Western Confluence

Winter 2014 Issue 01

NATURAL RESOURCE SCIENCE AND MANAGEMENT IN THE WEST

The Bird that Brought the West Together

Cattle as Ecosystem Engineers

The Ecology of Fear

A publication of the Ruckelshaus Institute, a division of the University of Wyoming's Haub School of Environment and Natural Resources

Western Confluence

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Twice a year, *Western Confluence* magazine brings you honest, fact-based stories about the research and policies that shape and inform natural resource management and decision making in the West. *Western Confluence* is unbiased, accessible, clear, relevant, and timely, and tells the stories of interdisciplinary, collaborative solutions to our toughest natural resource challenges.

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Western Confluence is published by the Ruckelshaus Institute, a division of the Haub School of Environment and Natural Resources at the University of Wyoming. The Ruckelshaus Institute supports stakeholder-driven solutions to environmental challenges by communicating relevant research and promoting collaborative decision making.

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UNIVERSITY OF WYOMING

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DIRECTOR'S NOTE

By Indy Burke

> "I'm weary and tired. I've done my day's riding. Nighttime is rolling my way.
> The sky's on fire and the light's slowly fading. Peaceful and still ends the day.
> And out on the trail the night birds are calling, singing their wild melody.
> Down in the canyon the cottonwood whispers a song of Wyoming for me."
>
> — *Chris LeDoux*

Grazing in the west has been an important way of life for well over a century, supporting families, inspiring poetry and song, and maintaining open spaces. Over recent decades, grazing has also provoked intense controversy. Differing grazing practices, variable impacts to public lands, and livestock influences on wildlife habitat trigger opposing views. Even the scientific literature is contradictory, with recent articles both demonstrating the positive effect of livestock grazing on biodiversity and landscapes, and excoriating livestock for desertification, erosion, and loss of biological diversity. How can we arrive at sound management solutions for both ranchers and wildlife when there is so much disagreement over what is happening?

"Conservation grazing" is a management tool with potential to resolve some of the conflict. This practice focuses on managing livestock to enhance wildlife habitat in western rangelands while sustaining economic production.

Some ranchers have long stewarded wildlife habitat, and particularly game species. Without using the term, progressive ranchers have implemented a number of conservation grazing strategies. For instance, some ranchers graze goats to reduce weeds. Others have enrolled in conservation easements to preserve habitat and protect ranches from estate taxes. Many ranchers have for years maintained big game habitat and benefitted from hunting revenues.

Meanwhile, changing cattle prices, drought, invasive species, threatened species, energy development, other landscape changes, and shifting government policies and incentives present challenges to ranchers who want to steward wildlife habitat. These stumbling blocks reflect many of the complex natural resources issues of the West. Such challenges include elements of our culture and tradition, public land management strategies and government policy, existing and new scientific knowledge, and uncertainties associated both with our gaps in knowledge, and our inability to predict the dynamic futures of the weather, the economy, and biology.

Scientific approaches investigate how rangeland plants, animals, and landscapes may be enhanced or negatively affected by certain types of grazing. Scientists are measuring how grazing animals interact with biodiversity and ecosystem services, such as water quality and quantity, carbon storage, and soil stability, on rangelands worldwide. Studies of grazing and biodiversity in the western United States have focused particularly on species of concern, for instance the mountain plover, sage grouse, and neotropical birds, as well as less desirable species including weeds like cheatgrass and leafy spurge. This research offers a solid foundation to inform evolving grazing management that can foster increased rangeland biodiversity.

Conservation grazing represents a scientific forefront, a prospect for alternative income for ranchers, the opportunity for wildlife managers to inspire habitat protection across large multi-ownership landscapes and regions, and win-win incentives for private land conservation. But barriers remain preventing its widespread implementation.

The first issue of *Western Confluence* magazine will address these challenges, bringing to light the new and developing scientific knowledge, and presenting, in an unbiased fashion, the multiple perspectives of different resource stakeholders. The magazine will be a junction where academic knowledge can meet on-the-ground natural resource management. We intend for this publication to add critical facts, data, and sound science-based information to efforts to resolve natural resource challenges in the West. Read on to learn more about innovative ways ranchers can apply scientific findings to host rangeland wildlife species, along with other exciting collaborations to maintain open space and understand resource dynamics in the west.

We look forward to hearing what you think of our new magazine. Please share your thoughts, ideas, and criticisms by writing to us at editor@westernconfluence.org.

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GREATER SAGE GROUSE:

The bird that

brought the West together

By Michael Brennan

The greater sage grouse lives in the extensive sagebrush steppe that spans parts of Washington, Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, Colorado, the Dakotas, Alberta and Saskatchewan. As of March 2010, the U.S. Fish and Wildlife Service (FWS) estimated that the species now is found in approximately 160 million acres of land, 56% of its historic range.[1] Wyoming is the stronghold of the species: 54% of the sage grouse in the world can be found in Wyoming on 32 million acres of sagebrush habitat. Wyoming is thus the key to sage grouse conservation.

Collaboration is more easily voiced than embodied when it comes to wildlife conservation in the Rocky Mountain West. Public and private land users and interests, state and federal governments, and the constituencies they serve tend to compete rather than cooperate. For decades battle lines have been drawn between traditional, agrarian perspectives on wildlife conservation and the competing goals and objectives of the modern environmental movement. These lines have been exacerbated by tension between state and federal governments, but efforts to protect sage grouse might be able to break that pattern.

The federal Endangered Species Act (ESA) has triggered endless conflict. The Yellowstone wolf reintroduction, referred to as "the Wolf Wars" by some, offers a prime example in the West. The FWS introduced an experimental population of gray wolves into Yellowstone National Park in 1995, and their subsequent dispersal beyond the Park's boundaries has rekindled conflict over control of wolves and wolf management. In the years leading up to and since wolf reintroduction ranchers filed suits to stop reintroduction or reduce wolf numbers, environmentalists filed suits to strengthen or maintain protections for wolves, and state governments filed suits to delist wolves and transfer management from the FWS to the states. Meanwhile wolves have been listed, downlisted, delisted, relisted, partially delisted, and fully delisted, and the fight continues as vehemently as ever. In spring of 2013 two coalitions of environmental groups were trying to consolidate their suits against the FWS for allowing Wyoming's wolf management plan, and Wyoming Governor Matt Mead is protesting that consolidation. Meanwhile, the FWS has proposed delisting gray wolves across the entire United States, a move opposed by wolf advocates.

The struggle over wolf management reflects much of the history of the ESA, and the high-profile species conflicts with which it is commonly associated—the snail darter, grizzly bear, northern spotted owl, golden-cheeked warbler, Pacific salmon, and the Colorado River squawfish (now known as the northern pikeminnow) to name a few. As species continue to decline in numbers and range, the Act is invoked more and more frequently to arrest further declines and provide additional regulatory protections to support species conservation, and hopefully, to promote species recovery. The various participants in the debate—including conservation and socioeconomic interests—have become adept at pursuing their respective objectives through whatever means available, including efforts to obtain the intervention of the federal judiciary or Congress.

This use of power-based advocacy strategies is not necessarily the most efficient way to accomplish the conservation and recovery of at-risk species. Nor is it a path pre-ordained by, or a necessary result of, the Act itself. It has, however, become "business as usual." At a time when our appreciation of the threats faced by wildlife has expanded dramatically, adoption of a different philosophy regarding the conservation of species at risk is long overdue. Properly viewed, the ESA itself can serve as the inspiration for growth in our approach to conservation.

Perhaps the most valuable role the ESA can play from a societal perspective is to motivate us to avoid a species being listed altogether by accomplishing timely and effective species conservation. In the case of the greater sage grouse, that is exactly what is going on. In contrast to the wolf saga, broad-scale efforts are underway to cut off similar struggles over sage grouse conservation. These activities are of particular interest in Wyoming, in large part because of the potential for sage grouse to affect the cultural and economic future of the state. Wyoming represents the heart of sage grouse country. And, although not as iconic as the gray wolf, a sage grouse listing would have the potential to impact public land uses in Wyoming to a far greater extent than does the wolf.

Recent collaborative initiatives at the state, federal, and local levels show the potential to revolutionize the manner in which at-risk species are conserved in the United States.

It is of course quite possible that sage grouse conservation efforts involving the ESA may follow a path similar to that of the wolf, with vested interests of all persuasions battling it out in various legal and political forums. On the other hand, recent collaborative initiatives at the state, federal and local levels show the potential to revolutionize the manner in which at-risk species are conserved in the United States. The principal question they pose is whether we can learn and act quickly enough to avoid repeating history.

A CONTENTIOUS START FOR GROUSE

The story of the greater sage grouse initially unfolded similarly to that of the wolf. The FWS was first petitioned to list the greater sage grouse as an endangered species in 2002. A second, and then a third, listing petition followed in 2003. Concurrently other efforts were mounted to list western populations of greater sage grouse, leading to administrative action and litigation. FWS ultimately determined that such populations should be evaluated as a part of the greater sage grouse listing process.

In January 2005, FWS announced its decision that the greater sage grouse was neither threatened nor endangered, and that listing thus was not warranted.[2] In 2006, FWS was sued over that decision, and in 2007, the Federal District Court in Idaho overturned the agency's decision.

Upon further review, in 2010 FWS announced that listing the greater sage grouse as a threatened species was warranted, but was precluded by other, higher conservation priorities, a decision that was eventually challenged.[3] FWS currently is reconsidering whether the species should be listed, and that decision is due in 2015.

Sage grouse litigation was not limited to the listing lawsuits mentioned above; other suits were filed challenging the Bureau of Land Management's (BLM) treatment of sage grouse under its resource management plans. Such lawsuits found fertile ground. One challenged 18 resource management plans in Idaho, Montana, Utah, California, Wyoming, and Nevada, on the grounds that BLM had failed to consider the cumulative impacts of BLM's management decisions on sage grouse populations.[4] Another case challenged BLM's environmental impact analysis of increased grazing on 1.4 million acres of sage grouse habitat in southern Idaho given recent fires that burned over 400,000 acres in the area.[5] Both were determined in favor of the plaintiffs, requiring BLM to update plans with greater consideration of impacts to sage grouse.

A timeline of sage grouse conservation

May 1999	July 2000	July 2000	January 2002	July 2002	February 2003
FWS was petitioned to list the Washington population of greater sage grouse as endangered under the Endangered Species Act	Western Association of Fish and Wildlife Agencies signed a Memorandum of Understanding with the FWS, Bureau of Land Management, and the U.S. Forest Service to work on sagebrush ecosystem conservation efforts including sage grouse	Wyoming Governor Jim Geringer created an 18-member Wyoming Sage-Grouse Working Group to develop a statewide sage grouse conservation strategy	FWS was petitioned to list the western subspecies of greater sage grouse as endangered	FWS was petitioned to list the greater sage grouse as endangered across entire range	FWS determined the subpopulations should be evaluated with the whole greater sage grouse population

Legally speaking, in determining whether a species should be listed under the ESA as threatened or endangered, the FWS must consider five factors: (1) threats to its habitat; (2) overconsumption of the species; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence.[6] In considering a listing decision, the Service must limit its review to "the best scientific and commercial data available," taking into account the conservation efforts of states and other entities.[7]

Many conservation efforts underway are relevant to the agency's evaluation of the fourth factor above, namely whether "existing regulatory measures" are adequate to provide for the conservation of the species. To be considered, however, such conservation measures must be concrete, sure to be implemented, and sufficient biologically to protect the species.[8] The weight that could be given to a particular conservation effort—such as a state core area policy—will be based on the degree of certainty that the conservation effort will be implemented and that it will be biologically effective.[9]

WYOMING LEADS THE WAY

Sage grouse conservation efforts at the federal and state levels proceeded at a somewhat desultory pace following the initial listing petitions. BLM issued a "National Sage Grouse Habitat Conservation Strategy" in November 2004, as well as guidance documents pertaining to sage grouse habitat conservation and management. The states, too, had either sage-grouse-specific or general wildlife conservation authorities applicable to the conservation of the species. And in 2006, the Western Association of Fish and Wildlife Agencies issued a "Greater Sage Grouse Comprehensive Conservation Strategy."

The efforts of the time, however, with a few exceptions, did not afford substantial protection for the species. In its 2010 finding FWS concluded that with the possible exception of new conservation strategies adopted by Wyoming and Colorado, the existing state-level sage grouse conservation plans were not sufficient to conserve the species. Similarly, FWS concluded that the sage grouse conservation strategies adopted by the BLM and the U.S. Forest Service did not afford adequate conservation to avoid the need for a listing. In aggregate, FWS found the absence of adequate sage grouse conservation regulatory regimes to be a "significant threat to the species, now and in the foreseeable future."[10]

The Service's 2010 finding notwithstanding, the landscape of sage grouse conservation efforts in Wyoming and elsewhere in the West had begun to change. State fish and wildlife agencies had long managed sage grouse with varying levels of urgency concerning species health. In 2007 the intensity of such efforts ramped up, catalyzed by the creation of a Sage Grouse Implementation Team by the Governor of Wyoming. The team, comprised of representatives of federal, state, and county governments, energy developers, mining companies, private landowners, and conservation organizations, was charged by then-Governor Dave Freudenthal with developing a long-term, science-based cooperative strategy for greater sage grouse conservation.

The team's efforts led Governor Freudenthal to issue Executive Order 2008-02, which established a "core area population strategy," intended to provide meaningful conservation benefits for greater sage grouse. The "Core Area Policy," as it subsequently came to be known, provides that the State of Wyoming will: (1) focus on maintenance and enhancement of sage grouse habitat and populations within the core habitat areas; (2) permit new development within the core areas "only when it can be demonstrated by the state agency that the activity will not cause declines in greater sage grouse populations;" and (3) provide incentives to encourage development outside the core areas.

Eighty-two percent of Wyoming's sage grouse are found within the core areas identified in the Policy, which encompasses federal, state and private lands within Wyoming. The State has broad authority to enforce the Core Area Policy on non-federal land, making this a landmark in sage grouse conservation. The policy was readopted by now-Governor Matt Mead in 2011 as Executive Order 2011-5. FWS endorsed the policy, stating that its full implementation could preclude the need to list the greater sage grouse as an endangered species, depending on what happened with grouse outside Wyoming's borders.

Wyoming led the effort, but is not alone in pursuing increased sage grouse conservation measures modeled along the "core area" concept. In 2008 and 2009 Colorado,[11] Montana,[12] and Utah[13] each resolved to map and adopt a core area protection plan as part of their statewide sage grouse conservation strategies. Oregon implemented a core area strategy in 2011[14] and Idaho in 2012.[15] And in 2011 Secretary of Interior Ken Salazar referenced the Wyoming core area plan in his commitment to have the BLM revise

March 2003	June 2003	December 2003	November 2004	January 2005	July 2006	December 2006	May 2007
FWS was petitioned to list greater sage grouse as endangered across entire range	Wyoming Sage-Grouse Working Group published "Wyoming Greater Sage-Grouse Conservation Plan"	FWS was again petitioned to list the greater sage grouse as endangered across entire range	BLM issued a "National Sage-Grouse Habitat Conservation Strategy" to guide sage grouse habitat conservation and management	FWS determined listing the greater sage grouse was not warranted	Western Watersheds Project issued a complaint alleging that the FWS finding was incorrect, arbitrary, unwarranted by the facts, etc.	Western Association of Fish and Wildlife Agencies published the "Greater Sage Grouse Comprehensive Conservation Strategy"	Montana Fish Wildlife and Parks Department issued "Agency Position: Sage-Grouse Conservation and Energy Development"

22 resource management plans to better take into consideration sage grouse conservation needs.

To enhance west-wide, state-level sage grouse conservation, on December 9, 2011, Governor Mead of Wyoming and Secretary Salazar hosted a sage grouse conservation meeting in Cheyenne involving representatives of Colorado, Idaho, Nevada, North and South Dakota, Oregon, and Utah; national directors of the FWS, BLM, and the Natural Resources Conservation Service; and the Deputy Regional Forester for the Intermountain Region of the U.S. Forest Service. The meeting focused on developing a coordinated, landscape-level greater sage grouse conservation strategy. The desired outcome was a proactive, collaborative conservation effort at the state, federal and local levels that would obviate the need to list the species under the ESA.[16] Following the meeting, Wyoming Governor Mead and Colorado Governor John Hickenlooper took the reins of a new Sage Grouse Task Force. The Task Force's purpose was to identify and coordinate high-priority actions to restore fragmented habitat and maintain or increase sage grouse populations in western states.[17]

In June of 2012 the Sage Grouse Task Force submitted a "Process for Developing a Range-wide Conservation Plan for Sage Grouse."[18] The report lists eight action items to coordinate sage grouse conservation efforts among western states.

COLLABORATIVE SAGE GROUSE CONSERVATION EXPANDS

Increased focus on sage grouse conservation is not limited to state government. Multiple conservation efforts are ongoing both at the federal level and in the private sector.

In 2010 the BLM updated its 2004 "National Sage Grouse Habitat Conservation Strategy."[19] And in August 2011, the agency established a charter for a "National Greater Sage Grouse Planning Strategy," to evaluate the adequacy of BLM Resource Management Plans to conserve greater sage grouse. The objective for the planning strategy was to develop new or revised regulatory mechanisms to conserve and restore greater sage grouse and its habitat on BLM lands range wide and long term.[20] The agency subsequently adopted instructional memoranda that provide interim sage grouse conservation policies and procedures to deal with ongoing and proposed public lands activities and land-use authorizations,[21] and

July 2007	July 2007	September 2007	December 2007	March 2008	August 2008	December 2008	February 2010
Wyoming Governor Dave Freudenthal created a Sage-Grouse Implementation Team	Murphy Complex Fire burned 650,000 acres of sage grouse habitat in southern Idaho	Wyoming Sage-Grouse Implementation Team presented the governor with a list of 21 recommendations to protect sage grouse	Federal District Court in Idaho overturned FWS's not-warranted decision, remanded decision to the agency for reconsideration	Western Watersheds Project challenged BLM's environmental impact analysis of increased grazing on 1.4 million acres of sage-grouse habitat in southern Idaho given recent fires	Governor Freudenthal signed Executive Order 2008-02 establishing a Core Area Policy to conserve greater sage grouse in Wyoming	Western Watersheds Project challenged 18 BLM Resource Management Plans in Idaho, Montana, Utah, California, Wyoming, and Nevada on the grounds that BLM failed to consider the cumulative impacts of management decisions on sage-grouse populations	"Candidate Conservation Agreement with Assurances for Greater Sage-Grouse in the West Central Planning Area between the Idaho Department of Fish and Game, Natural Resources Conservation Service, and the U.S. Fish and Wildlife Service in Cooperation with the West Central Sage-Grouse Local Working Group" was established

to consider greater sage grouse conservation measures during the land-use planning process.[22]

In late 2011, following an example set earlier in Wyoming, BLM and the U.S. Forest Service initiated a National Environmental Policy Act process to support the revision of those agencies' land use and land management plans in portions of the western states where sage grouse live. These revisions are intended to incorporate consistent conservation objectives and measures to protect sage grouse and sage grouse habitat on BLM and Forest Service lands by September of 2014.[23]

In related activities, the Department of Agriculture Natural Resource Conservation Service established a Sage Grouse Initiative in 2010 that focused on using conservation grant and technical assistance programs to support ranchers in improving sage grouse habitat and rangelands productivity.[24] In 2011, the Department of Agriculture announced an additional $18.2 million program to help ranchers in Wyoming, Idaho and Utah conserve critical sage grouse habitats through its Grassland Reserve Program.[25]

And on March 8, 2012, Agriculture Secretary Vilsack and Secretary of the Interior Salazar announced the establishment of the Working Lands for Wildlife partnership program, a $33 million program to work with farmers, ranchers, and forest landowners to restore, manage, and protect habitats for at-risk species and game animals. Greater sage grouse are among the first seven species that were selected for inclusion in the program.[26]

To inform its upcoming 2015 listing decision and to promote collaborative conservation efforts range wide, the FWS convened a sage grouse Conservation Objectives Team of state and agency representatives. In February 2013 this team released the "Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report,"[27] an unprecedented document over 100 pages long outlining recommendations for a coordinated conservation effort across ten states. It spells out specific aspects of conservation concern that states and federal agencies can focus on to reduce threats to sage grouse so that the species is no longer in danger of extinction.

FWS also has worked with states to develop Candidate Conservation Agreements (CCAs) and Candidate Conservation Agreements with Assurances (CCAAs), two voluntary tools to recover potentially threatened or endangered species and negate the need to list them.[28] CCAAs, to date the more substantial of the two agreements, apply only on nonfederal lands. Property owners (usually private individuals) agree to conservation measures drawn up with the FWS. In exchange, they get assurances that—should the species be listed—no additional land, water, or resource use restrictions will be imposed beyond what is already provided in the agreement.[29] CCAs, on the other hand, do apply on federal lands, and do not come with assurances or permits to allow activities that would harm a species should it be listed. In some cases, federal agencies have been reluctant to enter into CCAs for species conservation because they perceive that such agreements offer little in return for enacting conservation measures.

In the western United States, where federal and nonfederal lands are intertwined, the need for an effective public lands counterpart to CCAAs has become increasingly clear. In the case of sage grouse, some ranchers have expressed willingness to enter CCAAs on their private land only so long as an adjacent (and consistent) CCA exists for the federal land grazing allotments that rancher uses.

The Oregon Cattlemen's Association approached the BLM in Oregon to develop, with the FWS, a conservation agreement for sage grouse on public grazing lands. The BLM, FWS, and the Oregon Cattlemen's Association signed the "Greater Sage-Grouse Programmatic Candidate Conservation Agreement for Rangeland Management Practices on Bureau of Land Management Lands in Oregon" on May 30, 2013. The purpose of the agreement is to protect sage grouse on BLM grazing allotments. A parallel CCAA for sage grouse on nonfederal agricultural lands in southeast Oregon will be finalized later this year. Both are voluntary, and provide a template for a rancher who chooses to join the agreement. Both also provide the necessary "regulatory mechanisms" the FWS will be looking for when it determines whether to list sage grouse as an endangered species in 2015.

The FWS is also working on a statewide CCAA for Wyoming ranch managers to voluntarily enhance sage grouse habitat. Conservation measures called for in the "Greater Sage-Grouse Umbrella CCAA for Wyoming Ranch Management" include maintaining contiguous habitat, controlling invasive vegetation species, and maintaining or enhancing sagebrush communities.[30]

March 2010	March 2010	March 2010	August 2010	2011	April 2011	May 2011	June 2011
Upon further review FWS announced that listing the greater sage grouse as a threatened species is warranted but precluded by higher conservation priorities	BLM issued "Gunnison and Greater Sage-grouse Management Considerations for Energy Development" to supplement the 2004 "National Sage-Grouse Habitat Conservation Strategy"	Natural Resource Conservation Service launched the "Sage-Grouse Initiative," a conservation grant and technical assistance program to help ranchers improve sage grouse habitat and rangelands productivity, and committed over $110 million during the first two years for sage grouse conservation	Governor Freudenthal issued a second Executive Order for sage grouse conservation with more precise core area maps	Department of Agriculture announced an additional $18.2 million program to help ranchers in Wyoming, Idaho, and Utah conserve critical sage grouse habitats through its Grassland Reserve Program	Oregon Fish and Wildlife Commission adopted "The Oregon Greater Sage-Grouse Conservation and Strategy: A Plan to Maintain and Enhance Populations and Habitat"	Department of Agriculture announced an additional $18.2 million program to help ranchers in Wyoming, Idaho, and Utah conserve critical sage grouse habitats through its Grassland Reserve Program	Wyoming Governor Matt Mead readopted Core Area Policy as Executive Order 2011-5

Private-sector interests including members of the agricultural and ranching communities likewise are pursuing the development of sage grouse CCAAs. One of the first such agreements was adopted in 2010 when the FWS entered into a programmatic agreement in Idaho.[31] That agreement identifies threats to sage grouse, general conservation measures required to reduce such threats, obligations that must be met by participants, expected benefits to the species, funding commitments, and other measures. Similarly, local efforts are ongoing in Wyoming to develop similar conservation agreements.

As the foregoing examples demonstrate, considerable activities are underway that are meant to provide for greater sage grouse conservation. These efforts are motivated by a widespread desire to avoid the need to list the species under the ESA. The critical question, however, is whether these efforts, alone or in combination, will be biologically and legally sufficient to make such a listing unnecessary.

POTENTIAL FOR SUCCESS

The conservation initiatives outlined above represent a huge commitment of resources, and together with other initiatives and existing sage grouse conservation measures, have the potential to make an ESA listing of the species unnecessary. However, resource outlays alone, no matter the size, cannot per se make a listing unnecessary or a FWS decision to that effect legally supportable.

To keep sage grouse off the endangered species list, conservation measures must meet the criteria of the ESA and of the FWS's Policy for Evaluation of Conservation Efforts, and must be completed in time to allow FWS consideration prior to the agency's decision deadline in 2015. Additionally, to provide the greatest support for such a determination, approaches should be coordinated to provide a coherent conservation strategy across the lands sage grouse occupy. Furthermore, given the limited resources available to accomplish sage grouse conservation, they should be designed and managed to provide the greatest possible efficiency in the conservation benefits they achieve.

State and federal governments, and the private sector, have made significant commitments to greater sage grouse conservation. These efforts will require a concerted focus and continued commitment to make good on their promises. Based on the work to date, wildlife conservation and economic interests would be served by an overarching, coherent and efficient sage grouse conservation strategy that builds upon and supports the Core Area Strategy concept. To halt or reverse sage grouse declines and prevent the species from being listed as endangered, western states—and the federal government—must fully address the areas of concern outlined in the FWS's Conservation Objectives Report from earlier this year. Meeting that objective will require continued dedication and proactive leadership in the further development, coordination, and implementation of the multiple efforts now underway. A challenge under any circumstances, these efforts are made more difficult by budget cutbacks and resource constraints among the agencies most heavily engaged in sage grouse conservation.

Such an effort will not come easily. While avoiding the need to list a species under the ESA is easy to espouse, the precise nature of the conservation measures required to do so will in many instances be uncertain or controversial.[32] Nonetheless, the opportunity exists to provide species protection now. Doing so will conserve an "icon of western sagebrush ecosystems," and perhaps equally, if not more significantly, will establish a community of interest around public lands, resources, and wildlife. We are approaching the threshold of making conservation history; it remains to us to see these efforts to fruition.

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August 2011	December 2011	December 2011	2012	January 2012	March 2012	March 2012	July 2012
BLM chartered a "National Greater Sage-Grouse Planning Strategy" to evaluate the adequacy of BLM Resource Management Plans to conserve greater sage grouse	Sage grouse conservation meeting held in Cheyenne to coordinate a multi-state, range-wide effort to conserve the sage grouse resulted in a state/federal Sage Grouse Task Force led by Wyoming Governor Matt Mead and Colorado Governor John Hickenlooper	BLM initiated a NEPA process to revise West-wide land management plans by September 2014 to protect sage grouse and sage grouse habitat	USFS joined the BLM on five Environmental Impact Statements that will amend as many as 20 forest plans to conserve sage grouse habitat	Governor Gary Herbert of Utah established committee of stakeholders and agencies to establish a sage grouse management plan following Wyoming's core area model	A $33 million Working Lands for Wildlife partnership program was established to work with farmers, ranchers and forest landowners to restore, manage and protect habitats for at-risk species including greater sage grouse	Governor Butch Otter of Idaho created Idaho's Sage Grouse Task Force	Mead and Hickenlooper's Sage Grouse Task Force submitted a "Process for Developing a Range-wide Conservation Plan for Sage Grouse" to Secretary Salazar and the Western Governors

ENDNOTES

1 75 Fed. Reg. 13910, 13917-20 (Mar. 23, 2010).

2 70 Fed. Reg. 2243 (Jan. 12, 2005).

3 75 Fed. Reg. 13910.

4 Western Watersheds Project v. Salazar, 2009 WL 1299626 (D. Id., May 7, 2009).

5 Western Watersheds Project v. Dyer, 2009 WL 484438 (D. Id., Feb. 26, 2009).

6 16 U.S.C. § 1533(a)(1).

7 16 U.S.C. § 1533(b)(1)(a).

8 U.S. Fish & Wildlife Service, "Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE Policy)." 68 Fed. Reg. 15100, 15115 (Mar. 28, 2003).

9 68 Fed. Reg. at 15113.

10 75 Fed. Reg. at 13982.

11 Colorado Parks and Wildlife, "Colorado Greater Sage-Grouse Conservation Plan" (2008), http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/Birds/Pages/GreaterSageGrouseConsPlan2.aspx.

12 USDA Natural Resources Conservation Service, "Greater Sage-Grouse Habitat Conservation Strategy" (May 2009), ftp://ftp-fc.sc.egov.usda.gov/MT/www/technical/biology/SageGrouseStrategy/SageGrouseStrategy_with_maps.pdf.

13 Scott Streater, "Utah to Develop 'Core Area' Approach Modeled on Wyo. Protections" (Feb. 2, 2012), http://www.eenews.net/landletter/stories/1059959348.

14 Oregon Fish and Wildlife, "The Oregon Greater Sage Grouse Conservation and Strategy: A Plan to Maintain and Enhance Populations and Habitat" (April 2011), http://www.dfw.state.or.us/wildlife/sagegrouse/docs/20110422_GRSG_April_Final%2052511.pdf.

15 Governor C. L. Otter, "Governor Creates Sage Grouse Task Force" (Mar. 9, 2012), http://gov.idaho.gov/mediacenter/press/pr2012/3Mar/pr_13.html.

16 Department of Interior, "Department of the Interior, Salazar, Mead Reaffirm Commitment toward Development of Landscape Level Greater Sage-Grouse Conservation Strategy in the West" (Dec. 9, 2011), http://www.doi.gov/news/pressreleases/Salazar-Mead-Reaffirm-Commitment-toward-Development-of-Landscape-Level-Greater-Sage-Grouse-Conservation-Strategy-in-the-West.cfm.

17 Western Governors' Association, "Special Report to Western Governors: Inventory of State and Local Governments' Conservation Initiatives for Sage Grouse" (Dec. 2012), http://www.westgov.org/policies/doc_download/1666-inventory-of-sage-grouse-conservation-measures-2012.

18 Sage Grouse Task Force, "Process for Developing a Range-wide Conservation Plan for Sage-Grouse" (June 14, 2012), http://www.westgov.org/component/docman/doc_download/1617-sgtf-6-29-12-letter-to-sec-salazar-signed-with-attachment.pdf

19 BLM, Instruction Memorandum No. 2010-0871, "Gunnison and Greater Sage Grouse Management Considerations for Energy Development" (Mar. 4, 2010).

20 BLM, Instruction Memorandum 2012-0044, "National Greater Sage Grouse Planning Strategy" Att. 2 (Dec. 27, 2011).

21 Instruction Memorandum 2012-043 (Dec. 27, 2011).

22 BLM, Instruction Memorandum 2012-044 (Dec. 27, 2011).

23 BLM, "Notice of Intent to Prepare Environmental Impact Statements and Supplemental Impact Statements to Incorporate Greater Sage Grouse Conservation Measures into Land Use Plans and Land Management Plans," 76 Fed. Reg. 77008 (Dec. 9, 2011).

24 NRCS, "Introduction to NRCS' New Sage Grouse Initiative: Wildlife Conservation Through Sustainable Ranching" (Feb. 2011).

25 NRCS, "USDA to Protect Prime Sage-Grouse Habitat in Three Western States" (June 30, 2011), www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/?cid=STELPRDB1044365.

26 NRCS, "USDA and Interior Announce Working Lands for Wildlife" (Mar. 8, 2012), http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/?cid=STELPRDB1047050.

27 FWS, "Greater Sage-grouse (*Centrocercus urophsianus*) Conservation Objectives: Final Report," (Feb. 2013), http://www.fws.gov/mountain-prairie/species/birds/sagegrouse/COT/COT-Report-with-Dear-Interested-Reader-Letter.pdf.

28 U.S. Fish and Wildlife Service, "Candidate Conservation Agreements Fact Sheet," http://www.fws.gov/endangered/what-we-do/cca.html.

29 64 Fed. Reg. 32,706 (June 17, 1999).

30 FWS, Mountain-Prairie Region, "Environmental Assessment and Draft Greater Sage-grouse Umbrella Candidate Conservation Agreement with Assurances for Wyoming Ranch Management," (Feb. 7, 2013) http://www.fws.gov/mountain-prairie/pressrel/2013/02072013_GsG%20Agreement.html.

31 "Candidate Conservation Agreement with Assurances for Greater Sage Grouse in the West Central Planning Area between the Idaho Department of Fish and Game, Natural Resources Conservation Service, and the U.S. Fish and Wildlife Service in Cooperation with the West Central Sage Grouse Local Working Group" (Feb. 2010), http://www.fws.gov/idaho/ConservationPartners/WestCentralIdahoSagegrouseCCAA.pdf.

32 Manuel Quinones and Phil Taylor, "Mining Industry Calls Some Proposed BLM Protections Illegal," Greenwire (Mar. 26, 2012), http://www.eenews.net/greenwire/2012/03/26/stories/1059962002.

33 BLM, "Sage Grouse and Sagebrush Conservation," http://www.blm.gov/wo/st/en/prog/more/sagegrouse.html.

August 2012	January 2013	February 2013	May 2013	May 2013	September 2013	September 2015	
FWS released a draft report to conserve the greater sage grouse	FWS listed the Gunnison sage grouse as endangered	FWS and partners released "Greater Sage-grouse (***Centrocercus urophasianus***) Conservation Objectives: Final Report" prioritizing range-wide conservation measures	Governor Mead issued an energy strategy with a conservation objective that includes sage grouse studies to inform conservation and mitigation	Oregon Cattlemen's Association, FWS, and BLM signed programmatic CCA for sage grouse on rangelands	Chesapeake Oil released plan that would allow it to drill for oil in a sage grouse core area in eastern Wyoming in exchange for funding conservation work	FWS will issue its listing determination for greater sage grouse	

Cattle as ecosystem

New grazing management enhances rangeland biodiversity

By Justin D. Derner, David J. Augustine and Emily J. Kachergis

Climate, soils, topography, grazing, and fire have shaped the composition and structure of vegetation on rangelands in the American West. Collectively, the many possible combinations of these different factors should lead to diverse plant communities and associated diverse wildlife species. Differences in vegetation structure (i.e., how tall above the soil surface the plants are) and composition (kind and amounts of different plants) are both important for biodiversity.

Yet, many rangelands across the American West have been managed through similar grazing management practices so that extensive areas of vegetation have comparable kinds and amounts of plant species (e.g., same grasses, forbs and shrubs; vegetation composition). As a result, the lack of many different plant communities can result in few differences in height of vegetation (or vegetation structure), which are often needed by grassland birds. This lack of vegetation diversity can translate to a lack of habitat diversity and biological diversity on these lands.

Rangeland plant communities often appear uniform or unvaried due to the fact that ranchers have an economic incentive to graze their livestock using management practices that emphasize "management to the middle" and "avoidance of the extremes." These management practices are sustainable for livestock production,[1, 2], as they optimize both weight gain per animal and per acre. Producers have an economic incentive to effectively use available forage and convert it to pounds of weight gain as the well-established market-driven system emphasizes price per pound. However, the resulting "sameness" of vegetation composition and structure, due to the application of similar management across large land areas, has triggered the demise of many grassland birds as well as reduced biodiversity. As a result, many of the "species of concern" on rangelands of the American West live on landscapes that have little variation of vegetation composition and structure. For example, the mountain plover, adapted for breeding on bare ground, and the lark bunting and western meadowlark, adapted for high cover areas, have been declining on semiarid rangelands.

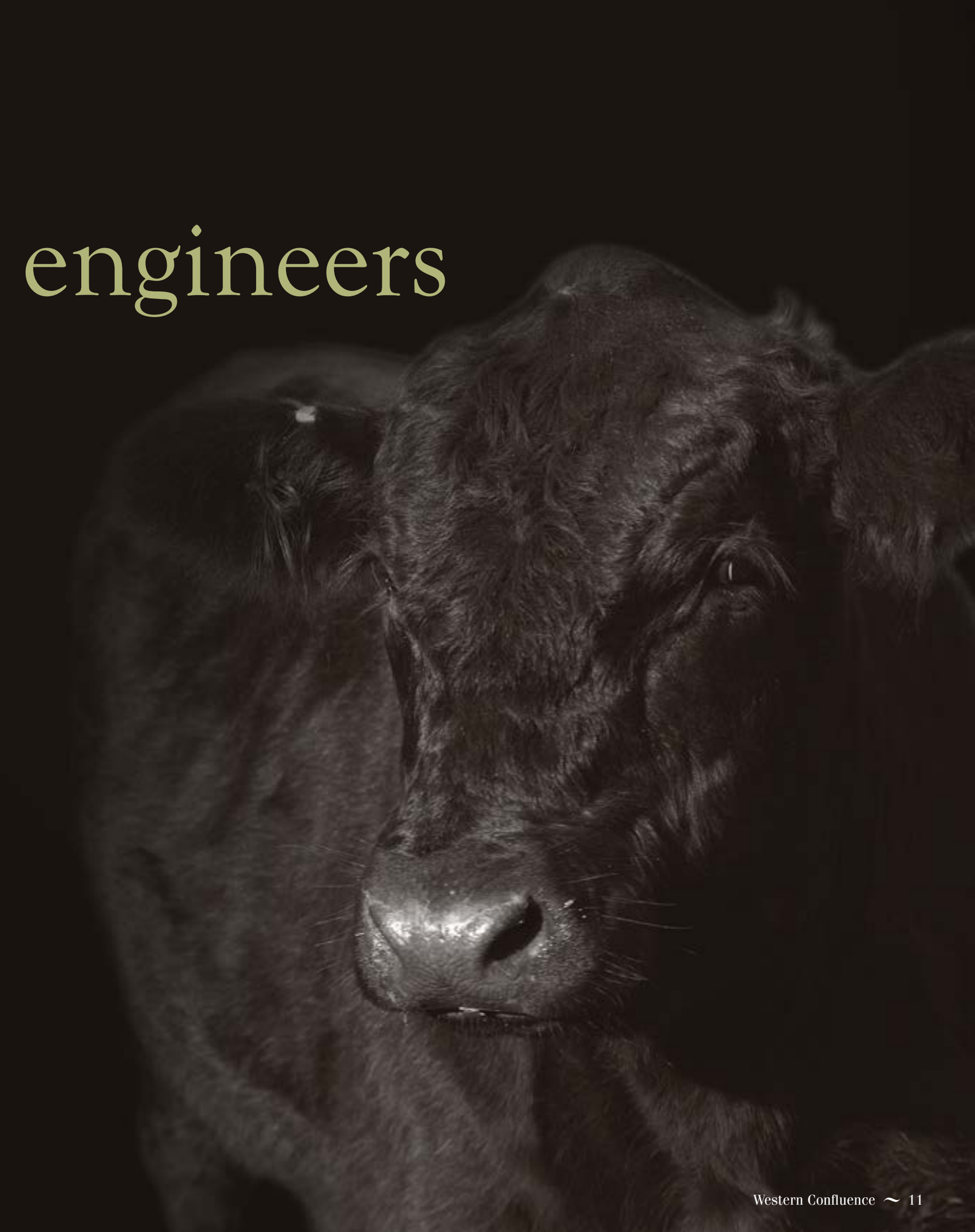
Incentivizing ranchers to increase differences in vegetation composition and structure on rangelands of the American West will require 1) understanding how livestock can be used as tools to engineer rangelands for *both* provision of ecosystem goods (e.g., livestock production) and services (e.g., wildlife habitat, water quality and quantity, soil health, carbon sequestration and storage), 2) determining ecosystem services' economic values, and 3) creating proper economic incentives that will foster vegetation—and greater biological—diversity.

MANAGING FOR DIVERSITY

What is vegetation heterogeneity? Livestock can engineer rangelands to produce differences in vegetation structure and composition. For example, intensive grazing in one area may result in higher amounts of bare ground, which benefits species such as the mountain plover. Resting a nearby area will allow the forage to grow taller, providing nesting habitat for grassland species such as the pintail, or in sagebrush, the sage grouse. This alternative approach to management increases percentages of the landscape with short and tall vegetation structure. Possible tradeoffs with livestock production merit additional investigation to provide economic valuations for the "costs" of providing vegetation heterogeneity.[3]

Livestock can engineer differences in vegetation structure and composition within the framework of most current management practices. For example, ranchers can alter timing and intensity of grazing, length of rest periods, and type of livestock to create different levels in height of vegetation and kind and amount of plants. Ranchers can control when livestock graze certain areas, for how long, and how much vegetation is left ungrazed (to a certain height or residue level) following a grazing period. Through management decisions, ranchers vary the length of rest periods from relatively short (weeks-months) to long (one year or greater). Longer rest periods stockpile forage resulting in greater vegetation heights.

engineers



Varying the time of grazing across years or stocking rates can shift vegetation composition. Combining different types of livestock, such as cow-calf pairs, yearlings, sheep, goats, or combinations of these, can strategically engineer the vegetation on rangelands due to different diet selections.

Combining grazing with prescribed fire in the Great Plains portion of the American West modifies the amount of bare soil, forage quality and quantity, vegetation structure and, in some cases, reduces unwanted species, such as prickly pear cactus or broom snakeweed (dry areas) or smooth brome (tallgrass prairie).[4, 5] Burning patches within pastures encourages livestock to graze recently burned areas where forage quality is higher. In addition, less grazing activity will occur in the non-burned parts of the pastures, which results in more vegetation structure. This creates a greater range of vegetation structure in pastures with patch burns, compared to those pastures managed similarly but without prescribed fire. Combining fire and grazing in the Great Plains, does not, however, consistently create vegetation heterogeneity.[6] Sites where the combination works effectively are those where fire is the primary driver of livestock grazing behavior, such as the tallgrass prairie. In addition, some invasive plant species, such as cheatgrass in the Great Basin and Lehmann lovegrass in the Southwest deserts, thrive following burns, so inclusion of fire as a management tool without consideration of the inherent risks associated with increasing vegetation heterogeneity in these ecosystems is not recommended.[7] For these rangeland ecosystems of the intermountain west and desert southwest, fire can result in 1) large-scale conversions of native plant communities to invasive plants, and 2) altered fire regimes with fires becoming more frequent.

Taller vegetation can be attained by grazing an area and then not coming back to graze again for an extended period. For example, rest periods greater than one year generally result in taller vegetation structure due to an absence of grazing. However, this requires some flexibility in the livestock enterprise to accommodate this strategy. Livestock and vegetation management require flexibility to incorporate prior use patterns, and current and near-future grazing plans, into the overall management plan. This flexibility can involve using livestock as ecosystem engineers by putting more animals on a unit of land area, but for a shorter time. This will decrease the selectivity of grazing animals but increase the uniformity of grazing, as well as dung and urine deposition within a pasture, but with an overall objective of creating differences among pastures and across years. Grazing animals for a shorter time period, in different times of the year and sequences across years will increase differences in vegetation composition and structure. Temporary electric fencing can subdivide existing pastures to provide more control of livestock grazing for these shorter time periods of grazing and longer periods of no grazing.

Photos representing vegetation heterogeneity created by engineering rangelands using livestock through differences in season and intensity of grazing in shortgrass steppe. Areas with high bare ground and limited plant cover were created by very heavy grazing in early spring (upper left), heavy grazing in summer created areas of very short structure (lower left), light grazing in the winter resulted in saltbush-dominated vegetation with more diverse vegetation structure (upper right), and diverse forb and grass species are enhanced with light grazing during the summer (lower right).[16, 17, 18, 19, 20]

ECOSYSTEM SERVICES AND LIVESTOCK PRODUCTION

Achieving both provision of ecosystem services and maximal livestock production at the same time on ranches is difficult. On one hand, there is high demand to increase production of livestock to feed an ever-expanding world population.[8] On the other hand, there is growing societal desire for rangelands to provide a suite of ecosystem services.[9] Fundamental to these challenges is the stark reality

that a developed economic market system drives livestock production whereas markets have yet to emerge for ecosystem services. The benefits of providing these services have yet to be monetized. Moreover, ranchers fear economic costs if they use livestock as ecosystem engineers such as lower livestock weight gains. For example, patch burning in pastures can provide greater heterogeneity of vegetation structure with no effects on livestock weight gains compared to pastures not burned,[10] but there are costs and risks to ranchers to incorporate these prescribed burns. Without incentives that compensate for this lost income, or developed markets for ecosystem services on which decisions could be made to modify management to emphasize additional outcomes that have economic rewards, this issue will remain problematic for ranchers. Preliminary efforts are unfolding in the western U.S. that may serve as a template for additional development of ecosystem service markets.[11, 12]

We are not suggesting that all current grazing management switch from a livestock production-centric basis to one that emphasizes provision of vegetation heterogeneity. Rather, judicious approaches that take advantage of pre-existing templates of heterogeneity of soils or topography can start the process. Changes in grazing management should take into account: 1) potential of different ecological sites to produce differences in vegetation, 2) determination that vegetation/habitat diversity is a desired outcome for management, 3) flexibility in the enterprise to accommodate modifications in grazing management, and 4) realization that there may be some tradeoffs associated with livestock production for certain aspects of this approach.

ECONOMIC INCENTIVES

Ranchers can use livestock to engineer landscapes for provision of *both* ecosystem goods and services,[13, 14] and this approach can be implemented on many rangelands, provided there are developed markets that value ecosystem services to determine economic returns associated with their decision-making. Given the current reality in which formal markets exist only for livestock weight gains, it is not surprising that management practices and associated decision-making processes are driven to maximize livestock production.[15] This has led to increasing the "sameness" of vegetation composition and structure on landscapes through "management to the middle," rather than management which embraces a much larger range in both vegetation composition and structure.

"Engineering" for greater vegetation heterogeneity will occur when markets for ecosystem services provide economic justification for ranchers to change management. Providing economic markets for these ecosystem services, and associated economic values for these services, are the nexus for facilitating more widespread engineering by livestock of rangeland ecosystems in the American West. Ranchers, land managers, policy makers, economists, and others need to come together in confluence to create proper economic incentives that will foster changes in management practices to increase vegetation heterogeneity and produce marketable commodities from these rangelands. Then, development of markets to place economic value on these commodities for the rancher, as well as for the general public, should provide the foundation on which to foster more engineering of rangeland vegetation by livestock.

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ENDNOTES

1 Bement, R.E. 1969. A stocking rate guide for beef production on blue-grama range. *Journal of Range Management* 22:83-86.

2 Hart, R.H., and M.M. Ashby. 1998. Grazing intensities, vegetation, and heifer gains: 55 years on shortgrass. *Journal of Range Management* 51:392-398.

3 Derner, J.D, J.K. Detling, and M.A. Antolin. 2006. Are livestock weight gains affected by black-tailed prairie dogs? *Frontiers in Ecology and the Environment* 4:459-464.

4 Augustine, D.J., and D.G. Milchunas. 2009. Vegetation responses to prescribed burning of grazed shortgrass steppe. *Rangeland Ecology and Management* 62:89-97.

5 McGranahan, D.A., D.M. Engle, S.D. Fuhlendorf, S.J. Winter, J.R. Miller, and D.M. Debinski. 2012. Spatial heterogeneity across five rangelands managed with pyric-herbivory. *Journal of Applied Ecology* 49:903-910.

6 McGranahan, D.A., D.M. Engle, S.D. Fuhlendorf, S.J. Winter, J.R. Miller, and D.M. Debinski. 2012. Spatial heterogeneity across five rangelands managed with pyric-herbivory. *Journal of Applied Ecology* 49:903-910.

7 Brooks, M.L., and J.C. Chambers. 2012. Resistance to invasion and resilience to fire in desert shrublands of North America. *Rangeland Ecology and Management* 64:431-438.

8 Food and Agriculture Organization of the United Nations (FAO). 2011. The state of the worlds' land and water resources for food and agriculture. Rome, Italy. 47 p.

9 Havstad, K.M., D.P.C. Peters, R. Skaggs, J. Brown, B. Bestelmeyer, E. Frederickson, J. Herrick, and J. Wright. 2007. Ecological services to and from rangelands of the United States. *Ecological Economics* 64:261-268.

10 Limb, R., S. Fuhlendorf, D. Engle, J. Weir, R. Elmore, and T. Bidwell. 2011. Pyric-Herbivory and Cattle Performance in Grassland Ecosystems. *Rangeland Ecology and Management* 64:659-663.

11 Cheatum, M., F. Casey, P. Alvarez, and B. Parhurst. 2011. Payments for Ecosystem Services: A California Rancher Perspective. Conservation Economics White Paper. Conservation Economics and Finance Program. Washington, DC: Defenders of Wildlife. 65pp.

12 Goldstein, J.H., C.K. Presnall, L. Lopez-Hoffman, G.P. Nabhan, R.L. Knight, G.B. Ruyle, and T.P. Toombs 2011. Beef and beyond: Paying for ecosystem services on Western US rangelands. *Rangelands* 33(5):4-12.

13 Derner, J.D., W.K. Lauenroth, P. Stapp, and D.J. Augustine. 2009. Livestock as ecosystem engineers for grassland bird habitat in the western Great Plains of North America. *Rangeland Ecology and Management* 62:111-118.

14 Toombs, T.P., J.D. Derner, D.J. Augustine, B. Krueger, and S. Gallaher. 2010. Managing for biodiversity and livestock. *Rangelands* 32(3):10-15.

15 Dunn, B.H., A.J. Smart, R.N. Gates, P.S. Johnson, M.K. Beutler, M.A. Diersen, and L.L. Janssen. 2010. Long-term production and profitability from grazing cattle in the Northern Mixed Grass Prairie. *Rangeland Ecology and Management* 63:233-242.

16 Knopf, F. 1996. Prairie legacies - birds. Pages 135-148 *in* F. Samson and F. L. Knopf, editors. *Prairie conservation: Preserving North America's most endangered ecosystem*. Island Press, Washington, DC.

17 Derner, J.D., W.K. Lauenroth, P. Stapp, and D.J. Augustine. 2009. Livestock as ecosystem engineers for grassland bird habitat in the western Great Plains of North America. *Rangeland Ecology and Management* 62:111-118.

18 Augustine, D.J., D.T. Booth, S.E. Cox, and J.D. Derner. 2012. Grazing intensity and spatial heterogeneity in bare soil in a grazing-resistant grassland. *Rangeland Ecology and Management* 65:39-46.

19 Augustine, D.J. 2011. Habitat selection by mountain plovers in shortgrass steppe. *Journal of Wildlife Management* 75(2):297-304.

20 Augustine, D.J., and J.D. Derner. 2012. Disturbance regimes and mountain plover habitat in shortgrass steppe: large herbivore grazing does not substitute for prairie dog grazing or fire. *The Journal of Wildlife Management* 76(4):721-728.

CONSERVATION GRAZING: RANCHERS LEAD THE WAY

Dave Powell, USDA Forest Service, Bugwood.org

By Emilene Ostlind

On the Howell Ranch and adjacent properties in western Colorado, cattle are used to create prime elk hunting opportunities. Managers carefully consider elk movements when they design the annual grazing plan for the ranch. In May and June they keep cattle away from elk calving grounds. Then the ranch hands concentrate cattle in favorite hunting spots in the first half of the growing season, and move them to other areas later in the summer, letting forage recover. When fall rolls around, those elk hunt areas are thick with new grass full of protein and energy.

"The elk appreciate that and have learned that. During the fall, in terms of grazing patterns, they tend to concentrate on areas grazed early," said Jim Howell, CEO of Grasslands LLC, and heir of the Howell Ranch. "The numbers are higher than ten years ago before we implemented it. There are almost too many elk."

The increased elk numbers are just one example of wildlife benefitting from new and improved management at the Howell Ranch. In an uncommon example of wide-scale ecosystem engineering, Howell and his team have made gradual, large-scale changes to how they move cattle through this and other ranches, and by their count they have successfully improved forage, biodiversity, and notably, livestock productivity. Scientists, however, who have studied "rotational grazing"—one term for the kind of practice Howell has implemented—have been unable to measure the benefits ranchers like Howell claim.

The Howell Ranch on Colorado's arid western slope spans deep, rocky canyons. When the ranch was managed using traditional grazing practices, cows roamed large pastures for extended periods throughout the year. They tended to concentrate along streams, munching fresh sprouts of plants trying to recover from recent grazing. Meanwhile, they never reached the bunch grasses high on the steep, forested slopes.

Under new practices implemented by Howell, ranch managers fence cross sections of the canyons about 600-800 yards wide with portable electric fences running from ridgeline to ridgeline. This creates a level of stock density that motivates the cattle to climb the slopes in a way they never did under low density, continuous grazing. As Howell describes it, on the first day the cattle graze along the creek bottom. Then they start climbing the slopes. They readily move up into the forest and by day two of a grazing period many cattle have reached the ridgelines. After three to five days, the managers move the cattle to the next fenced pasture.

Cattle also replace fire as a management technique on the Howell Ranch. Whereas some managers use fire to clear out decaying vegetation and trigger a flush of recovery, the Howell Ranch achieves that with cattle. Fire is too dangerous in western Colorado, and takes a lot of work to carefully burn even a small area. Instead, focused intensive grazing creates localized patches of regrowth attractive to wildlife and develops a mosaic of vegetation ages across the ranch.

Howell has ranched, consulted, and traveled in Argentina, Australia, Zimbabwe, South Africa, and New Zealand. In the mid 90s he and his wife, Daniela, managed the 34,000-acre High Lonesome Ranch near Lordsburg, New Mexico, where they deepened their management experience. When Howell and his wife moved back to their family ranch, they started to adjust grazing patterns. The switch from traditional to conservation grazing didn't happen all at once, but was gradually implemented season-by-season and year-by-year.

"The most important step is to get the mental shift to observer of ecology and animal behavior," said Howell. "You have to have managers on the ground with a research bent. They think in the abstract. They are not just strict cowboys."

That intellectual shift was the hard part, according to Howell. The infrastructure costs amounted only to grazing planning charts and a few reels of portable electric fence. Patience, trial and error, and gentle treatment helped the cows break old habits and learn new grazing patterns.

Howell's work in western Colorado is just one example of an outfit adopting altered grazing management and seeing benefits in grass production and habitat. Rotational grazing, as it is sometimes called, has been applied in the United States for about 45 years, and has become more sophisticated and widespread as decades pass.

The November 1969 issue of the American Society of Range Management's journal introduced the concept of intensive, short-duration grazing to North America. Range managers in Zimbabwe (then Rhodesia) were exploring the method. The idea was to concentrate livestock into small pastures and move them frequently. The paper's author, Sid Goodloe, wrote, "I saw ranches (in Africa) where existing fences had been stripped of one or two wires and those wires strung from tree to tree to divide pastures until the increased carrying capacity brought in enough money to build permanent fences."

Short-duration grazing, Goodloe wrote, "breaks the parasite cycle, puts the standing dry grass (top hamper)

Tim McCabe, USDA NRCS

down to litter, eliminates trails to and from water and chips the soil surface for better seed germination." Most importantly, ranchers applying the practice claimed they were able to reverse rangeland degradation even as they increased livestock numbers. Livestock would make better use of the available forage, according to proponents, and rangelands had time to grow back after each period of intense grazing. Ranchers could then raise more livestock on the same piece of land. Ranchers in Zimbabwe were enthusiastic that these new methods might help reverse deterioration of rangelands caused by long-duration or continuous livestock grazing. "The ranchers argued that results were plainly visible and that they couldn't wait for years of research," Goodloe wrote.

After publication of this paper, U.S. ranchers began to apply the practice with equal enthusiasm and results. It has gone by different names—short-duration grazing, holistic rangeland management, rotational grazing, conservation grazing. Many ranchers who have adopted rotational grazing, like Howell, swear by it. They say it has improved grass production and habitat diversity, repaired damaged streams, and reversed rangeland degradation. Many can share anecdotes of wildlife—from sage grouse to elk and from beavers to songbirds—returning to areas where they'd been absent for decades. And ranchers also claim they are able to increase stocking rates with rotational grazing because the animals have better access to more nutritional forage.

When Wayne Fahsholz started running the nearly-475,000-acre Padlock Ranch in the early 2000s he implemented what he calls a controlled grazing system. Electric fences keep cattle bunched in smaller pastures, and the animals are moved frequently—every few days to every few weeks. Fahsholz picked up these practices from working on other ranches and from attending the Ranching for Profit School, a program that teaches ecology alongside finance and grazing management.

"We have some massive spreadsheets," Fahsholz said. "Every two weeks our cowboys turn in an inventory of cows, the amount of supplement the cows used, what pastures they have used, and how many cows were in that pasture." That information is entered into a database and used to ensure that the same pastures don't get grazed too often, too long, or at the same time of year for consecutive years. In the winter the managers look at pasture conditions and correlate that to how many cattle were in each pasture at a given time of year, and for how long. They set up guidelines for the coming grazing season, but rely, too, on cowboys looking at pasture condition and deciding when the cattle need to move

on. "It's not an exact science," Fahsholz said.

But while ranchers extol the benefits of the practice, scientific studies have measured none of the proclaimed improvements to rangelands and livestock productivity. Despite claims of improved rangelands from ranchers, scientists who began to study rotational soon after Goodloe's paper was published have arrived at startling results. Controlled studies of rotational grazing have been unable to detect the benefits ranchers describe. Numerous studies over the decades measured reduced infiltration of precipitation into soils, no change in forage production, declined ecological condition of ranges, and lower livestock productivity.

These studies have teased apart the separate influences of grazing duration and stocking rates. One review, published in 2000 and authored by Jerry Holcheck and four others, scrutinized efforts by researchers at 13 locations in North America to validate short-term rotational grazing effects on plant succession, mineral cycling, water filtration into soil, and other purported benefits. The review stated:

- Hoof action from having a large number of animals on a small area for short time periods reduced rather than increased infiltration
- Short-duration grazing increased erosion compared to continuous or season-long grazing
- There is little difference in forage production between short-duration and continuous grazing systems if stocking rates are the same
- Short-duration grazing [was] similar to continuous grazing in effects on plant succession and range condition if stocking rates were the same

Several studies showed that livestock didn't gain weight as fast under short-duration rotational grazing as compared to continuous grazing, while other studies showed no difference and one study showed livestock gained extra weight with rotational grazing

A major study by W.A. Manley and five coauthors, cited in the above review, analyzed both grazing duration and stocking rates, and measured the effect of each on surface and underground biomass, plant species composition, and groundcover from 1982 to 1994 in southeast Wyoming. The researchers created a matrix of study plots and, for the 12 years of the study, assigned each plot a grazing strategy (continuous, seasonally deferred, or short-duration rotational grazing) and a stocking rate (from light at 0.16 steers per hectare, to heavy, 0.56 steers per hectare).

The researchers found that under heavier stocking rates—that is, with more livestock per acre—native grasses decreased and forbs increased over the years of the study, regardless of grazing strategy. They also found that steers gained less weight per hectare of land when they were heavily stocked compared to plots with fewer steers per hectare.

Rather than informing management practices, such findings have ignited controversy between advocates of rotational grazing (and the ranchers who believe it works) and ecologists who argue that increasing stocking rates come with no ecological benefit. Holcheck, author of the above review, wrote in his conclusions, "History shows that it's human nature to believe a good story rather than pursue the truth," adding his claim that *only* reducing stocking rates could help rangelands recover from decades of abuse. He even attributed financial losses experienced by ranchers in the 90s and growing conflict between ranchers and environmentalists to high-risk management strategies involving high stocking rates.

Justin Derner and his colleagues are among the ecologists starting to tease apart these discrepancies and understand from a scientific perspective how grazing can be used as a tool to improve the ecological health of rangelands. In a 2011 paper in *Rangeland Ecology and Management* titled "Origin, Persistence, and Resolution of the Rotational Grazing Debate: Integrating Human Dimensions Into Rangeland Research," Derner and five co-authors listed variables rangeland scientists may not be accustomed to accounting for in their experiments: ranch managers' goal setting, experience, and decision making. They wrote

> The scientific evidence refuting the *ecological* benefits of rotational grazing is robust, but also narrowly focused, because it derives from experiments that intentionally excluded these human variables. (Emphasis original.)

The authors argue that a rift exists between the piercing scrutiny of highly controlled scientific study and the broader reality of natural resource managers continually adjusting their prescriptions. The authors call for recognition of the limits of scientific knowledge as applied to management of such complex natural resource subjects as rangeland ecosystems, and propose developing a new model by which research of such ecosystems can account for human dimensions when measuring management practices.

In another paper ("Livestock as Ecosystem Engineers for Grassland Bird Habitat in the Western Great Plains of North America," *Rangeland Ecology and Management*, 2009), Derner and three different co-authors describe, much as in the accompanying feature article, methods for managing grazing to promote diverse rangeland vegetation. Moving beyond electric fences to control livestock movement, the authors recommend placing supplemental feed and water and herding as methods to get cattle to graze some areas more heavily than others, thus creating a mosaic of vegetation of different ages and heights. Such approaches, they say, can help rangeland managers achieve both conservation and production and offer an alternative to ending public lands grazing for conservation purposes.

Meanwhile, no one is measuring "biodiversity" on rangelands to test whether new practices are reversing loss of species. Ranchers and the BLM measure grass production, usually by measuring grass heights and other metrics. Wildlife agencies and some conservationists monitor rangelands for target species (such as sage grouse) or count plant species and abundance.

On the Howell Ranch regular monitoring transects prove that plant diversity and ground cover have improved with the new practices. Active monitoring of wildlife biodiversity isn't happening, but Howell said, "Whenever you are enhancing plant diversity, that

opens niches for all kinds of wildlife from insects to birds to mammals." Anecdotally, such as with the elk hunting successes and sage grouse monitoring projects on other Grasslands LLC ranches in Montana, biodiversity has increased with conservation grazing. Species once rare or absent are returning.

"In any given year, we leave up to half of the ranch ungrazed, and these pastures are mixed throughout the ranch, so we have a mosaic of ungrazed and grazed patches," Howell said. "And, all of the grazed patches are in different stages of recovery, with different vegetation structures. We effectively create a diverse landscape spread throughout the ranch, conducive to attract a diversity of wildlife."

Since he came to the Padlock, Wayne Fahsholz has been able to increase stocking rates, give less supplemental feed, and work with a smaller crew of cowboys. In addition, he said, the U.S. Fish and Wildlife Service tells him the ranch has created some ideal sage grouse habitat. "The overall range is better," Fahsholz said, "but you really see it in the riparian areas. They aren't all tromped out like they were." And the Padlock Ranch has been sweeping up conservation awards. The ranch won the 2013 Leopold Conservation Award and the 2012-13 Montana Environmental Stewardship Award and was nominated for the National Cattlemen's Beef Association's Environmental Stewardship Award.

Chris Pague, a senior conservation ecologist for The Nature Conservancy based in Colorado, sees a trend to more and more ranchers applying new science to improve rangeland management in ways that both boost vegetation productivity and benefit many wildlife species. The next step is to jump from measuring not just rangeland quality—that is how nutritious and productive is the vegetation—but to measuring the value of those rangelands for wildlife and biodiversity.

Achieving such measurements will require a new kind of thinking and widespread coordination that hasn't happened to date for biodiversity on private and public rangelands in the West.

Economics of Engineering with Livestock:

Incentives for Establishing Biological Diversity

Recognizing the importance of agricultural lands for wildlife, a number of programs in the western United States encourage ranchers to manage rangelands in ways that benefit both landowners and wildlife. Financial incentive for improving biodiversity per se is yet to come.

FEDERAL PROGRAMS

The **Environmental Quality Incentives Program** and **Wildlife Habitat Incentives Program**, administered by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), funds and provides technical support for voluntary rangeland enhancements on private lands. An interested landowner can work with NRCS staff to purchase and install water tanks or fences, for example, to control livestock movements. The NRCS requires that individuals who participate in their programs follow conservation guidelines, including livestock stocking rates that are meant to leave enough forage and habitat after livestock graze for wildlife.

These programs target rangeland productivity rather than biodiversity as an outcome. Metrics of success include how many inches high vegetation is after grazing.

"In Wyoming, the only species we are writing grazing systems for and paying enhancements for would be sage grouse," said Rick Peterson, state rangeland management specialist for the NRCS in Wyoming. The new west-wide **Sage Grouse Initiative** pays ranchers for practices that enhance sage grouse habitat on their lands. In two years, the Sage Grouse Initiative has worked with more than 700 ranches, put new grazing systems into practice on more than 2 million acres of sage grouse habitat, marked 500 miles of fence, secured 240,000 acres of conservation easements, and invested over $200 million. Another NRCS program, **Working Lands for Wildlife**, established about one year ago, is funded to the tune of $33 million. Two of the seven species it targets—the lesser prairie chicken and the greater sage grouse—live on western rangelands.

STATE PROGRAMS

While they typically have fewer dollars to leverage than the federal programs, state wildlife agencies work with both public and private landowners to improve habitat on rangelands. The **Wyoming Game and Fish Department Habitat Program** helps coordinate conservation easements of high value to wildlife. In

addition, Game and Fish provides technical assistance to rangeland managers. In 2012, the agency developed nine grazing management plans to boost wildlife habitat on 68,525 acres in Wyoming.

One innovative system for protecting wildlife habitat on private lands is **Colorado Parks and Wildlife's Ranching for Wildlife** program. On properties of 12,000 or more contiguous acres, ranchers implement wildlife habitat improvements, including grazing management to promote big game habitat and conservation plans for threatened and endangered species. They are also required to provide free access and information to public hunters (Colorado residents only) who apply to draw for coveted Ranching For Wildlife licenses. In exchange, ranches receive vouchers for a predetermined number of *private* hunting licenses, which can be distributed to any hunter. To date, over 1.2 million acres on 29 ranches are enrolled, with improved livestock grazing systems on more than 80% of those lands.

NONPROFIT ORGANIZATIONS

Land trusts can also incentivize ranchers by purchasing the development rights for lands rich in wildlife habitat value. The rancher receives a payment equivalent to the difference in market value of the land with and without the easement, as well as a tax deduction for the changed value of the property. Some conservation easement agreements specify grazing management activities to protect or enhance wildlife habitat.

The **Partnership of Rangeland Trusts**, an association of seven statewide agricultural land trusts in the west, has placed nearly 2 million acres into conservation easements. While many of these easements have no specific requirements for habitat protection or enhancements, keeping open ranch lands from being subdivided and developed has value for wildlife.

The Nature Conservancy has developed landscape habitat models to identify private lands with the highest wildlife value in need of conservation. The organization creates conservation easements with stipulations for habitat management that can include grazing programs, essentially paying ranchers to engineer rangelands for biodiversity.

AWARDS AND RECOGNITIONS

Land stewardship awards reward ranchers for grazing their livestock in ways to help wildlife. The Bureau of Land Management gives out a **Rangeland Stewardship Award** to one ranch in the nation each year. In 2012, the award went to the Kirby Creek Coordinated Resource Management Group in Wyoming's Bighorn Basin in recognition of their extensive efforts to restore a degraded watershed through fencing, invasive species control, water developments, and other efforts shared by several ranches and agencies. This prestigious national award comes with public recognition celebrating the management practices of the ranch.

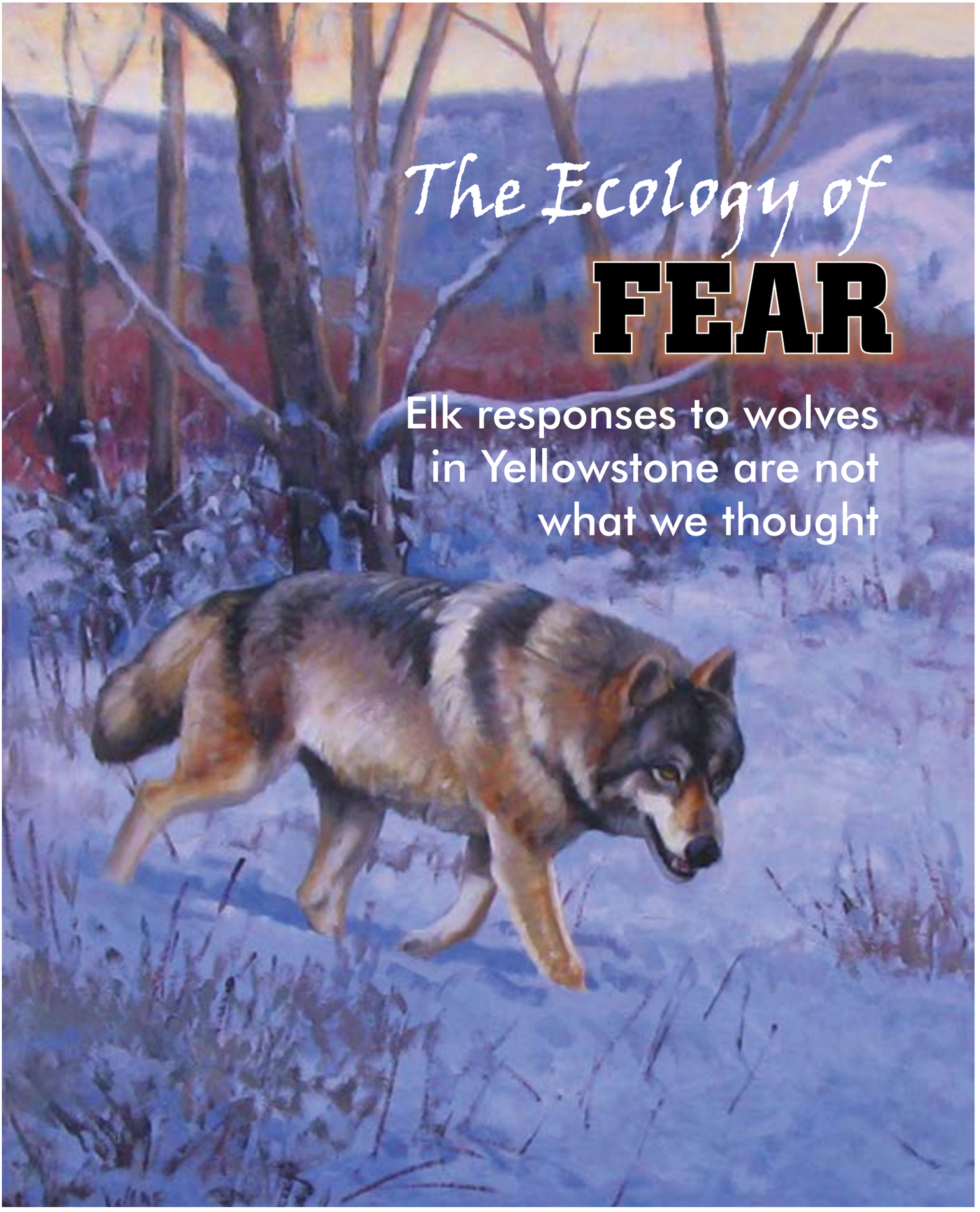
The **Leopold Conservation Award**, distributed by the Sand County Foundation and partnering organizations in eight different states, recognizes land owners who achieve conservation measures on their lands. The Padlock Ranch on the Wyoming/Montana border was recognized in 2013 for innovative grazing management that fosters wildlife habitat, among other practices. The award comes with publicity, recognition from the Governor, and a prize of $10,000.

The Wyoming Game and Fish Department also celebrates landowners who steward wildlife on their properties. One 2012 **Landowner of the Year**, the JY Ranch near Laramie, worked with Wyoming Game and Fish to develop a grazing plan that protects streamside vegetation and produces abundant rangeland forage for wildlife.

MARKET-BASED CONSERVATION FINANCE

While many of the above programs ensure productivity of rangelands and keep them from being developed, they do not measure biodiversity in itself. One upcoming idea to advance biodiversity conservation is tools that give biodiversity economic value in the marketplace. A few forward-thinking organizations are working toward that end, and marketplaces have developed for individual species such as the dunes sagebrush lizard in Texas.

The Environmental Defense Fund develops **habitat exchanges** and other programs to put a monetary value on habitat and species and enable those who benefit from protection of ecosystem services to give financial support to those who protect them. A habitat exchange pays landowners for conservation activities that improve wildlife habitat. Developers purchase credits created by the landowners to offset their impacts to the land.



The Ecology of FEAR

Elk responses to wolves in Yellowstone are not what we thought

By Emilene Ostlind
Paintings by Dave Wade

Wolf reintroduction to Yellowstone National Park in 1995 triggered an endlessly fascinating stream of ecosystem responses. More than a decade and a half later, ecologists are still trying to determine what restoration of a top predator means for the other species throughout the system.

Ecologist Matt Kauffman was working as a postdoc in conservation biology at the University of Montana in Missoula in 2003 when he first heard about studies showing that wolves were scaring elk away from certain areas in Yellowstone so that vegetation like willows and aspen could recover. Wolves, a top predator, influence relationships between species in an ecosystem through lethal effects, by reducing the number of browsers. But the idea that wolves could also affect vegetation simply by scaring the elk—a nonlethal effect—was new and exciting for terrestrial ecologists, including Kauffman.

This was also an exciting idea for conservationists advocating for wolf recovery. Amidst the controversial recovery of a predator that kills livestock and big game—especially the hunters' coveted elk—science now pointed to ways wolves benefited Yellowstone's ecology and helped aspen recover without spilling any blood.

The process of a predator changing the way its prey interacts within its level in the ecosystem is termed a "behaviorally mediated trophic cascade" or BMTC. Ecologists have studied how this works among insects and aquatic species since the early 80s. Through a BMTC, predators restructure an ecosystem's vegetation composition by changing the ways herbivores forage. Ecologists were interested to test whether some of the principles found in small-scale manipulable systems would hold true in larger ecosystems.

The wolf reintroduction to Yellowstone in 1995 offered an unprecedented experimental opportunity. "The embodiment of this ecological idea of the nonlethal effect of predators (was) being played out on the biggest stage in the world," said Kauffman.

The first paper suggesting that a BMTC may be unfolding in Yellowstone came out in 2000, and the idea quickly gained momentum among both ecologists and wolf recovery advocates. Popular media helped broadcast the story. The *New York Times* described the "ecology of fear" in 2005 and the March 2010 issue of *National Geographic* magazine included a foldout illustration of Yellowstone before and after wolf reintroduction emphasizing the recovery of streamside willows and upland aspen groves in areas where elk were no longer willing to forage.

But when Kauffman went to Yellowstone to prepare to design his own study of the BMTC, he didn't see what he expected. He was surprised that even ecologists, who tend to require solid proof of stories as powerful as this one, had let the Yellowstone BMTC idea stand, because from his observations it wasn't happening.

"In some ways the BMTC—that you could have these positive benefits on the plant communities that elk browse without having the wolves reduce the number of elk that are available for hunters—is too good to be true," said Kauffman.

THE BMTC

The idea behind the BMTC, first explored by aquatic ecologists in the 1980s, is that predators influence the ways their prey forage by scaring them into changing their behavior. Oswald Schmitz at the Yale University School of Forestry conducted some of the most renowned experiments to test this idea.

Schmitz studied spiders hunting grasshoppers inside screen cages in a field. He compared the ways grasshoppers foraged inside enclosures with and without predatory spiders present. When there were no spiders around, grasshoppers foraged almost exclusively on grass, but when a spider was introduced to the system,

grasshoppers switched to feeding on forbs. The forbs offered refuge from the spiders, which tended to lurk in the grass.

Then Schmitz created an experiment where he applied a tiny drop of glue to the mouthparts of predatory spiders to create "risk spiders"—spiders that can scare grasshoppers, but can't actually kill them. (He did tests to ensure the risk spiders behaved similarly to predatory spiders, and that they would survive for the duration of the experiments without perishing from the glue.) The grasshoppers had the same effects on vegetation whether they were in the presence of predatory spiders or risk spiders. That provided evidence, according to Schmitz, that spiders were influencing not just the number of grasshoppers, but also their behavior.

Ecologists usually think of terrestrial ecosystems as structured from the bottom up; that is, nutrient levels and soil determine vegetation, which determines how many and what kinds of creatures live there. But Schmitz's work showed that simply adding a predator to a system significantly altered plants and even nutrient levels from the top down.

"(E)ach predation event only influences a single herbivore prey per unit time," Schmitz wrote in 1997, "whereas the risk introduced by the mere presence of a predator could have more widespread effects, in that same time period, by causing many prey individuals to alter their foraging behavior." This changed the way ecologists thought about the role of predators in terrestrial systems.

Kauffman called Schmitz's research, "a particularly elegant demonstration of a BMTC," adding that several other researchers have studied it in invertebrate and aquatic systems. Ecologists, he said, often study small manipulable systems—like enclosures in a field where spiders and grasshoppers interact—and then try to figure out if there are ways to scale up their findings to larger systems.

"It's not that we are trying to stretch a grasshopper to make it look the size of a moose," Schmitz said. "It's the principles that you scale." For example, ecologists may look for scale in principles about how herbivore behavior or physiology evolves in response to pressures from food availability and predation.

After wolf reintroduction in Yellowstone, William Ripple, an ecologist from Oregon State University, and his colleague Eric Larsen, began to examine Schmitz's BMTC theories in Yellowstone. In 2000 they published an analysis of the history of aspen recruitment in Yellowstone National Park as it related to wolves. They wrote, "Wolves may positively influence aspen overstory recruitment through a trophic cascades effect by reducing elk populations, modifying elk movement, and changing elk browsing patterns on aspen."

In 2001 Ripple and three more colleagues wrote with even more conviction about ways wolves were changing elk behavior and influencing vegetation recruitment: "(I)t appears that elk foraging behaviors may have been altered by the increased risk of predation due to the reintroduction of the wolf. In the riparian/wet meadow habitat type, mean aspen sucker heights were significantly higher in the high wolf-use areas than in the low wolf-use areas."

RISK IN YELLOWSTONE

Kauffman was intrigued, and he developed a study to further investigate the wolf-elk-aspen BMTC. His study area was the Northern Range of Yellowstone, nearly 600 square miles of grasslands, shrubs and conifer forests that make up the winter range of the Northern Yellowstone elk herd. The range straddles the Lamar Valley where park visitors gather to view wolves. In the winter, the highway is lined with neon puffies as wolf enthusiasts peer through spotting scopes and binoculars.

When Kauffman visited the Northern Range for the first time, he expected to see stands of thriving aspen suckers throughout the Lamar Valley where wolves are known to hunt. Instead, "I was amazed that everywhere we looked, aspen had been heavily browsed," he said. "So immediately I was thinking there must be something more to this story."

As Kauffman considered the BMTC studies and their results, he realized one aspect of the wolf BMTC that needed elucidation was a better description of where on the landscape elk perceived risk of attack from wolves. He found there was little consensus about how to best characterize the "landscape of fear."

Early studies of the BMTC in Yellowstone mapped wolf territories and described the core of those places as dangerous and the periphery as safer. But Kauffman had a different idea. He worked with Doug Smith, the wolf project leader in Yellowstone, who had collected ten years of data about wolf kills. Kauffman used 774 locations where wolves had killed elk—an especially robust data set—to create a "risk map" of the northern range. The risk map incorporates information about distribution of wolf packs and relative elk density as well as several landscape features including slope, snow depth, distance to streams and roads and whether the habitat is open grassland or forest. It shows, for example, that the center of the Lamar Valley is highly risky to elk, while the higher, forested ground away from rivers has a lower level of risk for elk.

With a data-driven risk map in hand (the first of its kind for Yellowstone wolves), Kauffman analyzed how well aspen were recovering in the risky areas compared to the less risky areas. He categorized aspen in 16 stands across the range as suckers, juveniles and adults. Suckers are less than 2 meters tall and are susceptible to browsing by elk. Juvenile trees are more than 2 meters tall, but have a diameter of less than 6 centimeters at about 5 feet above the ground. They have escaped being browsed by elk and are on their way to becoming adults.

If the BMTC was happening, stands in risky areas should have had more juvenile trees than stands in safe areas. But according to the published study, "No individuals in the juvenile class were found in natural stands." The lack of juvenile aspen indicated none of the younger suckers escaped the intense browsing by elk, despite the influence of wolves.

This surprised Kauffman. No one wanted to throw cold water on the BMTC idea in Yellowstone, but as an ecologist, Kauffman also wanted to get the science right. "And at the end of the day, it's the role of science to characterize how wolves and other large predators interact in these systems. And if we don't get it right that will have negative consequences down the road," he said.

KAUFFMAN'S FINDINGS

Meanwhile, Schmitz had made a new discovery of interactions in his spider-grasshopper-field system. In 2008 he published a paper that showed two kinds of predatory spiders had opposite effects on vegetation structure. He distinguished between "sit-and-wait" spiders and "roaming" spiders.

"Sit-and-wait ambush predators cause largely behavioral responses in their prey because prey species respond strongly to persistent point-source clues of predator presence," he wrote. This matched with his findings from earlier studies of web spiders that lurked in the grass, waiting to ambush the grasshoppers and thus scaring them into the forbs for refuge. "Widely roaming, actively hunting predators may reduce prey density, but they produce highly variable predation risk cues and are thus unlikely to cause chronic behavioral responses in their prey."

The two kinds of predatory spiders could be compared to the different ways mountain lions (a sit-and-wait predator) and wolves (a roaming predator) might influence prey behavior. Mountain lions ambush prey from specific locations like steep, rocky cliffs. And when a mountain lion strikes, it usually ends in a quick kill. So prey learns to avoid the lions' hunting spots.

But wolves hunt all over the landscape, continually moving from place to place. And they often pursue elk without killing them. According to data from the Yellowstone Wolf Project, as many as 80 percent of elk that are pursued and attacked by wolves escape alive. "Elk can't know where wolves are, so they don't have this preemptive behavior of avoiding areas where wolves are going to attack them," Kauffman said. "Wolves are sort of everywhere, so for an elk they are nowhere."

Elk may avoid a valley or riparian area for a few days while wolves are present, but as soon as the wolves move elsewhere, the elk return. Over the course of a winter, elk don't avoid certain areas consistently enough for reduced browsing to translate to higher growth rates of aspen. In fact, research by Scott Creel and David Christianson in Yellowstone published in 2009 found that "elk consumed significantly more willow when wolves were present … contrary to the behaviorally mediated trophic cascade hypothesis." They suggest this may be a result of elk seeking cover in the willows rather than staying out in the open grasslands when wolves are around.

Additionally, there is a key difference, according to Kauffman, between how elk respond to wolves and how grasshoppers respond to spiders. Elk browse aspen in winter, when they live off dwindling fat reserves, progressively losing weight as the months go by. "It's well-supported in the literature that animals that are near death by starvation basically ignore predation completely," Kauffman explained. "If you are in really poor condition it's worth the risk to feed in a risky place because you have to feed or you will die."

All of this, Kauffman said, points to the fact that wolves don't influence elk behavior enough to spur aspen recruitment in risky areas. He sums it up this way "Elk certainly respond behaviorally to the predation risk posed by wolves, but those small alterations to feeding and moving across the landscape don't seem to add up to long-term benefits for aspen, even in the riskiest areas."

RESPONSES

"The story of wolves in Yellowstone has been made true by repeated telling, not by good science," said Tom Hobbs, an ecologist at Colorado State University who studies how willows are responding to the wolf reintroduction in Yellowstone. "The trophic cascade story is stated as if it is undisputed fact, but it is not. It's a lovely story, a simple clear one. But in reality, it is more nuanced, more complex, and it may even be dead wrong."

He agrees with Kauffman that shrubs are not responding to elk behavioral changes. His research shows that after wolves were wiped out in Yellowstone, elk grazing hammered the willows, which drove beavers out. Without beaver dams, streams cut into the ground between their banks, leaving the willows on high terraces. Now, he says, reducing herbivory is not enough to help the willows recover unless the beavers and the water tables are restored as well. "The question is, can you quickly restore a system by putting wolves back in? The answer is no in most places."

"The wolf is neither a saint nor a sinner except to those who want to make it so," wrote L. David Mech of the U.S. Geological Survey in his 2012 paper, "Is science in danger of sanctifying the wolf?" He suggests that even scientists have become so attached to the iconic cachet of the wolf story that they credit the species with ecological roles beyond what research has shown for them.

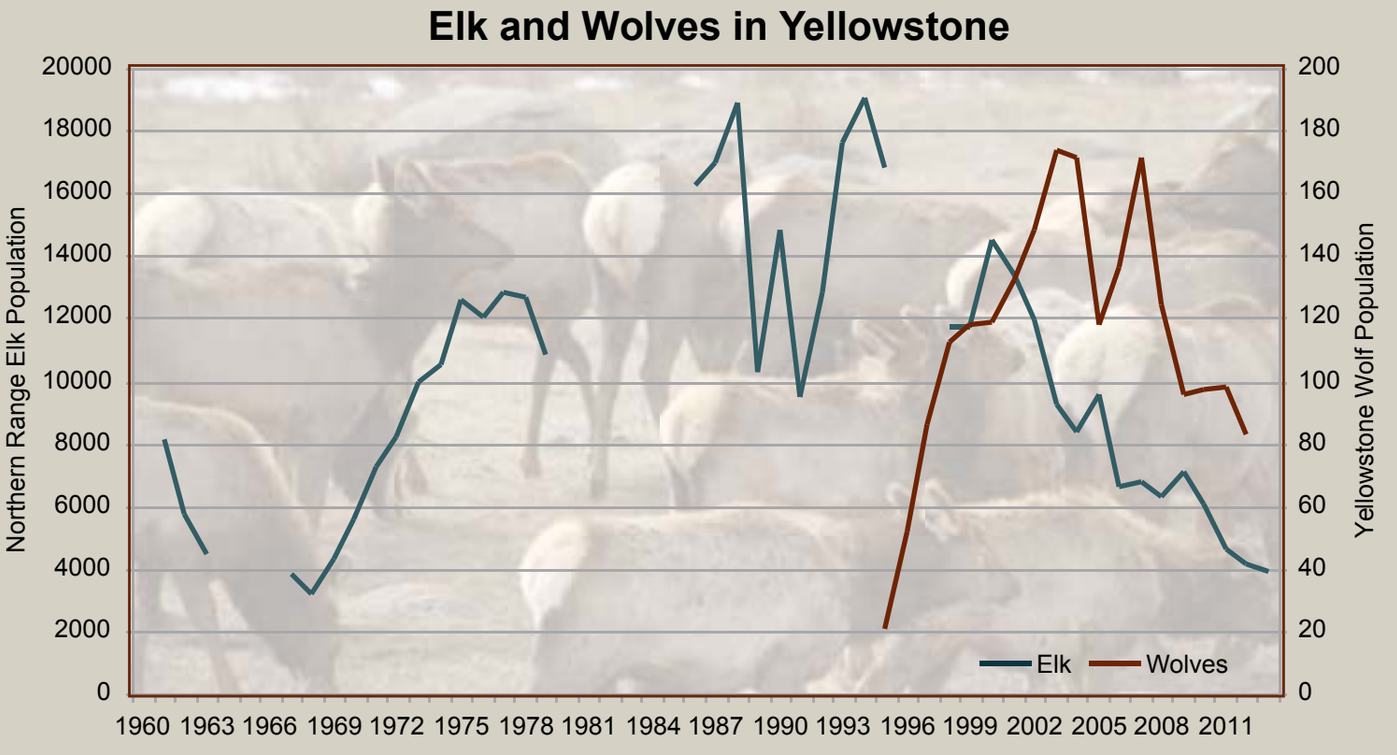
"It's often misunderstood that if you don't support the top-down approach you are not an advocate," said Roy Renkin, a botanist who has studied ungulate herbivory in Yellowstone National Park for 35 years. He agrees that restoring top predators is crucial to ecosystem recovery, but he emphasizes that it's not clear how to untangle wolf reintroduction influences on vegetation recruitment from other causes.

"The trick is trying to understand the feedbacks of the system," he said. His research has examined how factors such as shifting winter snowpack, increasing aridity in Yellowstone,

Elk and wolves in Yellowstone

The Northern Yellowstone Cooperative Wildlife Working Group, an interagency collaboration between Yellowstone National Park and Montana Fish and Wildlife, began counting elk on Yellowstone's Northern Range in 1961. Counts are taken from the air one day a year. This population migrates seasonally, often to interior parts of the park. Gaps in data represent years when poor visibility conditions made for abnormally low counts. These counts represent an absolute minimum. Biologists estimate that actual populations are 20 to 50% greater than the annual count, depending on conditions.

In this data set, wolf populations from 1995-1998 included all wolves in the Greater Yellowstone Area, whereas the data post-1998 counts only wolves in Yellowstone National Park. In addition to pressure from wolves, factors such as hunting, severe weather, and other predators also influence the fluctuating population of elk in Yellowstone.



and a dramatically lengthened growing season since the time of wolf reintroduction can all influence elk behavior and shrub recovery. He cautions against any ideas that simplify the system, including strong adherence to either a top-down or bottom-up interpretation of ecosystem structure.

"It's fascinating. And that's science," he said. "Hypotheses emerge. People question them. That just advances science."

Kauffman's findings have not seen the popularity of the earlier BMTC findings. "There are lots of people who are pro wolves and pro restoring predators who saw my paper as 'hurting the cause,'" said Kauffman. Even though he doesn't believe the BMTC is happening the way it was first proposed in Yellowstone, he supports wolf recovery as necessary to restore wildness to the Park. "I think hands down wolf recovery is one of the most remarkable achievements and success stories in the history of wildlife management. …We have plenty of reasons to reintroduce wolves. We don't need this ecological one."

ENDNOTES

Creel, S. & Christianson, D. (2010) Wolf presences and increased willow consumption by Yellowstone elk: implications for trophic cascades. *Ecology*, 90, 2454-2466.

Kauffman, M. J., Brodie, J. F., & Jules, E. S. (2010) Are wolves saving Yellowstone's aspen? A landscape-level test of a behaviorally mediated trophic cascade. *Ecology*, 91, 2742-2755.

Mech, L. D. (2012) Is science in danger of sanctifying the wolf? *Biological Conservation*, 150, 143-149.

Ripple, W. J., & Larsen, E. J. (2000) Historic aspen recruitment, elk, and wolves in northern Yellowstone National Park, USA. *Biological Conservation*, 95, 361-370.

Ripple, W. J., Larsen, E. J., Renkin, R. A., & Smith, D. W. (2001) Trophic cascades among wolves, elk and aspen on Yellowstone National Park's northern range. *Biological Conservation*, 102, 227-234.

Ripple, W. J., & Beschta, R. L. (2007) Restoring Yellowstone's aspen with wolves. *Biological Conservation*, 138, 514-519.

Schmitz, O. J., Beckerman, A. P., & O'Brien, K. M. (1997) Behaviorally mediated trophic cascades: Effects of predation risk on food web interactions. *Ecology*, 78, 1388-1399.

Schmitz, O. J. (2008) Effects of predator hunting mode on grassland ecosystem function. *Science*, 319, 952-954.

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Dave Wade *grew up hunting and studying wildlife in the Rocky Mountain West. He attended the University of Utah in Salt Lake City and the Art Center College of Design in LA and has been painting full time since 1976.*

"Regen"

An ecologist's retrospective on the wildfires of 2012

By Indy Burke

My own home was surrounded by one of the massive wildfires that swept the Rocky Mountain region in 2012. While the house and barn made it, many of the neighbors' homes did not. When I returned to the area after the evacuation orders were lifted, I saw blackened ground and scorched trunks. This summer massive mudslides and major ash-flows in the burned areas surged to the canyon floors, destroyed additional houses, and smothered roadways.

My property is a snapshot of what's becoming a west-wide issue. Wildfires burned more than nine million acres in the United States during 2012, enough to cover a square 120 miles long on each side. Much of that burned in the Rocky Mountain West. Last year was the third most extensive wildfire year in the last five decades (following 2006 when 9.87 million acres burned and 2007 when 9.33 million acres burned).[1] Six of the worst wildfire seasons in the last fifty years have occurred since 2000.[2] And increasingly, these wildfires affect areas where homes and other development encroach into forest fringes.

Even though much less acreage has so far burned this year than last, there has already been substantial damage in the so-called "wildland-urban" interface. More than 500 homes were lost early this summer in Colorado's most destructive fire ever, and nineteen hotshot firefighters were killed trying to protect homes in Arizona.

To counter these damages, policy-makers are considering bills such as HR 818, the Healthy Forest Management and Wildfire Prevention Act, to support U.S. Forest Service fuel reduction programs. And communities, which bear substantial cost from wildfires, are discussing responsibilities for homeowners building in high-risk areas. Given the continuing drought, climate change, and human incursion into wildlands, these mitigation efforts will only become more crucial.

Meanwhile, the areas that burned around my home provide a fascinating window into fire ecology, demonstrating the resilience of the forests and reminding me that fires do not represent total destruction. By only a few weeks after the fire, aspen in heavily burned stands had re-sprouted. Now, 13 months after the fire, stands of new sprouts reach over my head. This summer, a native plant I haven't seen in 25 years of exploring these mountains as an ecosystem scientist appeared. It eventually covered as much as 20% of the ground in heavily burned areas—more area than the Forest Service has been able to mulch with straw. *Corydalis aurea*, better known as "golden smoke" or "scrambled eggs," is native. It sprouts from seed following fires, blankets the ground in the first year, and disappears by the second or third year.[3] Both golden smoke and aspen provide natural flood and erosion mitigation, and aspen offers cover and forage for wildlife.

The landscape won't be back quickly, and it likely won't ever have quite the same composition as before the fires. Some areas that used to be forested won't grow back. Other spots will carry the scars of standing dead trees for a few decades. But it will be green and diverse and absorbing water in only a few years.

***Indy Burke** is an ecosystem ecologist whose work focuses on carbon and nitrogen cycling in semi-arid rangeland and forest ecosystems.*

1 National Interagency Fire Center, "Total Wildland Fires and Acres," accessed July 16, 2013, www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html.

2 Gorte, Ross. *The Rising Cost of Wildfire Protection* (Bozeman, MT: Headwaters Economics, June 2013).

3 U.S. Forest Service, "Index of Species Information: *Corydalis aurea*," accessed July 16, 2013, http://www.fs.fed.us/database/feis/plants/forb/coraur/all.html#FIRE ECOLOGY.

Humans: The wildest animal in the forest

Social science bolsters a massive management plan

By Jessica Clement

In 2007 the mangers of Wyoming's rugged and far-reaching Bridger-Teton National Forest revisited their forest plan as mandated by the National Forest Management Act. For the Forest Service planners, their colleagues, and the public this meant exploring trade-offs among integrated ecological, social, and economic variables to develop potential management guidelines for a whole suite of issues on a 3.4 million-acre landscape for the next 15-20 years. No mean feat.

A task like this, rife with interrelated, complex data and resources, and spiced with conflict and high emotions, is termed "wicked" by social scientists. Pull on one thread in this mass, and the whole thing moves. If economic and ecological facts and figures indicated a clear path toward a healthy forest, abundant wildlife, and economic wellbeing, writing a forest plan would be a simple task. Most folks working for land management agencies know a lot about vegetation, water, wildlife, maps, and ecological processes, but few are steeped in social psychological knowledge. It is the pesky social, or human, component that truly creates the complexity and is difficult to absorb into decision making. That one wildlife species, *Homo sapiens*, complicates it all.

Most folks working for land management agencies know a lot about vegetation, water, wildlife, maps, and ecological processes, but few are steeped in social psychological knowledge. It is the pesky social, or human, component that truly creates the complexity and is difficult to absorb into decision making.

In 2007 the Wyoming Governor's Office asked me, then human dimensions in natural resources scientist with Colorado State University and now with the Ruckelshaus Institute at the University of Wyoming, to unravel this social complexity in the Bridger-Teton. I conducted a random sample mail survey and applied other social science methods to map residents' values to important places in the forest. The survey results showed the strongest connection between residents and their forest that I've ever found doing this kind of work. That's because both working and recreational uses of the forest were meaningful here. Residents cared about the Bridger-Teton for the grazing, logging, and outfitting work, camping and tourism experiences, and sustenance through hunting and fishing.

Within these strong connections a range of priorities rose to the surface. Some survey respondents preferred opening roads while others wanted them closed. Many called for more active logging to reduce insect-affected trees and protect property, and many opposed oil and gas leasing on the forest. Most respondents supported grazing permits with limitations. People were concerned about the moose population, and they wanted managers to protect vegetation for wildlife habitat.

Armed with the survey results, I travelled through the Bridger-Teton, meeting with loggers, cattle and sheep ranchers, hunters, business owners, mountaineers, energy industry professionals, county commissioners, mayors, helicopter pilots, weed and pest department folks, environmentalists, second and primary home owners, and motorized and horse-back outfitters, often in remote areas. As a social scientist, I hope my data will inform decisions, but integrating this knowledge can be tricky for natural resource managers. So I met, too, with the Bridger-Teton supervisor and her staff, and planners in each of the six forest districts. I wanted to dig deeper into the survey results, and to explain my findings.

In Afton, Wyoming, for example, I sat down with the Greys River District Ranger, county commissioners, and other community members to discuss motorized recreation. The survey showed less support for motorized recreation in their county, and in the whole forest, than they had hoped. We discussed creating a collaborative process to find a sound management solution. Here, information generated by social science helped ground-truth assumptions about what people thought.

Like many natural resource issues, forest management is inherently complex and can be controversial. A survey designed with real help from local residents can truly address the questions folks have. Results that have validity in residents' and agencies' eyes, can inform management options. And face-to-face conversations can further unravel "wicked" interrelated issues.

In the case of the Bridger-Teton, the survey results reached even beyond the planning process. The data confirmed that locals found proposed oil and gas exploration in one part of the forest unfavorable, informed the creation of a Jobs and Recreation Act in Montana, and started collaborative discussions around motorized recreation in the Star Valley. Five years later, people tell me they are still using the data for projects in the forest.

***Jessica Clement**, a social scientist who has studied collaborative processes for forests, public lands, and other resources for twenty years, directs the Ruckelshaus Institute's Collaboration Program in Natural Resources.*

Federal government fast tracks a Wyoming wind farm

Carbon County's Chokecherry-Sierra Madre project will be the nation's largest

By Anne Jakle

A year ago the Bureau of Land Management signed the Record of Decision for the Chokecherry and Sierra Madre Wind Energy Projects, which combined would be the nation's largest wind facility. The proposed facilities would consist of 1,000 wind turbines that would represent 2,000–3,000 megawatts of total generating capacity, or up to fifteen times that of Wyoming's largest existing wind facility and two to three times larger than the largest existing project in the United States.

The project developer, Power Company of Wyoming, LCC, a subsidiary of Anschutz Corporation, estimates Chokecherry/Sierra Madre would provide enough electricity to power one million homes. The project will cost $4-6 billion to construct, and the company estimates project construction and operation will create over 1,000 temporary jobs and up to 114 permanent positions. In addition to payments to the federal government for land use, and state income from property tax and sales tax, the project would pay up to $7.5 million per year to the state of Wyoming under its wind energy production tax instated in 2010.

Located south of Rawlins, the project area encompasses 219,707 acres of public, private, and state lands, or roughly the area of the Jonah and Pinedale natural gas fields put together. The Power Company of Wyoming states, however, that turbines and associated infrastructure will directly impact less than 2,000 acres. Part of this acreage includes mule deer crucial winter range and elk and pronghorn range. The projects are estimated to kill 5,400 birds each year, a figure that includes 150–210 annual raptor fatalities.

To mitigate for impacts to wildlife species, the project developers will seasonally restrict construction activities and create avian and bat protection plans. They also plan to avoid sage grouse core areas and monitor sage grouse for five years post construction.

Federal forces are pushing the project forward with the full support of the Obama Administration. In August 2012, the administration announced the federal government would expedite seven renewable energy projects, including Chokecherry/Sierra Madre. The BLM also lists the project as a "2012 Priority Renewable Energy Project."

The momentum for federal support of renewable energy projects on public lands began nearly a decade ago. In the 2005 Energy Policy Act, Congress directed the Secretary of the Interior to approve 10,000 megawatts of renewable energy projects on public lands by 2015—the approval of Chokecherry/Sierra Madre reaches this goal. A 2009 Department of Interior Secretarial Order also states that environmentally responsible renewable energy development on public lands is a priority of the department.

From here, BLM will conduct additional environmental reviews for the specific turbine layout. It is anticipated site-specific environmental reviews will continue through 2014.

***Anne Jakle** served as acting interim Assistant Director of the Ruckelshaus Institute at the University of Wyoming and is now Senior Policy Analyst at the New Mexico Energy, Minerals, and Natural Resources Department.*

CICADAS

Wyoming's summer songsters

By Alex Latchininsky and Scott Schell

Walk through the sagebrush or a forest in the west in the summer and you are likely to hear the raucous clicking or buzzing of cicadas. Cicadidae, a family of shiny, large-eyed insects in the suborder Hemiptera, are probably the noisiest bugs around. Their shrill song is in fact a mating call males produce to attract the quieter females. Most adult cicadas live for only two to six weeks, sucking sap from trees and shrubs using their piercing beak mouthparts. Females lay eggs in twigs and thus sometimes damage terminal branches of trees. After hatching, the nymphs drop down to the soil and burrow into it using their enlarged front legs. The nymphs live for many years underground where they feed on the fluids in plant roots.

In the eastern United States, the so-called periodical cicadas (*Magicicada* species) produce spectacular synchronized broods emerging *en masse* every 17 or 13 years. This year a big brood of 17-year cicadas was expected, but the actual emergence was smaller than entomologists had predicted. Sometimes these cicadas are incorrectly called "periodic locusts" while in fact the real locusts are a different type of insects, the swarming grasshoppers. Nymphs spend all those years in the soil and then emerge, molt into adults, and live for a few weeks as adults to reproduce. As such, the periodic cicadas have one of the longest life cycles among all insects; in Wyoming, they would even qualify for driver's licenses! However, these periodical cicadas do not occur in the Rocky Mountain region.

Wyoming is home to over 20 different cicada species. They do not live as long as the famous eastern species, usually between 2 and 5 years. These cicadas are found in sagebrush, grassland, and shrub areas. They are so well camouflaged that usually you hear them but can't spot them. Some of our species are quite big. For example, the giant grassland cicada and dog-day cicada, both *Tibicen* species, are close to two inches long with wingspans of over four inches. Adult cicadas are great fliers.

This year two pretty, at least to entomologists, orange and black colored species of cicadas emerged in noticeable numbers in the mountain foothills of northern Colorado and southeast Wyoming. If you didn't see them you probably heard them. The narrow, one-inch-long *Platypedia putnami* males make clicking calls, it is thought, by flexing their semi-rigid wing surfaces and then letting them return to their relaxed shape, similar to pressing and releasing the sides of a pop can to make clicking noise. The more stout, 1.5-inch-long *Okanagana bella* males produce the typical shrill buzzing song. *O. bella* and most other species of cicadas have paired membranes, called tymbals, on the abdomens that they vibrate with muscles and resonation chambers inside their bodies to produce their mating calls.

The adults of these two particular species do not feed but are good food for other animals. After their long lives as grubs underground, cicadas emerge to provide a rich source of calories for birds and small mammals, and the defining music of a Wyoming summer.

Alex Latchininsky *and* ***Scott Schell*** *are Extension Entomologists at the University of Wyoming.*

Collaborative problem solving in the gas fields

A diverse team knuckles down on a daunting natural resource issue

By Chad Baldwin

Problems with ground-level ozone have bedeviled Sublette County in recent winters, creating a periodic public health hazard, management issues for the region's oil and gas operators, and a regulatory challenge for Wyoming's Department of Environmental Quality.

And when the federal Environmental Protection Agency declared Sublette County a "nonattainment" area in 2011, the need to solve the ozone problem became even more urgent.

Ground-level ozone is the main component of smog and is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC). Unhealthy ozone levels normally are associated with hot, sunny days in urban environments, but the phenomenon has occurred in Sublette County—the home of intensive oil and gas development—on sunny days when snow is on the ground and temperatures are near or below freezing. High ozone levels can cause or exacerbate health problems, especially with breathing.

Then-DEQ Director John Corra, recognizing that finding a Sublette County ozone solution would be difficult in part because the situation involved concerns about the region's public and economic health, decided the best approach would be to bring all parties to the table. Also recognizing that getting such a group to work together could be a challenge in and of itself, he turned to the University of Wyoming's Ruckelshaus Institute of Environment and Natural Resources for help.

Steve Smutko, UW's Spicer Wyoming Excellence Chair in Collaborative Practice, and Elizabeth Spaulding, public policy facilitator, were tapped for their problem-solving expertise. They served as facilitators for the 26-member group formed by Corra—the Upper Green River Basin Air Quality Citizens Advisory Task Force—and were instrumental in its development of recommendations to address the ozone problem.

"Without a good process, convening a group of 26 people would not have succeeded. It's too big of a group and too diverse. We purposely chose people who were strong in their beliefs and ideals, articulate and actively involved in the area," Corra said. "It really did require good facilitation. Both Steve and Elizabeth did a great job."

The task force—which includes local residents; local government leaders; and representatives of the oil and gas industry, DEQ, the Bureau of Land Management, the U.S. Forest Service, public health groups and the governor's office—presented its recommendations to DEQ in September 2012.

The task force brainstormed more than 60 possible ways to reduce ozone formation, but members determined that the final list of recommendations would include only measures upon which everyone agreed. The process of reaching that consensus was tedious and time consuming, all participants agreed. But it was successful.

In the end, the group produced 10 recommendations. They include improving management of ozone "action days"; existing stationary emission sources; non-road mobile exploration and production emission sources; leak detection and repair; produced water and storage; monitoring and reporting; and stronger DEQ involvement in monitoring. In general, Smutko said, the recommendations call for use of best available technology to reduce emissions both from existing industrial operations and newly permitted operations in the area.

"We know this will reduce ozone," he said. "We don't know by how much."

Wyoming Gov. Matt Mead praised the task force's collaborative effort, and Corra said the recommendations were "all very good," as his agency began an analysis to determine if they can be implemented. Corra retired in 2012, and Todd Parfitt became the new director of Wyoming's DEQ.

Unhealthy ozone levels normally are associated with hot, sunny days in urban environments, but the phenomenon has occurred in Sublette County—the home of intensive oil and gas development—on sunny days when snow is on the ground and temperatures are near or below freezing.

In March, DEQ's Air Quality Division released its Upper Green River Basin ozone strategy, with short- and long-term activities designed to tackle the nonattainment issue. The strategy addresses several of the recommendations made by the task force, such as strengthening monitoring and reporting requirements and designating a point person at DEQ to respond to public comments and concerns as the ozone strategy moves forward. In addition, DEQ soon will begin new rulemaking on issues identified by the task force.

Having worked with Smutko in a similar process to develop a new strategy for coal-bed methane wastewater discharge permits in the Powder River Basin, Corra knew the UW faculty member had the expertise to help the task force navigate a contentious, high-stakes process. While Smutko was involved from the start, Spaulding served as the primary facilitator, a job that included initial one-on-one discussions with the task force members, and leading a meeting to establish objectives and ground rules for the group.

The Ruckelshaus Institute also provided a joint fact-finding scientific document—which included findings of UW researchers—about ozone formation and transportation in the Upper Green River Basin.

Some task force members wanted to consider factors beyond industrial activity that might contribute to the ozone problem, but the group decided to focus on the issue as an industry impact, Smutko said.

"We had to make sure that everybody, early on, understood the issues to be resolved," he said.

Smutko's and Spaulding's backgrounds in natural resource issues, combined with their facilitator skills, constitute a tremendous resource for the state, Corra said. Both Corra and Parfitt are members of the board of UW's Haub School of Environment and Natural Resources, of which the Ruckelshaus Institute is a division.

"Seeking input from a diverse group to help us solve problems requires the services of a facilitator," Corra said. "My sense is that the value of that service by the university is going to grow."

Smutko, who was hired two years ago from North Carolina State University largely because of his background in collaborative process, said bringing parties together to solve problems is part of the Ruckelshaus Institute's mission to "communicate relevant research and promote collaborative decision making to support stakeholder-driven solutions to natural resource challenges."

"We want to see the university fill a role as not only a provider of information for decision-makers, but also to provide a neutral forum to enhance the capacity of the people of Wyoming to solve these sorts of problems," Smutko said.

Chad Baldwin *is Director of Institutional Communications for the University of Wyoming.*

Western Confluence submission guidelines

We are currently accepting submissions or queries for upcoming issues. Submission deadline for our spring issue on western forests is **February 3**. Writers should use plain language rather than academic, scientific, wonky, or jargon-filled writing. We're looking for unbiased, in-depth, and substantive article that are meaningful and accessible for the following content:

NOTES FROM THE FIELD

These pieces include updates, summaries, and descriptions of current studies, research, collaborations, legal decisions, policies, or other projects or news relevant to natural resources in the West. 250 to 500 words

EMERGING ISSUES

These feature-length articles describe research or management/policy decisions pertaining to emerging or evolving natural resource issues. Articles in this section bring to the forefront issues that will require policy decisions to be made in the next five to ten years. Potential topics include evolving information or decision developments on land use, wildlife, water, energy-environment linkages, and environmental policy. 2,000 to 5,000 words

NEW PERSPECTIVES

These feature-length articles cover innovative or new perspectives on issues in natural resource and environmental science. Articles in this section describe and put into context new research that changes the way stakeholders think about a natural resource issue. 1,500 to 4,000 words

DOWNSTREAM

An essay that looks critically at a relevant issue and offers new analysis. 500 to 750 words

HOW TO SUBMIT

Please email your draft as an attached Word document to the managing editor, Emilene Ostlind, at editor@westernconfluence.org. Include the author(s) name(s) and contact information and a one- to three-sentence byline describing the credentials of the author(s). List sources of funding for the research as well.

Any supplemental information, such as additional figures, photographs, videos, or other items that complement the text, should be submitted as separate files.

For additional information on content and style guidelines, visit **www.westernconfluence.org**.

Events and opportunities with the Ruckelshaus Institute

The **Wyoming Open Spaces Initiative**, a partnership of the Ruckelshaus Institute, the Wyoming Geographic Information Science Center, the Wyoming Natural Diversity Database, the UW Department of Agriculture and Natural Resources, and UW Extension, is our longest-running white-paper series. The initiative presents data and findings to inform efforts to maintain Wyoming's open spaces. The latest publication, "Understanding Wyoming's Land Resources: Land-Use Patterns and Development Trends," is now available.

The Ruckelshaus Institute's **Energy Mitigation Research and Outreach Initiative** gathers and synthesizes information on mitigation practices intended to ameliorate the consequences of landscape-scale energy development to wildlife populations. The initiative's third publication, "Market-based Wildlife Mitigation in Wyoming," is now available.

This spring the Ruckelshaus Institute will welcome the second cohort to our **Collaboration Program in Natural Resources**. Directed by Dr. Jessica Clement, the Collaboration Program leads mid-career professionals through a year-long program of intensive workshops and a practicum. Participants gain skills in negotiation, leadership, collaboration, public participation, and decision making for natural resource challenges.

For information on these initiatives and programs, visit our website: **www.uwyo.edu/haub/ruckelshaus-institute**.

SUPPORT OUR MISSION

A significant portion of our budget is made up of individual contributions from people who believe in our mission. There are three easy ways to support our work to advance informed, collaborative decision making for natural resource issues in the West:

- Give online through UW's secure platform: **www.uwyo.edu/giveonline**
- Send your contribution in the mail:
  University of Wyoming Foundation
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Conservation is a Conservative Ethic

By John Turner

"Save the parts," my dad and grandfather used to say while I was growing up on our ranch. I recall many ranches and farms hoarding a respectable bone pile of motors, bolts, springs, axles and an interesting variety of metal parts. I was surprised at how often we retrieved one of these relics to fix something or build a new of piece of equipment. This conservative habit was a practical and economic approach to meet the needs of daily ranch work.

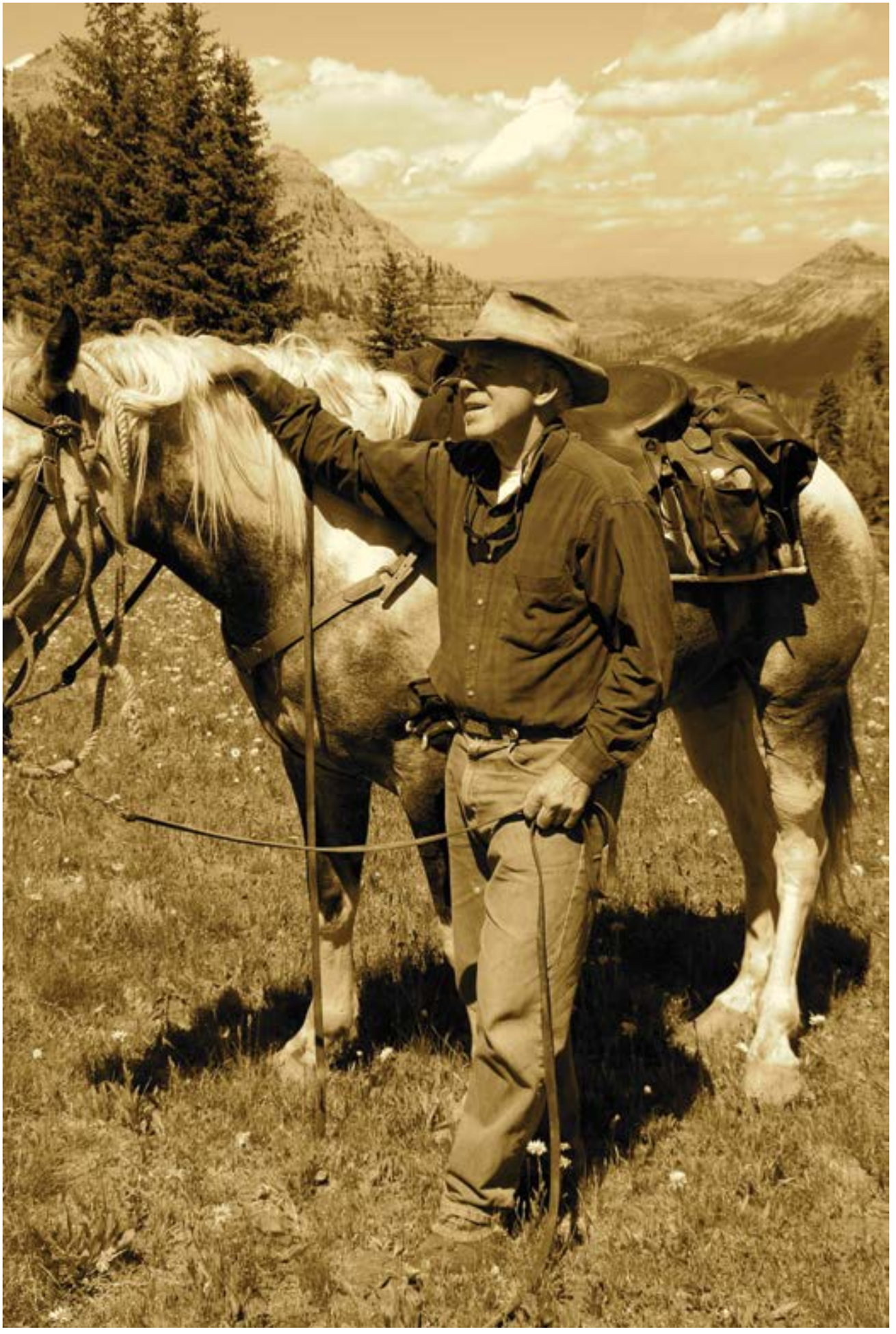
Conserving landscapes, watersheds, and the critical elements of ecological systems is also an essential strategy to protect the health and economic wellbeing of our lives and communities. Like with the scrap pile, we should save even pieces that don't have a clear purpose today, not let anything go to waste or get trashed, and ensure that when we need something down the road, we have it on hand. I have always believed that conservation is founded on conservative principles.

These principles include taking full responsibility for one's action and resources. It means carefully and strategically budgeting our resources for the future—with full consideration of generations to come. We want our children and grandchildren to have the freedom to choose options that we cherish. It's stewarding our natural resources for the long pull.

Environmental stewardship is simply good business. This is why the ranks of superb stewards include ranchers, farmers, timber operators, miners, and a multitude of hunters and fishermen who are traditionally conservative. Wyoming citizens, who usually tilt conservative, place a high value on productive natural landscapes, healthy agricultural lands, open space, an abundant and diverse wildlife complex, and clean streams and clear air sheds. Wyoming has sound laws and programs to ensure land stewardship, site industrial complexes, provide responsible wildlife management, protect air and water, manage waste and hazardous materials, and even conserve royalties from mineral extraction for successive generations. These were forged and implemented with bipartisan leadership, and were all passed by conservative state legislatures.

Conservation is a tenet of a conservative philosophy. Just as tucking away old machinery parts and bailer tines is a way to make sure we're not left in the lurch when a piece breaks unexpectedly, so does protecting our air, water, wildlife, and scenic vistas ensure our quality of life into the future. Conservation and conservatism pull in tandem like a team of good workhorses.

John Turner *runs the Triangle X Ranch in Jackson Hole, chairs the Haub School Advisory Board, and is former director of the U.S. Fish and Wildlife Service.*



John Turner in Wyoming. Photo by Mark Turner.

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