DEFINITION	EXAMPLE
Process Variables		
Information		
Challenges	Challenges encountered in using science in decision-making processes	*Science is not static, not absolute. There is always the challenge of keeping up with new information.*
Interpretation	Scientific information needs to be interpreted, and interpretations can vary	*There is resistance due to the inability to integrate science from various studies and interpret them together—there's huge variability in interpretation and possible conclusions.*
Local Knowledge	Information accumulated by local communities, through living and working in an area over time	*The ranchers out there every day, they can tell you where they're nesting, what their habitats are, etc.*
Role of Science	The function or outcome of the use of scientific information	*Had that research work by the scientists not been done, not been published…that livestock grazing is not only compatible but beneficial, too—that would have fallen on deaf ears.*
Science Disagreement	Topics where stakeholders disagreed about scientific information	*The continuous issue out there that keeps raising its head is the extent of predation impacts, and how that should be addressed or not by management.*

<u>Social</u>		
Relationships	Established interpersonal connections among stakeholders	*The PEA lost a key person from FWS, and the new person had their own views, so it took a year to recuperate from that and to reestablish the relationship.*
Communication	Exchange of thoughts, views, and information	*By framing it the problem through vegetation communities, the conversation is easier to have with the ranchers.*
System Variables		
Agencies	Administrative agencies tasked with implementing policy and management decisions	*ESA is only as good as the people that administer it. So that's FWS, in cooperation with state agencies. S*
Decisions	Policy choices	*Not all political decisions are bad, but when it comes to SG, it seems to me political decisions are bad.*
Legal Challenge	The use of lawsuits to challenge policy and management decisions	*The BLM was watching this . . . thinking, do we follow the Idaho plan, or is Western Watersheds going to sue us?*
Politics	The pursuit of power and control in government institutions	*The legislature seems to have it in for IDFG and their budget. .*
Private Land	Lands under private, non-federal ownership	*So SG are dependent on private land. We needed them . . . the SG needed them.*
Sage Grouse Threats	Conditions or activities that cause harm to sage grouse and their habitat	*Grazing per se is not a threat, it's the mismanagement of grazing that's a threat, and that's what the BAS tells us.*

Chapter 3 Coding Themes: *Candidate Conservation Agreements with Assurances: Post-normal science and opportunities for improved conservation on private land*

CODE	DEFINITION	EXAMPLE
Technical Validity of Information		
Rigorous and Credible	Information was created/developed according to trusted and acceptable scientific methodology	*If the science is sound and can be replicated, then that's what makes it the BAS.*
Peer-Review	Evaluation of scientific information by scientists in the appropriate field	*What reflects the peer-reviewed literature [is the BAS]. The system is not perfect, but that is where we have the best chance at getting at something close to the truth.*
Perspective of Scientific Literature and Scientific Community	How well an idea or analysis is supported by other published work and other experts in its field	*What does the rest of the literature say? Are there studies with different results?*
Published in Reputable Source	Source is trusted and reliable in publishing high-quality information	*From a nuts and bolts standpoint . . . peer-reviewed, published in standard, reputable journals.*
Expert Advising	Technical support and advising by scientific experts	*I rely on my experts to tell me what the good science is!*
Unbiased Source	Source is fair and impartial	*We should be able to get a decision and an interpretation of the science from an entity that is able to have the appropriate expertise without a conflict of interest with the decision at hand.*

Other Vetting Process	Evaluation of information validity by means other than technical peer-review	*Call it a vetting process, because peer review is so specific.*
Diversity of Information		
Integration of Diverse Information	Bringing together information from variety of sources, fields, and scales	*What worked in Wyoming was rigorous scientific approach from multiple entities.*
All Available Information	All information available to decision-makers	*We were transparent and open about looking at all information, independent of where it came from, and being ready and willing to assess the credibility of that information.*
Local and Anecdotal Knowledge	Information that is developed and maintained by local communities, through living and working in an area over time	*What my parents see on a daily basis at Big Piney has as much bearing to me as what the biologist counts in January, for deer.*
Human Dimensions Concerns	Social, economic, and political concerns	*Best available [science] does not equal truth. You have to use what you have, but be careful with the social considerations.*
Agency Reports and Monitoring Data	Data and analytic products created by agency officials to inform management decisions	*[BAS] includes peer-review literature and grey literature from agency reports.*
New and Emerging Science	Scientific information that is recently developed or in the process of emerging	*They've got this highly developed HAF, they've got this less developed fire science, but it's here. W*
Management Experience	Cumulative knowledge of operations by managers over time	*BAS is also informed by past practices and experience.*

Industry Science and Technology	Scientific information and technology developed by private economic organizations	*There is more recent and better science done by industry scientists. It looks at what's published and peer-reviewed, all the data since 1940. It's the most applicable, robust, and recent analysis.*
Multi-Disciplinary Perspectives	Combining multiple fields of learning and analytic perspectives	*One of the big issues with sage grouse is that you have range science and wildlife biology. And they, for the most part, you can go through either program and never learn anything about the other.*
Identification of Unknowns	Assessment of information that is missing or poorly understood	*Identifying unknowns can be targeted as BAS.*
Application of Information		
Applicable to Problem and/or Purpose	Whether information use useful for the specific problem or concern under consideration	*For example, the sagebrush cover map—use the "best available" information, but best available for what purpose?*
Information Requires Interpretation	Analyzing and explaining the meaning and significance of information	*Does it pass the straight-face test, would it pass the scrutiny of other experts out there . . . That's why we do peer-review and public comment—if we do get the interpretation wrong, we want to hear about it.*
Appropriate Ecological Context and/or Scale of Analysis	Whether information is relevant to local environmental conditions, or is created at the suitable level of measurement	*Because, one piece of science may suggest one thing, and put up against another landscape or another issue, it may be the wrong thing for the bird, or for that landscape. And we have to be sensitive to that.*
Policy Considerations		
Availability of Information	Information that is readily accessible	*You have to separate the 'Best Available' from 'Good,' because what you have available might not be the best, but it's what you have.*

Specific Decision Needs	Legal requirements, timeline of action	*That's the classic policy-making versus science as a pure effort conundrum, because science has to continue, and to continue to answer questions, and there is no absolute. Whereas policy-making has to happen.*
Adaptive Management Practices	Flexible management structures that can incorporate changing conditions and information	*Sometimes assumptions would be made and circumstantial evidence would be used because that was the best information available. So there was an adaptive management component to the process*
Judgement Required to Make Decisions	Human and/or professional assessment of goals, evidence, and possible outcomes	*Somebody has to sort that out…it's a tough thing to do. But it's a better intention to have in making policy than ignoring the science. So you make decisions based on your best professional judgement.*
Consideration of Diverse Perspectives	Including a variety of viewpoints in discussion	*The BAS is determined kind of determined on a consensus-basis. It all comes down to time, trust, and people working together.*
Policy Action is Sensible	There is a clear relationship between policy goals and actions	*You know, you see lots of little examples where things work out okay, and lots of little examples where things are ridiculous [on science-based decisions]*
Policy Action is Legally Defensible	Policy actions can be effectively defended in court from legal challenge	*Is it comprehensive, and defensible, both in terms of the scientific community and in a litigation environment?*
Impacts are Measurable	Information leads to measurable changes in outcomes	*The BAS is that which has truly measurable impacts on SG, and uses cutting edge information.*

Other Concerns		
Bad Science/ Misinformation/ Bias	Information that was developed with poor techniques, or deceptively spread with the goal of pushing a specific policy choice	*I've seen where litigants have abused the scientific method, brought in utter crap, relied on it in court documents, and the law clerks don't know the difference, right?*
Political Influences on Science	Inappropriate intrusion of political pressure on the development, results, and analysis of scientific information	*There is a huge push to expose scientific papers by petitioning to get peer-review comments in order to discredit the final conclusions.*
Conceptual Ambiguity of 'Best Available Science'	Confusion or uncertainty about the meaning of the BAS concept	*You could quibble with each of those words, "best," "available," and "science."*
Science Requires Careful Consideration	Scientific information must be read closely and thoughtfully assessed	*It's important for us to dig into that science, and to understand what it really says and make smart decisions out there.*
Scientists Should Avoid 'Changing Goal Posts'	Scientists should not continually change criteria for assessing outcomes	*The ESA needs to set a standard and stick with it.*
Volume of Information to Consider	The amount of information available for evaluation	*There is so much information, and it's so hard to keep on top of available science and to know what's applicable to you and the producers you work with.*
'Best Available Science' is a Poor Decision Metric	BAS cannot make decisions alone, other considerations need to be taken into account	*Science legitimacy is important, but the decision itself needs to be sustainable*

Appendix C: Interview Participants

Interview Number	State	Name	Organization	Interview Date	Interview Length	CCAA	SageCon	BLM RMPA
1	OR	Brett Brownscombe	Office of the Governor	10/22/2015	50		X	
2	OR	Dan Morse	Oregon Natural Desert Association	10/5/2015	63	X	X	X
3	OR	Tom Sharp	Harney County CCAA Steering Committee	10/7/2015	122	X	X	
4	OR	John O'Keeffe	Oregon Cattlemen's Association	10/8/2015	73	X	X	X
5	OR	Dr. Chad Boyd	Eastern Oregon Agricultural Research Center	10/6/2015	93	X	X	
6	OR	Jay Kerby	The Nature Conservancy	10/14/2015	130	X	X	
7	OR	FWS Staff 1	USFWS	10/9/2015	79			
8	OR	Jason Kesling	Burns-Paiute Tribe	10/16/2015	68		X	
9	OR	Steven Grasty	Harney County	10/7/2015	66	X	X	
10	OR	Marty Suter-Goold	Harney County SWCD	10/7/2015	63	X	X	X
11	OR	Zola Ryan	Harney County NRCS	10/7/2015	63	X	X	X
12	OR	Jamie Damon	Institute for Natural Resources	11/6/2015	47		X	
13	OR	Catherine MacDonald	The Nature Conservancy	12/2/2015	70		X	
14	OR	Bob Sallinger	Portland Audubon Society	12/1/2015	65	X	X	X
15	OR	NRCS Staff 1	NRCS	11/4/2015	125		X	
16	OR	Mike Haske	BLM	11/3/2015	58		X	X
17	OR	Ron Alvarado	NRCS	11/10/2015	79		X	
18	OR	FWS Staff 2	USFWS	10/4/2015	52		X	
19	OR	Theresa Burcsu	Institute for Natural Resources	11/3/2015	98		X	
20	OR	FWS Staff 3	USFWS	11/4/2015	71			
21	OR	Paul Henson	USFWS	11/5/2015	81	X	X	X
22	OR	FWS Staff 4	USFWS	11/4/2015	67			

23	OR	NRCS Staff 2	NRCS	11/10/2015	79	X
24	WY	Sen. Larry Hicks	WY Legislature	12/13/2015	70	
25	WY	John Espy	Carbon County Board of Commissioners	12/2/2015	56	X
26	WY	David Pellatz	Thunder Basin Grasslands Prairie Ecosystems Association (Director)	12/14/2015	140	X
27	WY	Fred Van Ahrens and Staff	FMC/Tronox	12/11/2015	61	
28	WY	Paul Ulrich	EnCana Energy	12/12/2015	65	
29	WY	Penny Bellah	Samson Energy	12/15/2015	58	
30	WY	Brian Rutledge	Audubon Society	12/8/2015	66	
31	WY	Doug Thompson	City of Lander	12/17/2015	78	
32	WY	John Kennedy	Wyoming Fish and Game Department	12/7/2015	61	
33	WY	Bob Budd	WY Wildlife and NR Trust Fund Board	12/7/2015	124	
34	WY	Mark Watson and Staff	WY Oil/Gas Conservation Commission	12/15/2015	66	X
35	WY	Buddy Green	BLM	12/9/2015	109	
36	WY	Mark Sattelberg	USFWS	12/14/2015	70	X
37	WY	NRCS Staff 3	NRCS	12/15/2015	62	
38	WY	Jerimiah Reiman	Governor's Office	12/7/2015	124	
39	WY	FWS Staff 5	USFWS	12/16/2015	75	X
40	WY	FWS Staff 6	USFWS	12/10/2015	26	X
41	WY	Mary Flanderka	Wyoming Fish and Game Department	12/18/2015	59	
42	WY	Tom Christiansen	Wyoming Fish and Game Department	12/11/2015	82	

43	WY	Dave Freudenthal	Governor's Office (former)	12/18/2015	95	
44	WY	Ryan Lance	Governor's Office (former)	12/18/2015	95	
45	WY	FWS Staff 7	USFWS	4/18/2016	59	X
46	WY	FWS Staff 8	USFWS	4/19/2016	83	X
47	WY	Jim Magagna	Wyoming Stock Growers Association	8/25/2016	53	
48	ID	Stephen G. Leonard	Cowdance Range and Riparian Consulting	3/14/2016	105	X
49	ID	Richard Savage	Idaho Cattle Association	3/10/2016	98	
50	ID	Dustin Miller	Idaho Office of Species Conservation	3/7/2016	77	X
51	ID	Joshua Uriarte	Idaho Office of Species Conservation	3/7/2016	77	X
52	ID	Don Kemner	IDFG	3/7/2016	61	X
53	ID	Alan Sands	TNC	3/9/2016	174	X
54	ID	Royce Schwenkfelder	West Central LWG	3/9/2016	47	X
55	ID	NRCS Staff 4	NRCS	3/8/2016	87	X
56	ID	Steven Knick	USGS	3/10/2016	70	X
57	ID	FWS Staff 9	USFWS	3/8/2016	44	X
58	ID	FWS Staff 10	USFWS	3/8/2016	44	X
59	ID	Joe Hinson	Northwest Natural Resource Group, LLC	4/8/2016	114	X
60	ID	Jack Connelly	IDFG	4/14/2016	69	X
61	ID	Steve Sutton	West Central LWG	4/19/2016	52	X
62	ID	Gene Gray	West Central LWG	4/25/2016	59	X

Appendix D: Acronyms and Abbreviations

BLM	Bureau of Land Management
CCAA	Candidate Conservation Agreement with Assurances
CCA	Candidate Conservation Agreement
CCP	Comprehensive Conservation Plan
COT	Conservation Objectives Team
EIS	Environmental Impact Statement
EOARC	Eastern Oregon Agriculture Research Center
ESA	Endangered Species Act
FWS (USFWS)	U.S. Fish and Wildlife Service
HAF	Habitat Assessment Framework
IDFG	Idaho Department of Fish and Game
LWG	Local Working Group
ODFW	Oregon Department of Fish and Wildlife
OSC	Idaho Office of Species Protection
NRCS	Natural Resources Conservation Service
RMPA	Resource Management Plan Amendment
SageCon	Sage-Grouse Conservation Partnership (Oregon)
SSP	Site-Specific Plan
STM	State-and-Transition Model
SWCD	Soil and Water Conservation District
WGFD	Wyoming Game and Fish Department