DEVELOPING A CONCEPTUAL SCIENTIFIC FRAMEWORK FOR CONSERVATION IN THE ARID WEST

Aridlands Grazing Network, Workshop 1
Medano-Zapata Ranch, Colorado
April 11–13, 2001
TNC’s Mission Statement
The mission of The Nature Conservancy is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

Conservation Vision
The Nature Conservancy’s vision is to conserve portfolios of functional conservation areas within and across ecoregions. Through this portfolio approach, we will work with partners to conserve a full array of ecological systems and viable native species.

Conservation Goal for 2010
By 2010, The Nature Conservancy and its partners will take direct action to conserve 600 functional landscape--500 in the United States and 100 in 35 countries abroad. The Conservancy also will deploy high-leverage strategies to ensure the conservation of at least 2,500 other functional conservation areas--2,000 in the United States and 500 in other countries.

Copies of this summary are available on the Landscape Conservation Network Web Site:
www.tnc-ecomanagement.org

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EXECUTIVE SUMMARY

Landscape Conservation Networks (LCNs) are a promising new vehicle for catalyzing the development and implementation of innovative, landscape-scale ecological management and restoration strategies at hundreds of TNC’s conservation areas. The networks bring together Conservancy field staff, partners, and experts in a progressive series of facilitated workshops focused on key threats and strategies.

In the five-state region known as the Rocky Mountain Division, TNC has identified 60 landscape-scale areas where it intends to work with partners to conserve biodiversity. Because more than 75% of these 60 areas occur in ranching landscapes, the Conservancy has begun to develop strategies that are inclusive of livestock production; this work also extends beyond the states that comprise TNC’s Rocky Mountain Division. The Conservancy is now involved with grazing as a conservation tool at more than 25 sites in the American West.

The issue of “conservation ranching” is both complex, requiring integration of a number of disciplines, and controversial. Recognizing the need to imbue “conservation ranching” with sound science, and develop practical, appropriately scaled solutions, TNC created the Aridlands Grazing Network.

The network held its first workshop at the Medano-Zapata Ranch in Colorado, April 11–13, 2001. The meeting focused on reviewing the conceptual scientific frameworks of four “focal landscapes.” These four focal landscapes are the Zumwalt Prairie in Oregon, the Owyhee Canyonlands in southwest Idaho, the Great Sand Dunes portion of the Closed Basin in Colorado, and the Headwaters Ranch area in New Mexico.

Important concepts were outlined in three guest presentations:

- Bruce Runnels, Vice President of TNC’s Rocky Mountain Division, provided an overview of grazing within the Conservancy and touched on some of the biodiversity challenges unique to the American West. Bruce also introduced the Rocky Mountain Division’s Range-land Conservation Initiative.

- Charles Curtin, Director of the Arid Lands Project, gave an overview of the scientific literature on the impacts of grazing. Charles noted that the impacts of grazing are confounded, and often overshadowed, by factors such as climate (especially rainfall) and fire. Removing cattle from a particular degraded area will not necessarily lead to recovery. Rather, evidence suggests that conservation practitioners need to focus their efforts on restoring and sustaining natural processes.

- Richard Knight of Colorado State University talked about socio-economic issues in today’s American West, and how they relate to conservation of ranchlands. There has been much discussion about the relative impacts of residential development versus ranching in the West (the “ranches vs. ranchettes” debate). Citing both his own research and studies conducted by others, Richard explained why he believes the conservation community needs to seek common ground with today’s ranchers to preserve both biodiversity and the ranching way of life.

Over the course of the three-day meeting, six key lessons and ideas emerged. Four of the lessons relate to the idea that models form the foundation for adaptive management and effective conservation:

- Clearly document conceptual model assumptions and where model components are based on expert opinion versus data. By documenting our degree of certainty in
model structure, we can identify areas needing further study, and where adjustments may be necessary based on improved knowledge.

**Maintain consistency between viability analyses and model structure.** Models need to include those key ecosystem structures, functions, and dynamics that maintain or degrade conservation target viability.

**Short-term climatic variation can be overwhelmingly important to aridland systems.** Physical drivers (e.g., geologic substrate, climate, soils) can often be more important than anthropogenic agents of change or biological factors to system structure and function. In the Arid West, systems are often sensitive to climatic variation (especially rainfall) and long-term climate change, and these relationships are integral to a thorough understanding of the conservation needs of targets.

**Physical template and ecology first, economics second.** It is critical to understand the physical template of a system and how physical factors constrain ecosystem dynamics. Although economic and social components must eventually find their place within our hypotheses about ecosystem structure and dynamics, site practitioners must gain a thorough understanding of the ecology of a system before incorporating economic and social analyses.

The other two lessons are about adaptive management and engaging our partners in the ranching community:

**Use compatible grazing practices as a multi-site or ecoregional-scale strategy.** Successful grazing practices on Conservancy-owned or other properties should be exported to adjacent or regionally similar sites where they will foster achievement of conservation goals.

**Identify shared goals as a means to reduce barriers to action.** When working with partners, be open to compromise but be aware of the consequences for conservation goals. Document why decisions are made and scientifically assess the impacts of actions taken. Long-term success depends on maintaining a realistic approach to landscape planning.

The Nature Conservancy is using cattle grazing as a strategy to help protect two rivers and their associated conservation targets at the Headwaters Ranch in New Mexico.
FOREWORD

Critical threats to biodiversity, including fire suppression and dangerous fuel loads, invasive species, and incompatible forestry and grazing practices, imperil thousands of species and hundreds of conservation areas across millions of acres. If The Nature Conservancy (TNC) is to achieve its mission of preserving the diversity of life on earth, these threats must be addressed at the scale of entire landscapes. Accordingly, the Conservancy recently set the ambitious goal of taking direct action to conserve 600 functional landscapes—500 in the United States and 100 in 35 countries abroad—by 2010.

Achieving this goal will require TNC to develop ecological management strategies that are effective at large spatial scales, and to implement these strategies across portfolios of conservation areas quickly and efficiently. To address these challenges, the Ecological Management and Restoration Program launched a series of Landscape Conservation Networks (LCNs) in late 2000.

The goal of the Landscape Conservation Networks is to foster cross-site learning while significantly advancing ecological management practices at TNC’s priority landscapes. The networks bring together site-based practitioners, partners, and scientific experts who deal with similar landscape-scale ecological threats such as fire suppression, invasive species, or incompatible forestry practices. They provide a highly effective forum for:

- Fostering cross-site learning;
- Identifying and communicating best practices and lessons learned;
- Leveraging expert knowledge and experience within the Conservancy;
- Engaging partners and external scientific experts;
- Testing new concepts; and
- Communicating standardized methods and concepts (e.g., the 5-S framework).

Each network consists of 15 to 35 landscape-scale sites, and is structured around a series of workshops held over a period of two to three years. Each workshop lasts approximately three days and consists of presentations by Conservancy and external scientific experts, work group sessions, and intensive peer review of products created by the focal and participating landscapes (e.g., conceptual ecological models or monitoring plans).

The Aridlands Grazing Network, launched in April 2001, provides a forum and ongoing support for the development and implementation of conservation strategies in the context of aridland ranching. There are currently four other Landscape Conservation Networks addressing wetland management, restoration of fire-adapted ecosystems, invasive species, and compatible forest management.

For more information on the Aridlands Grazing Network, contact Bob Unnasch (bunnasch@tnc.org). For more information about the LCNs, contact Jeff Hardesty (hardesty@botany.ufl.edu) or Wendy Fulks (wfulks@botany.ufl.edu).
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INTRODUCTION

Livestock production is the dominant land use in the Arid West; fully 70% to 80% of the lands west of the 100th meridian are managed, at least in part, for grazing. The Nature Conservancy has recognized that its success in protecting intact landscapes in this region is only achievable if the ranching community is included in our conservation strategies. As a result, the Conservancy is presently directly or indirectly involved in livestock production at more than 25 sites in the West. However, across the entire West, public land livestock grazing is a contentious issue. Federal agencies, the livestock industry, and more recently, TNC have come under fire from the scientific community and environmental groups who cite credible evidence that grazing is not an ecologically or economically sustainable enterprise, particularly in the arid Southwest.

Recognizing the need to imbue “conservation ranching” with sound science, and to develop practical, appropriately scaled solutions, The Nature Conservancy created the Aridlands Grazing Network. The network’s goal is to promote the understanding of key landscape-scale conservation strategies where livestock grazing may be an important component for advancing conservation goals. The strategy for achieving this goal is to make tangible progress toward understanding the role of grazing at four high-priority functional landscapes (“focal” landscapes), while leveraging critical learning and best practices to 30 to 35 additional priority landscapes (“participating” landscapes) managed by The Nature Conservancy and its public and private partners. The framework for the network is a series of four workshops over two years that will:

1. Facilitate communication and cross-site learning among Conservancy practitioners, ranching partners and external scientific experts;
2. Develop ecological management objectives that explicitly integrate target viability within the framework of ranching operations;
3. Promote the implementation of key strategies that include adaptive ecological management, restoration, and compatible economic development;
4. Develop multi-scale monitoring and assessment methods;
5. Help practitioners integrate weed management strategies into management plans; and
6. Develop and disseminate best practices, including recommendations for prescriptive conservation easements.

The network is coordinated and facilitated by Robert Unnasch, director of the Monitoring and Adaptive Management Program (bunnasch@tnc.org), and Tim Whittier, program assistant (twhittier@tnc.org).

Goals and Objectives of Workshop #1

The network’s first workshop was held April 11–13, 2001, at the Medano-Zapata Ranch in Colorado. Thirty-one people participated, representing Conservancy practitioners from more than 28 landscapes. Every western state was represented, with the exception of Montana. Appendix A contains a list of all participants. Brief descriptions of many of the participating landscapes are provided in Appendix B.

The primary goals of this first workshop were to introduce the four focal landscapes and review the underlying scientific framework for each of these areas. Typically, each Landscape Conservation Network devotes the first workshop to discussing ecological models, conservation targets, and the viability of those targets. This provides a solid foundation for later discussions about conservation strategies.
Specific objectives for the first workshop included:

- Provide in-depth peer review to focal landscapes on their conceptual scientific framework;
- View first-hand the landscape encompassing the Medano-Zapata Ranch and discuss management practices used or proposed at this site;
- Establish a network of aridland managers within the Conservancy who are dealing with grazing issues;
- Inform the Ecological Management and Restoration Program on the current status of tools and information needed for arid landscape management; and
- Provide participants with a forum for interaction with a diversity of Conservancy staff, outside experts, and agency partners.

The agenda (Appendix C) included plenary talks, in-depth peer review of the conceptual ecological models and other products developed by the focal landscapes, and a tour of the Great Sand Dunes conservation area (the Medano-Zapata Ranch is located within this landscape). There were three plenary talks: Grazing and Conservation in the West by Bruce Runnels, Towards an Understanding of the Ecological Effects of Grazing in the Arid West by Charles Curtin, and The Old West, the New West, the Next West by Richard Knight. These talks are summarized in the following section, and supporting information is provided in Appendices D-F.

Focal Landscapes

The focal landscapes are Zumwalt Prairie in Oregon, Owyhee Canyonlands in southwest Idaho, the Great Sand Dunes portion of the Closed Basin in Colorado, and the Headwaters Ranch area in New Mexico (which includes portions of both the Mimbres River and Gila River conservation areas). These four landscapes were selected to represent both the diversity of landscape types found in the Arid West and the broad range of issues associated with conservation in this region.

Teams from each focal landscape developed conceptual ecological models and conservation target viability criteria that were discussed and refined during the workshop in small breakout groups. Each focal landscape took home a list of recommendations for improving their models and viability criteria. These products will serve as the scientific underpinning for the development of conservation strategies at these sites.
OVERVIEW OF CONCEPTS AND ISSUES: PLENARY PRESENTATIONS

Grazing and Conservation in the West

Bruce Runnels, Vice President of TNC’s Rocky Mountain Division (see Appendix D for full presentation)

The Nature Conservancy is faced with an urgent need to protect ranching landscapes in the West. These areas are being subdivided and developed at an alarming rate to accommodate population growth (see Figure 1). In fact, it has been estimated that 70% of all western ranches may change ownership in the next five years.

Much of the ranchland in the West is a high priority for conservation, so it is imperative that TNC engage these private landowners before the lands’ biodiversity values are lost.

This is why The Nature Conservancy is involved with livestock grazing as a conservation tool both directly and through partners at a number of sites. Because of its community-based conservation emphasis, landscape-scale focus, and capacity to employ adaptive management, TNC is in a unique position to pursue this particular conservation strategy.

TNC recently developed the Rangeland Conservation Initiative, which has a three-pronged strategy to abate the accelerating threat of fragmentation from conversion and subdivision of ranch lands:

**Strategy #1:** Enhance the stability of existing ranch operations;

**Strategy #2:** Facilitate voluntary conservation transactions on ranch lands under development pressure; and

![Map of the United States showing population trends and top five fastest growing states: Nevada, Arizona, Colorado, Utah, Idaho.](image)

**Figure 1.** Population Trends in the United States.
**Strategy #3:** Support the next generation of ranch owners and operators in their use of science-based, adaptive management techniques.

The Aridlands Grazing Network, which is grounded in science and adaptive management, is closely tied to Strategy #3.

**Towards an Understanding of the Ecological Effects of Grazing in the Arid West**

Charles Curtin, Arid Lands Project Director

Talk based in part on paper included as **Appendix E**.

A careful review of the literature reveals no consistent positive or negative effects of grazing. The most likely explanation for this is that when investigators compared grazed and ungrazed areas, they failed to take into account the interactions that processes such as climate and fire have with herbivory. The most important of these ecological variables is climate, especially rainfall. Because these interactions can act to either multiply or mitigate the effects of livestock, research is needed to characterize the thresholds at which these different factors become important.

An important lesson to be learned from this is that simply removing cattle from the landscape will not lead to the recovery of western lands. A second lesson is that those who advocate rangeland conservation programs such as grass banks must accompany those projects with clearly defined restoration goals, management actions, and careful and consistent monitoring to ensure that the objectives have been attained. Monitoring of management or restoration actions must also be flexible and long-term.

We can expect livestock grazing to continue throughout a sizable portion of the West; therefore, the challenges to conservation biologists and land managers are to better understand the ecological implications of livestock management, to better determine the environmental thresholds at which grazing can have negative or positive consequences, and to work toward land uses that preserve the ecological, economic, and social fabric of the West.

**The Old West, the New West, the Next West**

Richard Knight, Professor of Wildlife Conservation, Colorado State University

Talk based in part on book chapter included as **Appendix F**.

Although livestock have historically overgrazed western rangelands, recent reports indicate that rangeland health is improving in the West, even in riparian areas. This is due, at least in part, to the checks that are in place to limit livestock numbers and regulate periods of grazing on public lands. Despite this, ranchers today continue to be criticized for abusing rangelands. However, the impacts of ranching must be viewed alongside other land uses, including recreation and subdivision/development.

With regard to the impacts of grazing, it is becoming clear to researchers that simply removing cattle does not lead to restoration (e.g., see Appendix E). Many rangelands evolved with large ungulate grazers that provided an intermediate level of disturbance within the landscape. Such disturbances, within their natural range of variation, are considered important to maintaining the biodiversity health of these systems. It is possible that cattle are serving the same function in areas where natural herbivores are absent in large numbers.
It is also important to note that whereas there are checks to limit the impacts of grazing on public lands, oftentimes there are no similar limits placed on another potentially harmful use, recreation. Recent research indicates that even solitary hikers on established trails can have a measurable impact on wildlife.

One way to shed some light on the ranches vs. ranchettes issue is to compare the biodiversity values of representative examples of these two types of areas. Preliminary studies conducted by Richard and colleagues have revealed large differences in the species of birds and carnivores found near ranches compared to those that live near ranchettes. These studies indicate that the influx of humans that follows the creation of ranchettes favors the presence of generalist species (e.g., brown-headed cowbirds) that displace species of conservation concern (e.g., blue-gray gnatcatchers). This underscores the need for conservation policies that promote compatible land use and the protection of large ranches. This result also implies that such policies may preserve a larger amount of biodiversity than expected as displaced animals from ranchettes find a haven on these large ranches.
Zumwalt Prairie, Oregon

Zumwalt Prairie is the largest and highest-quality expanse of fescue bunchgrass prairie left in North America. It covers more than 220 square miles (146,000 acres) on the Joseph-Imnaha Plateau, east of Enterprise, Oregon, at elevations from 4,500 to 5,500 feet. It is perched above Hells Canyon to the east and the Grande Ronde River to the north; to the south rise the Wallowa Mountains. Along the edges of the plateau, the grasslands descend into wooded canyons shaded by quaking aspen, pine, and cottonwood. Because it is higher, colder, and drier than other prairies in the Blue Mountains—Middle Rockies ecoregion, little of this prairie has ever been cultivated, and livestock grazing has been managed in ways that have minimized impacts to the bunchgrass ecosystem. Zumwalt Prairie is almost entirely in private ownership.

Fescue-dominated bunchgrass prairies occur in the intermountain region of the northwestern United States and Canada, in the northern foothills of the Rockies, on the northern edge of the Great Plains, in southern Eurasia from the Black Sea to China, and in New Zealand. Historically, these deep-soiled, fertile prairies evolved a rich and complex diversity of wildlife and plant communities including large and small mammal herbivores, raptors, and invertebrates. Today, however, nearly all have been converted to crop production or livestock grazing, and the bunchgrass prairie ecosystem is now globally imperiled. A survey of natural heritage programs in Canada and the United States revealed that the Zumwalt Prairie is the largest known remaining expanse of bunchgrass prairie in North America.

Zumwalt Prairie supports one of the highest known concentrations of breeding birds of prey in North America. Ferruginous hawks and Swainson's hawks, which are declining throughout the West, thrive here, along with golden eagles, redtail hawks, rough-legged hawks, and prairie falcons. Columbian sharp-tailed grouse, extirpated form Oregon in the 1960s, are being reintroduced at Zumwalt Prairie. In addition to elk, mule deer, bighorn sheep, bobcat, and other wildlife, moose are also recorded here. Snake River steelhead, federally listed as a threatened species, spawn in the creeks draining the prairie, as do inland redband trout. Two at-risk plant species are found on Zumwalt Prairie, Indian ricegrass and Spalding's campion, the latter of which is proposed for federal listing as a threatened species.

There are three key threats to Zumwalt Prairie. First, aggressive, habitat-modifying exotic plant species are expanding throughout the region. Grazing represents another threat, although to date grazing has been managed to minimize impacts to the grassland habitat. Compared to the sod-forming grasses of the Midwest, the fibrous-rooted bunchgrasses of northeast Oregon's prairies are more vulnerable to changes in native species composition, structure, and function. Third, northeast Oregon and the Wallowa Mountains are increasingly becoming destination points for vacationers and recreationists. Fragmentation due to subdivision or rural development would negatively impact the prairie's ecological values. This is especially true in light of Zumwalt Prairie's status as one of the few remaining expanses of prairie large enough to support viable populations of wide-ranging species and animals that are particularly sensitive to human disturbance.

In October 2000, the Conservancy purchased the 26,920-acre Camp Creek Ranch on the
east edge of Zumwalt Prairie. In this area rolling grasslands drop off dramatically toward the Imnaha River and Hells Canyon. The preserve includes approximately 12,000 acres on the Joseph-Imnaha Plateau and 15,000 acres of canyonlands, which capture approximately 90% of the Camp and Trail Creek drainages and 38 stream-miles. The plateau portion of the ranch supports an approximately 12,000-acre mosaic of bunchgrass prairie including pockets of quaking aspen groves, spring-fed wet meadows, and rose- and hawthorn-dominated draws. The canyons support grasslands, ponderosa pine woodlands, quaking aspen groves, hawthorn thickets, and white alder/ black cottonwood riparian forests. In total, the property spans a 2,500-foot elevation range from its deep canyons to the top of the Findley Buttes.

Figure 2. Conceptual Ecological Model for the Upland Plateau at Zumwalt Prairie, Oregon.
Owyhee Canyonlands, Idaho

The Owyhee Canyonlands landscape, part of the Columbia Plateau ecoregion, encompasses portions of southwestern Idaho, eastern Oregon, and northern Nevada. This region is sandwiched between the Great Basin to the south and the Snake River Plain to the north. The landscape covers more than 1.1 million acres.

The Owyhee Canyonlands are a rugged landscape of sagebrush plateaus incised by deep river canyons. The region is a broad, northward tilting plateau that ranges between 4,000 and 6,000 feet in elevation and is deeply dissected by meandering, sheer-walled canyons carved by the Owyhee River and its tributaries. This area represents one of the largest blocks of intact shrub-steppe habitat within the entire Columbia River Basin. The Canyonlands are also home to the largest population of California bighorn sheep in the United States and more than a dozen endemic or rare plant species.

To provide a base for conservation work in the Owyhee Canyonlands, The Nature Conservancy purchased the 45 Ranch located along the South Fork Owyhee River, at the

Figure 3. Conceptual Ecological Model for Wyoming Big Sage/Bluebunch Wheatgrass System in Southwest Idaho.
mouth of the Little Owyhee River. The ranch includes 240 acres of deeded land and nearly 70,000 acres of adjacent public lands grazing allotment. It is the only developed ranch within the Owyhee Canyonlands in Idaho.

The conservation targets of highest priority are:

- Shrub-steppe habitat, consisting of five major sagebrush/shrub/bunchgrass community types (see Figure 3);
- California bighorn sheep;
- Redband trout;
- Springs and spring creek systems that provide critical wildlife habitat and diverse plant communities including wandering spike rush and threesquare bulrush, and the rare plants Nevada Angelica, giant heléborine, and cut-leaved water parsnip;
- Intermittent streams and rivers that provide habitat for the unique endemic Owyhee sagebrush community, prairie sage, and Howell’s goldenweed;
- Large river terraces that contain basin big sagebrush/basin wildrye; and
- Vernal pools that include the rare Davis’ peppergrass community, creeping spike rush and silver sagebrush/mat muhly.

Three key threats to this landscape have been identified: invasive plants, altered fire regimes, and loss of soil integrity. In addition, human disturbance is a threat to the region’s California bighorn sheep.

TNC’s 10-year goals for the Owyhee Canyonlands are to identify and protect the existing high-quality sagebrush-steppe habitat, and to identify and improve fair quality sagebrush habitat over a total of 1 million acres in this landscape; to reintroduce natural fire regimes into approximately 150,000 acres of juniper/mountain mahogany savannas; and to maintain and protect sensitive springs, spring creeks and riparian systems.

The Conservancy has identified three primary conservation strategies for this landscape:

- Facilitate improved grazing management and flexibility over 300,000 acres of shrub-steppe habitat in the Owyhee Canyonlands landscape. Further develop and implement proposals within the “Owyhee Initiative” which include grass banking, land exchanges, federal funding for research, and designation of special research areas;
- Reintroduce a natural (ecosystem sustaining) fire regime into 50,000 acres of juniper/mountain mahogany savannas. Seek federal funding to help the U.S. Bureau of Land Management (BLM) and private landowners develop and implement fire plans; and
- Maintain large blocks of weed-free sagebrush-steppe habitat totaling 100,000 acres. Using Weed Management Areas as the model, develop the partnerships and tools to identify priority “weed-free” areas and to aggressively prevent invasions.
Great Sand Dunes, Colorado

The Great Sand Dunes (GSD) conservation area is in the southeastern portion of the Closed Basin, a region with no surface water outlet, in the San Luis Valley of Colorado. This area, which is within the Southern Rocky Mountain ecoregion, is one of the richest spots in Colorado in terms of biodiversity values.

The GSD area is supported by an eolian depositional system that extends from the Rio Grande River northeastward to the Sangre de Cristo Mountains and covers about 500 square miles, including areas with playa lakes, a vegetated sand sheet, and a main sand dune mass. Elevation ranges from 7,300 to 9,000 feet. The main vegetation types are grasslands, riparian and wetland communities, and shrublands. Common plant species within these vegetation types include greasewood (Sarcobatus vermiculatus), rabbitbrush (Chrysothamnus spp.), blue grama (Bouteloua gracilis), alkali sacaton (Sporobolus airoides), saltgrass (Distichlis spicata), Indian ricegrass (Oryzopsis hymenoides), and sedges (Carex spp.).

During a 1998 study, the Colorado Natural Heritage Program (CNHP) recognized 46 biologically significant elements in the GSD and the adjacent San Luis Lakes areas, including 15 plant communities, 14 insects, nine birds, four plant species, three mammals, and one fish. Many of these elements are restricted in range, endemic to the GSD area, or endemic to the San Luis Valley.

The six primary conservation targets are:

- Active dune and swale complex;
- Stabilized sand dunes;
- Wet meadows;
- Ephemeral wetlands and greasewood flats;
- Lower montane riparian; and
- Lower montane aquatic.

All six of these ecological systems targets include the species mentioned in the CNHP report as well as all other natural elements and regimes that help maintain the systems' ecological viability. However, historical and current alterations of natural regimes (especially the hydrology) modify these systems and threaten natural biodiversity. The main active threats identified across the different systems directly relate to issues such as water diversion and potential exportation from the San Luis Valley; current and potential management practices; and alteration of natural species composition due to invasion by exotic species, harvesting practices, and herbivory (see Figure 4).
**Misc. Abiotic Processes**
1. Lowering of water table
2. Blowouts
3. Sand deposition
4. Blowout contacts water table

**Misc. Biotic Processes**
5. Invasion of whitetop / Canada thistle
6. Ecological succession driven by Muhlenbergia
7. Prairie dog cycle
   - Prairie dog disturbance increases plant diversity
   - Prairie dogs “plague out”
   - Species diversity declines
8. Ecological succession driven by ponderosa pine

**Grazing**
9. Heavy grazing pressure (historical and current)

**Fire**
10. Dormant season fire
11. Growing season fire
12. Absence of fire

**Active Manipulation**
13. Herbicide application

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**Figure 4.** Conceptual Ecological Model for the Sandsheet Ecosystem, Great Sand Dunes, Colorado.
Headwaters Ranch, New Mexico

Composed of the Mimbres River & Black Range and the Gila River

TNC established— and currently co-manages— the Headwaters Ranch, an experimental collaborative venture in conservation ranching within the Gila National Forest. The Headwaters Ranch covers more than 155,000 acres, much of it within the Mimbres watershed, and an additional 15 river miles. The Conservancy created the ranch with partner Greer & Winston LLC in order to protect and restore watershed and stream condition in the headwaters of the Gila and Mimbres Rivers. The Headwaters Ranch includes portions of two Nature Conservancy portfolio sites, both within the Arizona-New Mexico Mountains ecoregion: Mimbres River and Gila River. Each site is described separately below.

Mimbres River

The Mimbres River, a closed-basin desert stream, flows from headwaters near 10,000 feet in the Aldo Leopold Wilderness of the Gila National Forest to its terminus in the Chihuahuan Desert grasslands near the Mexican border. The Mimbres watershed includes dense forests of Douglas fir and ponderosa pine, pinyon-juniper savanna (see Figure 5), desert grasslands, Chihuahuan desertscrub, riparian forests, ciénegas, springs, and stream reaches that may be perennial, intermittent, or ephemeral.

Most notable among the elements of conservation concern in the Mimbres watershed are its cottonwood-willow and green ash forests, sacaton floodplain grasslands, hot and cold springs, and the migratory birds and the endemic fish and invertebrates that these systems support.

The Mimbres supports 57 conservation targets, including nine plant communities, eight plants, three invertebrates, two herptiles, two fish, and eight birds. The Mimbres River ecosystem is threatened by agricultural surface water diversion, groundwater withdrawal, inappropriate livestock grazing, channelization, suppression of restorative wildfires, and exotic species. Rapid population growth and continued degradation by some traditional uses make protection of the Mimbres River an urgent matter.

The Conservancy is working to restore the river’s natural flow regime, restore fire to the watershed’s uplands, and encourage the recovery of riparian forests and aquatic habitat lost to channelization. Key strategies include land acquisition for direct protection; development of conservation partnerships with individuals and public agencies to improve river and watershed management; compatible economic development via conservation ranching in the upper Mimbres River watershed; and sponsorship and dissemination of ecological research to enhance community understanding.

Gila River

The Gila River arises in the mountains of the Mogollon Plateau in southwestern New Mexico, and flows westerly through southern Arizona to its confluence with the lower Colorado River. Dammed, diverted, and dewatered in Arizona, the Gila retains much of its natural character in its New Mexico headwaters. The river gathers in the high-elevation montane forests of the Gila and Aldo Leopold Wilderness areas, passing through ponderosa pine forests, pinyon-juniper woodlands, and finally, Chihuahuan desertscrub before reaching the San Carlos Reservoir in eastern Arizona.

The Gila supports 57 conservation targets, including 20 plant associations, 12 plants, three invertebrates, three herptiles, eight fish, and nine birds. Most notable are the site’s native fish fauna and neotropical migrant bird community (perhaps the highest density of breeding birds in the U.S.).
The region's towns and extractive industries are demanding more and more of the Gila River's water and its floodplain. Fire suppression in the watershed's uplands, livestock overgrazing, non-native species, river channelization, water withdrawals for agriculture and copper mining, and proposals for dam and levee construction are all important, present-day threats. Population growth and development—and the water demands that accompany them—represent more distant threats.

The Conservancy's strategies at this site are the same as those mentioned for the Mimbres River site, with the addition of compatible economic development via organic agriculture on floodplain farms.

**Figure 5.** Conceptual Ecological Model for the Pinyon-Juniper Ecosystem in Southern New Mexico.
A number of important ideas and lessons emerged from the workshop. The most important of these relate to conceptual ecological models and adaptive management.

Models Form the Foundation of Adaptive Management

Conceptual ecological models are living documents and are used to record our current knowledge of ecosystem structure, function, and change. As such, they provide the means to detail our assumptions, our beliefs, and our predictions about natural systems. We adjust models as we monitor and learn over time.

The science staff at the Medano-Zapata Ranch have used their draft ecological model as a touchstone for their work with partners — especially the National Park Service and the U.S. Fish and Wildlife Service. Using the model as a focus of discussions with these partners, they have realized that they need to revise their assumptions about the importance of fire in these landscapes.

Key best practices relative to model use and development include:

- **Clearly document assumptions and where model components are based on expert opinion versus data.**

By documenting our degree of certainty in model structure, we can identify areas needing further study, and where adjustments may be necessary based on improved knowledge. Monitoring is used to test and inform the model. Upon analysis, the model identifies areas of research needed to improve our understanding of these systems.

**Maintain consistency between viability analyses and model structure.**

Key ecosystem structures, functions, and dynamics that maintain or degrade target viability should be explicit components of the model. For example, if invasive plant species are a significant threat to target viability, then one or more communities representing an invaded condition, and the agents creating, maintaining, and abating that condition should appear in the conceptual ecological model. Also, desired conditions and hypothesized paths from undesired to desired conditions must be integral to model structure, for this will form the basis for adaptive strategy development.

**Short-term climatic variation can be overwhelmingly important to aridland systems.**

Physical drivers (e.g., geologic substrate, climate, soils) can often be more important than anthropogenic agents of change or biological factors to system structure and function. It is critical to understand the physical template of a system and how physical factors constrain ecosystem dynamics. In the Arid West, systems are often sensitive to climatic variation (especially rainfall) and long-term climate change, and these relationships are integral to a thorough understanding of the conservation needs of targets.

At the Headwaters Ranch, a major concern is the conversion of the arid grassland system into a pinyon/juniper woodland. While still not completely understood, it has become clear that climatic changes over the past two to three centuries have facilitated juniper encroachment into the grasslands.
Physical template and ecology first, economics second.

The ecology and biology of ecosystems define the “solution space” or range of conditions within which sustainable grazing is feasible in that landscape. Although economic and social components must eventually find their place within our hypotheses about ecosystem structure and dynamics, site practitioners must gain a thorough understanding of the ecology of a system before incorporating economic and social analyses.

Adaptive Management Accelerates Learning and Reduces Conflict

An adaptive approach to conservation and management — or “learning by doing” — is a means to take action to conserve biodiversity in practical and timely ways while still acknowledging that we will always have something to learn. Best practices and lessons learned relative to the adaptive management of aridlands include:

Use compatible grazing practices as a multi-site or ecoregional-scale strategy.

TNC’s conservation goals extend beyond its boundaries, and we must constantly question how our actions will affect the lands outside of our ownership. In particular, successful grazing practices on TNC-owned or other properties have the capacity to leverage best practices to adjacent or regionally similar sites.

The Conservancy purchased the 67,000-acre 45 Ranch to facilitate our work throughout the entire 1.1 million-acre Owyhee Canyonlands conservation area. All our work with the ranch is viewed through the perspective of how it affects our goals for the entire area. This and other TNC-owned ranches are viewed as living laboratories where conservation grazing and a range of other strategies can be tested and refined.

Identify shared goals as a means to reduce barriers to action.

While we must continue to strive for goals that are compatible with the conservation of biodiversity, we must incorporate partners and their individual objectives into the process of goal development for a landscape. Be open to compromise but be fully aware of the consequences of compromise for conservation goals. Document why decisions are made and scientifically assess the impacts of actions taken. The long-term success of our efforts depends on maintaining a realistic approach to landscape planning.
APPENDIX A

Aridlands Grazing Network Participants
Workshop #1, Medano-Zapata Ranch, Colorado

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APPENDIX B

Descriptions of Participating Landscapes
Aridlands Grazing Network, Workshop #1

Descriptions of focal landscapes are provided on pages 6-13 in the main body of this summary. NOTE: We did not receive descriptions for all participating landscapes. We anticipate including additional descriptions in subsequent workshop summaries and/or on the Aridlands Grazing Network Web site.

Boardman Conservation Area - Oregon
This site, south of the Columbia River and west of Boardman, contains seven globally rare plant communities. In addition, the site contains the only viable population of Washington ground squirrels in Oregon and together with the Navy Facility to the east is the only landscape-scale site remaining in this section of the Columbia Plateau Ecoregion. It also provides habitat for several other declining wildlife species. The area is leased from a large potato company but the Conservancy expects to buy the site with BPA funds soon. The site was leased with a 5-year grazing lease. Much of the area is in need of restoration and lends itself well to large-scale restoration research. The greatest threats are agricultural development, noxious weeds, and wildfire. Noxious weed control and fire suppression to control cheatgrass are the most important management issues.

Coconino Plateau / Hart Prairie Preserve - Arizona
Hart Prairie Preserve is located in Coconino County just 14 miles from Flagstaff, 150 miles from Phoenix, and 75 miles from the Grand Canyon. Surrounded by thousands of acres of forest and meadows, the preserve is home to uncommon wildflowers, old growth ponderosa pine, a rare grove of willows, herds of elk and deer, porcupine, prairie dogs, and more than 40 species of birds.

Cosumnes River - California
The Cosumnes is the last remaining undammed river on the western slope of the Sierra Nevada, flowing 80 miles to its confluence with the Sacramento-San Joaquin Delta. The absence of dams on the river ensures seasonal flooding along its lower reaches, creating wetlands important to tens of thousands of Pacific Flyway birds that winter in the area.

The Cosumnes floodplain is threatened by development, situated as it is between the rapidly expanding urban centers of Sacramento and Stockton. Intensive land conversion in the Central Valley destroyed the valley oak forests that originally lined the area’s rivers and streams. Today, only two percent of the original forests remain, and some of the best and largest remaining virgin stands are protected within the Cosumnes River Preserve.

The Nature Conservancy made its first 85-acre riverside purchase in 1984, establishing the Cosumnes River Preserve. In 1999, the Conservancy and its partners have increased its lower floodplain land holdings to 37,042 acres as it works to protect the freshwater wetlands and increase their population of migratory waterfowl, which has grown from several thousand to 79,000 by last count. The river protects two rare plant communities: streamside forest and freshwater marsh. Less than 4 percent of each community remains intact in California.
The success of the Conservancy’s partnership with a private organic rice farm, which provides forage for waterfowl by flooding the rice fields after harvest, demonstrates the compatibility of human use with the natural environment.

**Dugout Ranch - Utah**

The Dugout Ranch is located south of Moab, in San Juan County, Utah. The ranch is bordered by U.S. Bureau of Land Management (BLM) lands and Canyonlands National Park on the west, Newspaper Rock State Park on the east, and the Manti-LaSal National Forest and the Abajo Range on the south. Visitors to the Needles area of Canyonland National Park drive through a portion of the ranch. The remaining surrounding property is federal and state owned, with the majority managed by BLM. Dugout Ranch is located in Utah’s red rock desert which has become a popular destination for hikers, mountain bikers, and movie production companies due to the unusual geography. Newspaper Rock is a large rock face containing Native American petroglyphs crafted over an extended period of time. This area is rich in archeological history, with thousands of ruins and intact cliff dwellings.

The property is located in a large basin below the level of the surrounding mesas and above the level of the Colorado River. Indian Creek and Cottonwood Creek are the primary drainages, providing water for irrigation and an important riparian area through the desert. Vegetation consists of native grasses, sagebrush, and some juniper and pinion trees. Cottonwood trees and willows are located along the banks of Indian Creek and Cottonwood Creek. Cultivated land consists of 375 acres of irrigated crops and 346 acres of semi-irrigated crops with the majority of the subject being dry grazing. The site contains nearly 10 miles of riparian habitat, controls all water rights in the North Cottonwood Creek and Indian Creek drainages, and is responsible for grazing stewardship on approximately 250,000 acres of surrounding public lands — lands which contain a number of globally rare species and “relict” areas.

The ranch contains nearly 10 miles of riparian habitat, controls all water rights in the North Cottonwood Creek and Indian Creek drainages, and is responsible for grazing stewardship on approximately 250,000 acres of surrounding public lands. Dugout Ranch has been in agricultural production for over 100 years and continues today as a year-round cattle operation. Sprinkler-irrigated cropland is presently being used for alfalfa production and permanent pasture. Portions of the cultivated land are irrigated with surface flood systems during the early part of the season when stream flows are high and exceed the capacity of the pipeline systems. Federal and State grazing privileges provide a significant portion of the carrying capacity for the subject property. Federal grazing permits include both National Forest and BLM administered lands, with State-owned land intermingled with BLM permits, and are included under an exchange of use agreement with the BLM.

**Hells Canyon - Idaho**

Cleaved by Hells Canyon, the deepest river gorge in the U.S., Garden Creek is part of the Craig Mountain Wildlife Management Area, supporting Rocky Mountain bighorn sheep, elk, mountain lion, wolverine, black bear, ruffed grouse, partridge, and quail. To date, nine rare plant species have been identified in the vicinity, including Spalding’s silene, western ladies tress, and stalk-leaved monkey flower. The Conservancy and its partners have protected more than 90,000 acres here. The canyon, which begins about 30 miles south of Lewiston and stretches for over 70 river miles, survives much as it did back then—an unmatched wilderness area without a route bisecting even its edges.

**Henry’s Fork - Idaho**

The Upper Henry’s Fork Basin contains a natural system of grasslands, forests, springs, wetlands, and miles of meandering streams. These lands are home to large mammals such as antelope, elk,
mule deer, and moose. The area’s waters support large numbers of aquatic insects, which sustain a world-class wild trout fishery as well as an imperiled native cutthroat trout fishery. Migratory birds such as trumpeter swans, sand hill cranes, and long-billed curlews also depend on this lush and fertile basin.

**Juniper Hills - Oregon**

Juniper Hills is located in the geographic center of Oregon in the extreme southern portion of the Blue Mountains Subregion. In 1998 the Conservancy purchased the old Alaska-Pacific Ranch and set aside 14,000 acres to maintain the excellent ecological condition, understory communities in the juniper savanna, and to restore the entire Lost Creek drainage. The remaining 6,000 acres of the site are located on the Ochoco National Forest. The Conservancy is responsible for the grazing lease located on National Forest lands in the headwaters of Lost Creek. The elevation ranges from 3400 feet on the Crooked River to 5300 feet at the north boundary bordering the National Forest. Soils are volcanic in origin but very diverse leading to 57 distinctive plant communities. Precipitation averages 11 inches. The main management issues on the site are controlling the expansion of western juniper and restoring Lost Creek. Threats are juniper and cheatgrass invasion as well as large ungulate over grazing.

**Klickitat Oaks – Holter Ranch**

The Klickitat Oaks site includes a variety of high quality riparian, shrub-steppe, and forest habitats along Rock Creek and its tributaries. The Holter Ranch is the largest parcel under single ownership remaining in this area, and includes portions of two major drainages on the west side of Rock Creek. Multiple examples of several important vegetation types occur on the property, including Oregon white oak riparian forest, Oregon white oak/Ponderosa pine forest, Idaho fescue/houndstongue hawkweed grassland, and bluebunch wheatgrass-Sandberg’s bluegrass lithosol communities. Protection of the Holter parcel, which is contiguous to the Badger Gulch Natural Area Preserve and to land already owned by the Conservancy, would significantly expand the acreage and viability of the high quality communities within these preserves, as well as offer important additional protection to streams flowing into Rock Creek.

The greatest imminent threats to this landscape are subdivision of larger tracts and residential development of existing small legal lots. Additional threats include intensive cattle grazing, agricultural conversion, and weed invasion.

The Holter Ranch parcels contains nearly 1600 acres west of Rock Creek. Surrounding parcels have already been extensively subdivided. Development of the parcel poses the greatest threat to the protection of Rock Creek.

**Moses Coulee / Beezley Hills - Washington**

Moses Coulee is a 3,588-acre preserve in Douglas County, Washington. Geologically dramatic, the preserve contains 500-foot basalt cliffs, talus slopes, side canyons and rolling hills. It also supports one of the largest intact areas of shrub-steppe habitat remaining in Washington. Because of that diversity, the area is home to several important plants and animals, including some that are in decline or facing possible extinction.

Bat researchers working at The Nature Conservancy’s Moses Coulee Preserve in Central Washington have recorded 13 different bat species over the last three months, suggesting the area is one of the richest bat habitats in the state. Moses Coulee is also a haven for several bird species in decline elsewhere because of habitat loss, including the sage sparrow, sage thrasher, loggerhead shrive, and golden eagle.
The plant life at the site is also rich. Commonly called sagebrush country, shrub-steppe habitat is an arid landscape dominated by big sagebrush and bunchgrass. In the spring, the hillsides in Moses Coulee are awash with phlox, balsamroot, and shooting stars. Several rare plants exist in the area as well, including two newly discovered in Washington state: the slender cryptantha and Tiehm’s rush.

Beezley Hills is a 4,300-acre preserve of shrub-steppe habitat, the largest Conservancy preserve in Washington State. Dominated by sagebrush and several native bunchgrasses, this otherwise subtle landscape is awash in color each spring - a mosaic of magenta-colored bitterroot, yellow balsamroot, pale pink phlox and several other native species. The Beezley Hills area is a haven for many species of animals and plants, including some rare ones like the sage sparrow, the sage thrasher, the loggerhead shrike, and the hedgehog cactus.

Mount Hamilton - California
This vast wilderness area, stretching for 625 square miles or half a million acres, makes a huge impact on the quality of life in the southeastern part of the Bay Area. Urbanites have everything to gain from the promise of an open space that is two-thirds the size of Yosemite. The uniquely intact California landscape of oak woodlands, sycamore valleys, stream-fed canyons and pine-topped ridges is home to golden eagles, steelhead trout, rare butterflies, elk, and mountain lions. Its creeks are a vital water source to the South Bay, providing 50 percent of the area’s drinking water. Yet, this biologically rich habitat is seriously threatened, sandwiched as it is between two burgeoning population centers: the Silicon Valley to the west and the Central Valley to the east. Without protection, the area will be developed and subdivided within the next few years.

The Conservancy’s strategy is to connect the extensive public lands in the area — state, county and regional parks, university lands, and water district holdings — by securing the permanent protection of key private properties that surround them. These private lands, which are largely cattle ranches, will create a circle of protection around the core of the wilderness.

The Mount Hamilton Project was inaugurated in July 1998, when the Conservancy made the largest single conservation land purchase in northern California history — two large ranches totaling 61,000 acres in the foothills east of Mount Hamilton. The Conservancy is pushing to realize the goals of this landscape-scale conservation effort as quickly as possible, because the area’s high-tech industry continues to boom, requiring more and more people — and space — to support it.

The Nature Conservancy is committed to safeguarding not only the plants, animals, and natural communities of the Mount Hamilton wilderness area but also its economic base of cattle ranching, which has been conducive to conservation over the years. The Conservancy is working with ranchers to manage their lands so that natural habitats are protected and enhanced.

Muleshoe Ranch - Arizona
The Muleshoe Ranch Cooperative Management Area spans 49,120 acres, portions of which are owned and managed by The Nature Conservancy, the U.S. Forest Service, and the U.S. Bureau of Land Management. Muleshoe comprises most of the watershed area for seven permanently flowing streams, representing some of the best remaining aquatic habitat in Arizona. Some 80% of the region’s wildlife species depend upon these streamside communities at some time in their lives.

Pine Butte Swamp Preserve - Montana
Pine Butte Preserve is located at the interface of the Great Plains and the Rocky Mountains, and encompasses a diversity of natural habitats. Grasslands, badlands, savannah, forests, wetlands,
and riparian areas all find expression here. Over 700 species of plants occur on the preserve and the surrounding area. These diverse plant communities also provide habitat for 200 species of birds. Nearly all the animals native to this area still live here, including the plains grizzly bear. The bears roam from the mountains to the prairies as they did in the days of Lewis and Clark, favoring the wetland and riparian areas of the preserve for food and security.

Traditional agricultural operations including cattle grazing and hay production along with weed control, prescribed fire, and biological monitoring are the tools used to maintain the quality of habitat at Pine Butte. The preserve does not exist in isolation, so cooperation and collaboration with other private and public landowners are important aspects of preserve stewardship. Educational outreach is another focus, with the old Bellview Schoolhouse continuing service today as the preserve education center.

**River Fork Ranch / Carson Valley Project - Nevada**

Cradled by the Sierra Nevada’s Carson Range on the west and the Pine Nut Range on the east lies the Carson Valley, located in Douglas County, Nevada, about 40 miles south of Reno and 10 miles east of Lake Tahoe. This magnificent landscape is one of the oldest and most productive of Nevada’s agricultural regions.

The Carson Valley is home to some of Nevada’s oldest ranches. The economic health of the ranching landscape is critical to maintaining a large, unfragmented home for the valley’s wildlife. As unprecedented growth continues in the Carson Valley, however, an increasing number of ranching families are giving up their traditional agricultural heritage. About 40,000 acres of land in the Carson Valley remain in agricultural production to date; however, this historically rural environment is disappearing at an alarmingly rapid rate.

**Southern Pioneer Mountains/Crater of the Moons - Idaho**

The Southern Pioneer Mountains are located in the southern extension of the Middle Rockies Ecoregion while Craters of the Moons is part of the Columbia Plateau Ecoregion. The two conservation sites are adjacent.

Craters of the Moon is characterized by unique lava formations, plant communities, kipukas, and shrub-steppe habitat. Rare species include a plant, inconspicuous scorpion-weed; a mammal, Townsend’s big-eared bat; and an insect, blind cave leiodid beetle. The site, which lies mostly in the Columbia Plateau, contains a large amount of big sagebrush-steppe, critical to declining sage grouse and other shrub-steppe obligate birds.

The Southern Pioneer Mountains rise abruptly from the northern edge of the Snake River Plain. Elevations start at about 5000 feet and extend to over 10,000 feet. As a result of these rapid elevational changes and slope exposures, plant and animal communities change rapidly, providing for much diversity. Starting from the xeric low elevation shrub-steppe transitioning upward to mesic shrub-steppe, mountain shrub, aspen, xeric and mesic forest communities and alpine meadows at the highest elevations. The many drainages dissecting these mountains support willow and cottonwood riparian communities. Much of this area is ecologically intact. The geographic location of the mountains at the edge of the plains makes the area important as a big game wintering area, which in-turn, makes it attractive to wide-ranging predators like black bears, mountain lion, and wolverine. Wolves, which are currently recolonizing central Idaho, will undoubtedly take up at least seasonal residence in this area.

**Vanishing Rivers - Idaho**

Pristine high peaks, including Idaho’s tallest mountain (Mt. Borah) tower over rare wetlands and important streams and rivers. Rare plants survive here, including the alkali primrose and threat-
ened species like the sage grouse and bull trout. The Big Lost, Little Lost, and Birch Creek watersheds flow from the mountains and percolate underground feeding into the Snake River Plain Aquifer. This aquifer is one of the largest in North America and a vital source of water for people, plants, and animals across a huge expanse of southern Idaho.
APPENDIX C

Agenda
Aridlands Grazing Network, Workshop #1

Wednesday April 11, 2001

7:00  Breakfast
8:15  Introductory Exercise
9:00  Grazing & Conservation in the West, Bruce Runnels
9:30  An Introduction to the Aridlands Network, Bob Unnasch
10:00 Plenary speaker, Charles Curtin. Towards an Understanding of the Ecological Effects of Grazing in the Arid West
11:15 Focal Site #1 presentation
12:00 Lunch
12:30 Breakout groups
2:00  Reconvene for discussion
2:45  Focal Site #2 presentation
3:30  Breakout groups
5:00  Reconvene for discussion
6:30  Dinner

Thursday April 12, 2001

7:00  Breakfast
7:30  Observations and summary from Day 1, Bob Unnasch
8:00  Focal Site #3 presentation
8:45  Breakout groups
10:00 Reconvene for discussion
11:15  Focal Site #4 presentation
12:00 Lunch
12:30 Breakout groups
2:00  Reconvene for discussion
2:45  Field trip through Medano-Zapata Ranch & Great Sand Dunes National Monument

6:30  Dinner

7:30  Plenary speaker, Rick Knight. The Old West, the New West, the Next West

Friday April 13, 2001

7:00  Breakfast

8:00  Summary from focal sites

9:00  Participating sites exercise and discussion

12:00  Lunch

12:30  Workshop summary, recommendations, best practices and concluding remarks

1:30  Depart
APPENDIX D

Grazing and Conservation in the West
Summary of Presentation by Bruce Runnels

Reasons for Network

- Cattle grazing is being used as a conservation tool
  - Need clarity on targets and goals
- TNC is involved with cattle grazing
  - Through direct action
  - With partners (20+ projects)
- TNC is uniquely positioned to address role and compatibility of cattle grazing as a conservation tool
  - Community-based capacity
  - Landscape context and scale
  - Capacity to monitor and adaptively manage

Cattle Grazing as a Tool
Abate critical threats and enhance biodiversity health

- Five Myths
  - Less grazing = better land
  - Lighter grazing = better land
  - Less animals = conservation
  - Rarity = Poor management
  - Ignorance = BLISS
- No place for sweeping generalizations
- Depends on targets, goals, and the place

Scope of TNC Activities

- Direct TNC conservation action
  - Grazing used as an affirmative conservation tool
  - Grazing allowed in conservation easements
  - Grazing maintained as a compatible, traditional use on TNC-owned lands
  - Grazing removed under some conditions
- Indirect TNC conservation action
  - Partnering with rancher-led conservation organizations
  - Partnering with private landowners in ranching landscapes
  - Sharing best grazing and rangeland management practices
  - Influencing public policy and public lands management (tax incentives, Farm Bill, etc.)

Rocky Mountain Division Context

- 60 landscape-scale action sites
- Almost 50 million acres
- Over 75% occur in ranching landscapes
- Mix of public/ private lands
- Threat to Intactness and Ecological Values
Value of Private Lands in the West
- Species richness is greatest at lower, more productive elevations
- Private landowners hold most of the land with productive soils
- Private landowners hold most of the land at lower elevations
- Ranchers control more western land than any other class of property owners
  - Large, intact mosaic of ownership

Rocky Mountain Division Rangelands Conservation Initiative
- Three-pronged strategy to abate the accelerating threat of fragmentation from conversion and subdivision of ranch lands:
  1. Enhance the stability of existing ranch operations
  2. Facilitate voluntary conservation transactions on ranch lands under development pressure
  3. Support the next generation of ranch owners and operators in their use of science-based, adaptive range-management techniques

Aridlands Grazing Network Goals
- Understand the nature and extent of cattle grazing on TNC-owned or managed rangelands
- Critique the strengths and shortcomings of different applications of grazing (including rest)
- Get our messages straight
  - Consensus points, not one position
- Design next steps with scale, leverage, and catalytic action in mind
- Engage ranching partners, conservation colleagues
APPENDIX E

Removal of Livestock Grazing from the American West: Does Rest Equal Recovery?

DRAFT – PLEASE DO NOT CITE WITHOUT PERMISSION

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Introduction

The debate over preserving Western lands has often centered on ranching versus ranchettes (rural subdivisions). Some point to the history of overgrazing as evidence that livestock grazing is damaging to the West (Wuerthner 1994, Donahue 1999). In contrast, others believe that the only way to preserve western lands is to sustain ranching and rural economies (Starrs 1998, Knight et al. In Press). Ironically, solutions proposed by both sides of the grazing debate often hinge on the assumption that rest recovers rangelands. Critics of ranching advocate the removal of cattle from public range (Donahue 1999), while ranching supporters have advocated grass banking and other rest programs to restore rangelands and the economic viability of ranching (Blakeslee 2000).

Though the notion that a landscape degraded by grazing will naturally recover following removal of cattle is intuitively satisfying, the following pages illustrate that there is little evidence that degraded rangelands actually recover from rest alone. There is considerable evidence that the conservation of Western lands lies with restoring and sustaining natural processes, not with removing livestock.

Consequences of Livestock Grazing

Clearly, overgrazing can damage the landscape. There is no disputing the history of the West where excessive cattle grazing is associated with arroyo cutting and drops in the water table, soil erosion, and other damage to ecological systems (Hastings and Turner 1965, Cooke and Reeves 1976, Bahre 1991, Melville 1994, Donahue 1999). The conflict lies not in can cows damage landscapes, but is cattle ranching an intrinsically damaging activity.

Three of the seminal studies of grazing of the last decade are Milchunas and Lauenroth (1993) published in the peer-reviewed journal Ecological Monographs, the Rangeland Health review produced by the National Research Council of the National Academy of Science (1994), and research supported by the Biological Resources Division of the US. Department of Interior by Stohlgren et al. (1999) published in the peer-reviewed journal Ecological Applications. I have not included the review by Fleischner (1994) in the journal Conservation Biology because this paper failed to include much of the previous peer-reviewed literature including the widely cited work by Milchunas and Lauenroth and the National Research Council, and therefore did not represent a comprehensive review of the grazing literature.

Milchunas and Lauenroth (1993) analyzed a worldwide 236-site data set compiled from studies comparing species composition, above ground net primary production (ANPP), root biomass, and soil nutrients of grazed vs. protected sites. None of these factors differed consistently between grazed and ungrazed areas. Changes in species composition with grazing were primarily a
function of ANPP and the evolutionary history of grazing on the site, with grazing intensity third in importance. These three variables explained greater than 50 percent of the variance of species response to grazing. Percentage differences in ANPP between grazed and ungrazed sites decreased with relation to evolutionary history of herbivory with the geographic location of grazing appearing to be more important than how many or how intensively an area is grazed. Finally, there was no relationship between ANPP with grazing or difference of root mass with grazing. While there were often significant differences between grazed and ungrazed sites, these differences were not consistent.

The National Research Council’s report (1994) concluded that the lack of consistent monitoring methods prevented accurate assessment of whether grazing was currently degrading Western rangelands. The report concludes: “Many reports depend on the opinion and judgment of both field personnel and authors rather than current data. The report cited above attempted to combine these data into a national-level assessment of rangeland, but the results have been inconclusive.”

Stohlgren et al. (1999) contrasted 26 long-term grazing exclosures in Colorado, Wyoming, Montana, and South Dakota. These exclosures were seven to sixty years old and averaged thirty years without livestock. The authors found no difference between the number of species and their relative abundance, cover by grasses, forbs, shrubs, soil texture, or soil percentage of nitrogen and carbon between plots in grazed and ungrazed areas. The paper concluded: “1) grazing probably has little effect on native species richness at landscape scale; 2) grazing probably has little effect on the accelerated spread of most exotic species at landscape scales; 3) grazing affects local plant species and life-form composition and cover, but spatial variation is considerable; 4) soil characteristics, climate, and disturbance may have greater effect on plant species diversity than do current levels of grazing; and 5) few plant species show consistent, directional responses to grazing or cessation of grazing.” Stohlgren et al.’s analysis illustrates the necessity of viewing grazing as a landscape level process, because of the patchy nature of herbivory, small-scale and short-term studies are likely to be uninformative or misleading.

Conclusion

The independent peer-reviewed literature studies discussed above essentially came to the same conclusion, that there are no consistent negative or positive effects associated with contrasts of grazed and ungrazed areas. Do the results mean that livestock grazing does not effect Western lands? The answer is no. By focusing on grazing, and the lack thereof, studies of grazing alone miss the dynamic interaction of processes within arid lands including grazing, as well as climate and fire (Curtin and Brown 2001). Long-term studies of native herbivores have demonstrated that herbivory has varying interactions with other environmental variables and have started to characterize the thresholds at which different ecological factors become important (e.g. Weltzin et al. 1997, Western 1997, Frank et al. 1998, Knapp et al. 1999, Curtin et al. 2000). It is this dynamic interaction of grazing with other processes that multiply or mitigate the effects of livestock on the land. While in some cases grazing may well damage fragile environments particularly in riparian habitats (Belsky et al. 1999), there is also evidence that in the face of recent climatic patterns in some regions of the West, elimination of grazing can actually accelerate desertification as defined by the loss of grasses and increase of shrubs (Curtin and Brown 2001).

While the above discussion demonstrates that simply removing cattle from the landscape will not lead to the recovery of Western lands, it also indicates that those who advocate rangeland conservation programs such as grass banks must accompany those projects with clearly defined restoration goals, management actions, and follow up with careful and consistent monitoring to assure the objectives have been attained. Preliminary studies in the Arizona-New Mexico bor-
nderlands indicate that climate is the overriding factor in determining the outcome of management actions and suggest close attention should be paid to climatic patterns when implementing grazing or fire treatments (Curtin 2001a, 2001b). Grass banking and other programs coupling rest and restoration need to be flexible to account for climatic variation because in arid lands vegetation response to management may be delayed, often several seasons, until adequate rainfall occurs (Curtin 2001b). This means that monitoring of management or restoration must also be flexible and long term and should be planned for well beyond the immediate post-management sampling typical of many studies.

Land managers and researchers must move beyond studies whose primary experimental treatment is the removal of livestock and instead look for the climatic conditions and disturbance factors that coupled with grazing can augment or mitigate the effects of livestock. This will entail both effective, compatible, and widespread monitoring (e.g. National Research Council 1994), and the implementation of landscape level experimental studies (e.g. Curtin 2001a). Because of the inherent limitations and expense associated with academic and agency related research initiatives, this is unlikely to be attained completely through conventional federally funded research programs on public lands, but will almost by necessity involve collaborative relationships with land owners, local communities, and support from the private sector (e.g. Curtin 2001a). In conclusion, because grazing occurs primarily on private lands (National Research Council 1994), regardless of public policy, grazing will continue on a sizable portion of the West; therefore, the challenge to conservation biologists and land managers is to better understand the ecological implications of livestock management, to better determine the environmental thresholds at which grazing can have negative or positive consequences, and to work toward land uses that preserve the ecological, economic, and social fabric of the West.

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In 1993 a professor appeared before the board of a scientific society and requested the organization’s endorsement for a review article he had completed on the environmental impacts of livestock grazing. In the discussion that followed I mentioned that his review failed to include a report on grazing undertaken by the National Research Council, the research arm of the U.S. National Academy of Sciences. Acknowledging that he was unaware of this report, and promising to include it in his paper, the board gave him its blessing. When his article appeared, no mention of the Council’s report could be found.

Why? Could it have been because the scientist only chose to report studies which paralleled his views regarding livestock grazing? After all, the Research Council’s report didn’t mirror his conclusion that “...livestock grazing has profound ecological costs. ...studies have confirmed that native ecosystems pay a steep price for the presence of livestock.” Instead, the research arm of America’s most august group of scientists had reported that inadequate monitoring prevented them from concluding whether livestock grazing had degraded rangelands in the West. Importantly, they concluded that, “Many reports depend on the opinion and judgment of both field personnel and authors rather than on current data. The reports cited above attempted to combine these data into a national-level assessment of rangelands, but the results have been inconclusive.”

In the same journal issue that the professor’s article appeared, an essay by David W. Orr, a noted thinker about people and land relationships, spoke to the alternative fate of land no longer in agriculture. His paper, titled “The effective shape of our future,” discussed the increasing flight of city dwellers to rural countrysides and what skills, knowledge and attitudes they arrived with. Wondering whether these former city and suburban families would be able to live ecologically sustainable lives in their new country homes, he asked, “What does the possibility of an urban diaspora have to do with the conservation of biological diversity?” Simply this: “If large numbers of people rehabit rural areas ignorantly and carelessly, the effects on biological diversity and ecosystems will be devastating.”

Some people might think it is a far stretch to connect livestock grazing with former-city-people-now-living-country but I see it differently. Ranching and exurban development are part of a single spectrum of land use in the West, representing the principal alternative uses of rangelands in much of the mountainous New West. This is so because the protection of open space, wildlife habitat, and the aesthetics of rural areas runs right through agriculture; at one end stands a rancher, at the other a developer. As we transform the West, seemingly overnight, we see the region’s private lands reincarnated as ranchettes, those ubiquitous estates, ranging from mobile homes to mansions, that are covering hillides faster than Herefords can exit. We have arrived at a point in Western history where conversations about Western lands and land health, grazing and ranchettes, are entwined, cannot be separated. They must be dealt with simultaneously when discussing the future of our Next West. The science needs to be accurate, not value driven, and the conversations about cultural and natural histories need to be honest, not mythologized. Science is important in these discussions, but to be useful, the science must be done carefully so that...
the answers are the best we can get. Ranchers and scientists and environmentalists need to look better and listen more carefully.

Land-Use Change on the Range
Can ranching be done badly? Yes. Was it done wrong in the past? Most certainly. There is little doubt among plant and animal ecologists, as well as environmental historians, that the history of livestock grazing west of the 100th meridian has, in many instances and periods, been one of overstocking. Too many animals on rangelands for too long with too little rest. To travel through the American Southwest today is to see untold thousands of acres of former semi-arid grasslands that are now in mesquite and creosote, to name just a few of the shrubs that have replaced perennial native grasses. Too many cattle, sheep, goats, burros, and, yes, even pigs, on lands coupled with little or no rest and dry years have altered soil properties and created plant communities that are quite different from those that once existed. Visit America’s basins, the Columbia, the Great, and the Great Divide, and you may read the land legacy that misguided grazing practices have left behind. Vast stretches of bajadas, valleys, and canyons display signs of grazing done wrong, with cheat grass, rabbitbrush, juniper and pinon serving as billboards of rangeland misuse.

What has been the response to this? Decades long reform, that is ongoing. The Taylor Grazing Act of 1934 authorized the government to create grazing districts, to formulate rules and regulations to restore the ranges, to set grazing seasons, to authorize range improvements, and to charge fees for grazing privileges. The chief advocates of the 1934 Taylor Grazing Act were ranchers who realized that sustainable use of grass was impossible until access to grass was allocated. The alternative was continued overuse by tramp herders and wildcat ranchers who had no tenure to land, using it as they could and getting everything they were able out of it. The Taylor Grazing Act, and attempts by the U.S. Forest Service even earlier, were a beginning, albeit best described as compromises controlled by western livestock associations. Only in recent history have the efforts by stockgrowers’ associations been subservient to other interests concerned with western public lands. Despite the entrenched and self-defeating attitudes of some western grazing associations, ranchers are increasingly acknowledging that grazing public lands is a privilege, not a right, and that these lands have to be stewarded.

Range science is not the discipline today it was in the early part of the last century. Ranchers and rangeland ecologists have grown up together; learning adaptively by trying different things on private and public ranges. Changes in these ongoing reforms in grazing include fewer cows on public lands, with shorter periods of grazing and longer times of rest, moving cows out of riparian areas by herding, development of water sources away from streams, strategic placement of salt and minerals to distribute cows better, and monitoring to track changes in the plant communities and gauge rangeland health. The national forest adjacent to the valley where I live have seen the retirement of more than 60 permits in recent years. The remaining permits allow fewer cows to graze for fewer days. My friend and neighbor, Al Johnson, is a permittee on the Elkhorn Creek allotment. In the 1950s the Forest Service allowed 150 mother cows and their calves on this land; today the Forest Service allows but 63 animals. In addition, the cows come off earlier. As a result, when you walk the Elkhorn permit today, it is becoming increasingly difficult to see any signs of grazing, let alone too much grazing. Indeed, an open-eyed individual might instead worry about increased trampling of vegetation by off-highway vehicles and expanding bare spots along Elkhorn Creek from campers and anglers. Wallace Stegner had it about right when he said, “The worst thing that can happen to any piece of land, short of coming under the control of an unscrupulous professional developer, is to be opened to the unmanaged public.” Have we arrived at a time in this New West where “the unmanaged public” means herds of recreationists rather than herds of cows?
A Wyoming rancher recently stood before an audience of non-ranchers, Westerners who care deeply about the region’s public lands and who use them for their amenity values, to apologize for what his parents, grandparents, and great-grandparents did to the land. He said, approximately, “I am sorry for what my ancestors did to this land; they abused it, they were hard on it during dry years, and they kept too many animals on it for too long during lows in the beef business. I know that they taught me much about the land; they also spoke of what they had to do to make a living during the hard times. I cannot change how my relations lived on the land before I came but I can work hard to make the land better for my children. If what you want is an apology from me when I was just a gleam in my Daddy’s eye, I apologize. Now can we move on?”

There are obvious implications to this story, but for the present, we might think hard about what he asked. In forgiving him the destructive land management practices, albeit unintentional, of his forebears, perhaps we can acknowledge our own limited understanding of what constitutes good land management practices, even today. Perhaps we can appreciate that our knowledge of good grazing practices, is evolving and that we are learning, adaptively, as we continue to better understand the interplay of wind, soil, plants, water and drought that make up the principal plant communities of the arid West, its grass and shrub lands. If we are able to understand and move beyond the incontestable fact that we harmed western lands in the past, perhaps we can refocus our energies toward working together to put right what was once torn asunder.

**Cows: Aiding or Abetting Rangeland Health?**

Have we learned anything at all about how to use livestock to enhance and maintain the health and vitality of grass and shrublands? Ranchers and agency officials, who tend to be optimists and measure progress in decades rather than calendar years, believe that rangelands are more nearly approximating historical conditions. For example, a recent government analysis reports that “Rangeland health has clearly improved over the past 20 years, regardless of its present stable state, if conditions are compared to those presented in 1979...” 8 The report further states that “…only about one acre in seven on National Forest Service lands is in a less than satisfactory ecological condition or downward trend.” What about riparian areas? Again, conditions are relatively static or improving. On both Bureau of Land Management and National Forest Service lands, the report concludes that nearly half of the riparian areas are in a proper functioning condition, whereas less than one acre in six is static or deteriorating. 9

What about rest—the hope that rangelands will improve by removing livestock? This belief is nearly a century old, and many environmentalists and natural resource agency personnel still cling to it as their short cut to rangeland salvation. Unfortunately, rest has seldom been proven to be the solution, even over decades of time. The emerging consensus from ecologists is, amazingly, premised on the belief that functioning plant and animal communities are the product of periodic disturbance, not “pure” rest. Although we have doubted that riparian areas require flooding to promote the health of our streams and rivers, and that forests need fires to ensure forest health, we have been slow to acknowledge that rangelands are only healthy if fire and herbivory occur, albeit within the historical range of natural variability.

In other words, just as we can overgraze lands, we can also over-rest them. Rangelands are disturbance-prone ecosystems that evolved with natural regimes of fire and grazing. These regimes themselves changed over time in response to human activities, climate change, species arrivals and extinctions and other factors. We would do well to learn from the historical patterns of these disturbance regimes and try to reinstate them through active management. How long will we persist in believing simple fixes exist for ecosystems, such as rangelands? This is particularly relevant as our understanding of how rangelands function is evolving, reflecting a level of maturity that no longer relegates them to always being the victim of such simple thinking. 10
One of the most thorough analyses on the ecological effects of rest from grazing compared 26 long-term grazing exclosures with similar ungrazed areas in Colorado, Wyoming, Montana, and South Dakota. The exclosures varied from seven to sixty years old, averaging over 30 years without livestock (once more proving the benefit of having national parks, refuges, and other protected areas across the Western mosaic of landscapes).

Not surprisingly, given what I have stated earlier, the scientists found no differences between the grazed and ungrazed areas in a number of factors: species diversity; cover by grasses, forbs, and shrubs; soil texture; and the percentage of nitrogen and carbon in the soil. The study furthermore concluded that: 1) grazing probably has little effect on native species richness at landscape scales; 2) grazing probably has little effect on the accelerated spread of most exotic plant species at landscape scales; 3) grazing affects local plant species and life-form composition and cover, but spatial variation is considerable; 4) soil characteristics, climate, and disturbances may have a greater effect on plant species diversity than do current levels of grazing; and 5) few plant species show consistent, directional responses to grazing or cessation of grazing.

A word of warning about the results I have explained above. The West is not one place, but many places which grade into each other. In southeastern Arizona, for example, there is a subtle transition between the Chihuahuan and Sonoran Deserts. They have different biological histories, and different ecological structures and functions—upon which cultural histories and landscape have been and are being superimposed. These regional and local differences in the ecology of the West have implications for grazing by large domestic ungulates. Slope matters, as does elevation and aspect, and local rainfall. On a longer view, so does the post-Pleistocene environments in the presence of large, social ungulates—bison, elk, pronghorn. At a first approximation, then, some places should be more compatible with grazing by large, social, domestic ungulates than others.

Grass and shrubs co-evolved with herbivores, species that grazed and browsed their new growth. The West has always been defined by large populations of herbivores, although the actual identity has changed over time. Whether it was mastodons and sloths, or bison and pronghorn, or grasshoppers and rodents, grass and shrubs need the stimulating disturbance brought about by large, blunt-ended incisors clipping their above-ground biomass. Not to mention the dung and urine incorporated by hoof action facilitating more efficient nutrient cycling. Today the mastodons are gone and there are fewer bison and pronghorn that what had once occurred. And there are cattle, though not as many as we saw in the last century. But, we have learned that grazing by livestock, when appropriately done, contributes to the necessary disturbance that rangelands require. Perhaps we have come to the point where we measure land health premised on disturbance rather than just rest and realize there is no “balance of nature,” but instead a “flux of nature.” Getting the disturbance patterns right is the challenge.

Rainfall, Grazing, and Fire: Forces That Change
As though to verify the dangers of incomplete thinking and to emphasize one of the conclusions listed in the exclosure study described above (“soil characteristics, climate, and disturbances may have a greater effect on plant species diversity than do current levels of grazing”), recent studies in arid rangelands have begun to untangle the complex interactions among precipitation, livestock grazing, and fire. We are, according to an ever increasing body of evidence, in the midst of a global warming trend. Ecologists predict that as North America heats up a couple of degrees over the this century, plant communities, from forests to grasslands, will shift to the north and upward in elevation. Less appreciated until now is the role that changes in storm frequency—and the droughts and heavier rains and snows these changes bring—can have on rangelands.

It turns out that some ecosystems respond more strongly than others to pulses in rainfall. And, importantly, these pulses of rainfall, with or without herbivory and fire, can largely determine
the type of plant community that occurs in a given area. Although scientists had long suspected that fluctuations in rainfall could strongly affect plant productivity, such effects have only recently been confirmed at the ecosystem scale. Because they are adapted to dried conditions, grassland and desert ecosystems show extreme responses to fluctuations in precipitation. In particular, wet years have a much greater effect on plant growth than do dry years. This is largely due to the ability of drought-resistant plants to resist drought and sprout new growth when well watered.

How does this relate to arid rangelands and the effects of historical overstocking? Understanding the effects of rain pulses, it now seems, is essential to understanding how herbivory and fire can reverse the effects of past desertification (increases in shrubs and declines in grasses) that have ravaged so much of the American West. Recent studies in New Mexico and Arizona have found a three-fold increase in woody vegetation across a gradient of different elevations. These changes, however, have occurred in both grazed and ungrazed (rested) sites. Importantly, these indicators of desertification appear not to be the result of grazing, but of high levels of winter rain, coupled with dry summers, all of which favor shrubs over grasses.

Work by scientists in the Malpai borderlands of Mexico, New Mexico, and Arizona using historical photographs dating back to the 1880s indicate an earlier period of desertification but also a second epoch of vegetation change early in the 20th century. Their findings suggest that these vegetation changes are climatically driven, cyclical in nature, and apparently a pervasive feature of rangelands throughout the Southwest. Examination of tree rings indicate that the high levels of rainfall the area is presently experiencing have not occurred in nearly 2,000 years. The upshot has been an increase in shrubs and trees expanding into grasslands.

If these changes, as now suggested, are not brought about just by overstocking, then it still begs the question: how do we reverse the effects of desertification and bring back the grasslands? This is where understanding the effects of both herbivory and fire come into play, at least for those determined to restore ecosystems. Work now being done by Charles Curtin and his colleagues in the Malpai borderlands has begun to document substantial increases in grass cover in what had been a degraded Chihuahuan Desert grassland only weeks after spring fires and extensive summer rains. Importantly, this has occurred in an area that had not been grazed for nearly seven years. It took fire, followed by heavy rains, to accelerate the recovery of grass in this particular desertified rangeland. These results are in stark contrast to those at a nearby area, where drought followed fires. Here, grasses did not replace shrubs; indeed, in some plots vegetation actually decreased. Again, these results suggest that climate, as expressed in pulses of rainfall, often have a greater impact than either grazing or fire.

Borderland studies have also documented the effects of herbivory by cattle and native species, such as small mammals. Noted desert ecologist Jim Brown and his associates have found that small mammals can play a critical role in reversing the effects of climatically driven increases in woody vegetation. In long-term study plots near Portal, Arizona, they found that shrubs were more abundant in plots from which they had excluded small mammals. If small mammals can suppress increasing shrub growth, they hypothesized that livestock grazing might serve a similar purpose. They compared woody vegetation between grazed and adjacent ungrazed areas and, as expected, found that shrubs had increased six-fold in the ungrazed area and only two-fold in the grazed site.

What are we to make of these recent findings? They certainly do not fit in our tidy stereotype of: cows → overgrazing → desertification → rest → recovery. Instead, these discoveries reinforce what some might suggest to be the obvious: that nature is more complex than we can understand, and ecologists are continuing to learn about the inter-relatedness of climate, fire, and grazing, not to
mention the importance of time and space scales, in understanding ecosystems. Perhaps we should be humbled by this. After all, it was a similar appreciation of the non-linear behavior of semi-arid Southwestern ecosystems that first prompted Aldo Leopold to consider the need for a land ethic. To heal unhealthy lands we should seek counsel from both ecologists and those whose connections to the land are long and deeply rooted. Maybe research, management, and husbanding of cows along the Malpai borders of the Southwest have something important to teach us about how ecosystems function.

**Ranching, Ranchettes, and Biodiversity**

Earlier I suggested that ranching and ranchettes belonged on the same spectrum of Western land use. Although some have tried to deny this, their arguments suggest a strong reluctance to confront reality, for ranchette development is not only a more lucrative use of ranchland, it is also the fastest growing use. Reconsider the statistics given in this book’s second essay by Martha Sullins and her colleagues. Nine of the ten fastest growing states are Western, and have been for over a decade (accolades to Atlanta for ensuring Georgia makes the top ten list as well; thanks for keeping us from a monopoly!). In Colorado, the loss of agricultural land is sharply accelerating. From 1987 to 1997, the average annual rate of ranch and farm land loss was 141,000 acres per year. Between 1992 and 1997, the rate of conversion nearly doubled the past 10-year average, to 270,000 acres a year. Regretfully, with Colorado’s burgeoning population, most of this formerly agricultural land has gone straight into residential and commercial development.

The “deniers” on the other hand, claim that the conversion of ranchlands to rural housing developments occurs only in “pretty places;” such as around Sun Valley, Taos, Bozeman, and Aspen, but not out on the real West. In some respects this is true, for much of what has come to be called “the buffalo commons” is not booming and ranches are not being avidly sought by speculators and developers. Not yet. A demographer recently declared that given enough time, there is no place in the West so remote, so poor, with such bad weather and poor roads, that it can hide from the boomers, individuals who appreciate the easiest way to make money is to buy ranchland cheap and sell it high for houses and commercial development. And I have seen it. When you visit the outback, the West away from interstates, airports, and blue-ribbon trout streams, you can sniff it in the air; newcomers prowling, looking for a deal on land, or a place to escape from, or to live a life that has animals and land in it. We are deceiving ourselves if we believe parts of the West will be spared just by geography and poverty; what is saved will come about from conscientious hard work, involving local communities and good land-use planning.

Importantly, to appreciate the real cost of the conversion of ranchlands to ranchettes, remember what Martha Sullins and her co-authors have pointed out, that growth in population results in disproportionately greater conversion of land. New Westerners are not living in cities so much as they are on sprawling ranchettes. Look at Figure 1 in her essay and consider her words, “From 1960 to 1990, annual rates of land consumption reached 7.2%-far surpassing the 2.8% annual population growth rate.”

To deny that the conversion of ranchlands to ranchettes has no connection to the maintenance of our natural heritage assumes that biodiversity is no different on ranches than on ranchettes. Consider Figure 7.1 for a second. This ranch in Colorado near where I live was sold in the 1950s. Over time you can track the increase in homes and the spread of roads that allow access to these homes. The question relating to biodiversity comes down to, “Is there a house effect?” Is the wildlife near these homes the same wildlife that occupied this ground before the homes arrived? If it’s not, and if homes like these are becoming ubiquitous across the New West, then it is likely that our region’s biodiversity is changing to something quite different from what it was.
We addressed this question by studying the birds and carnivores that occurred near ranchettes and asking whether they differed from those that occurred away from rural homes. We found that the birds that lived near these homes were very similar to the birds you found near homes in cities, but not in rural landscapes. For example, robins, black-billed magpies and brown-headed cowbirds were among the species most abundant near ranchettes. In terms of carnivores, we found that domestic dogs and cats were most numerous near homes, whereas coyotes and foxes were not. Indeed, they only became numerous once you were a considerable distance away from homes. Prized songbirds, such as blue-gray gnatcatchers, orange-crowned warblers and dusky flycatchers, were nearly absent near homes and their numbers did not increase until you were hundreds of yards away from the homes, in undeveloped areas.

Does this matter? Conservation biologists would say yes. The species that thrive near ranchettes, the cowbirds, robins, magpies, cats and dogs, are exactly the species that result in depressed populations of other songbirds, raptors, and small and medium-sized mammals, many of which are of great conservation concern. This happens because these human-adapted species are superior competitors for nesting sites and food, or are skilled predators of other species. Even worse, the cowbird, doesn’t even build its own nest. It locates nests of other songbirds, dumps its eggs in their nests and flies away, leaving their young to be raised by the host species. Although these other songbirds are willing to be “adoptive parents,” the young cowbirds grow faster, resulting in the starvation of the host’s young.

We took our studies one step further. Northern Larimer County, Colorado, where I live, is a blend of protected areas, ranches, and ranchettes. A student and I are examining the bird, carnivore, and plant communities across these three different land uses. If, as we found in the study described above, ranchettes indeed attract generalist species and repulse species sensitive to elevated human densities, then we hypothesized that biodiversity would be more similar on protected areas and ranches than on ranchettes. And that is what we found. Generalist bird species, such as magpies and cowbirds, showed elevated populations across the ranchette land use category while species subject to conservation concern, like towhees and grassland sparrows, were common only on protected areas and private ranchlands. Similar trends existed for native plants compared to exotic and invasive weeds, and dogs and cats compared to native carnivores.

It appears that groups like The Nature Conservancy are doing the right thing when they promote ranching as a compatible land use in the New West. When ranches support viable populations of species sensitive to urbanization, they serve much the same role as protected areas because they serve as “sources” of sensitive plant and animal species. If ranchettes serve as “sinks” (places where death rates exceed birth rates) for species of conservation value, populations on these areas are kept afloat by the addition of surplus individuals dispersing from nearby protected areas and ranchlands. The value of ranchlands becomes even more obvious when one compares the productivity of these lands. Public lands, by and large, occur at higher elevations and on the least productive soils. Private ranchlands, on the other hand, generally occur at lower elevations and on much more productive soils. This is why conservation groups concerned with the maintenance of native biodiversity see ranches as critical components in their protection strategies. Perhaps not surprisingly, results similar to ours have been reported from Europe and Latin America.

The upshot of the biological changes associated with the conversion of ranchlands to ranchettes will be an altered natural heritage. In the years to come, as the West gradually transforms itself from rural ranches with low human densities to increasingly sprawl-riddled landscapes with more people, more dogs and cats, more cars and fences, more night lights perforating the once-black night sky, the rich natural diversity that once characterized the rural West will be altered forever. We will have more generalist species—species that thrive in association with humans—and fewer specialist species—those whose evolutionary histories failed to prepare them for ele-
nd fewer specialist species—those whose evolutionary histories failed to prepare them for ele-
vated human densities and our advanced technology. Rather than lark buntings and bobcats, 
we will have starlings and stripped skunks. Rather than rattlesnakes and warblers, we will have 
garter snakes and robins. Is that the West we want? It will be the West we get if we do not slow 
down and get to know the human and natural histories of our region better, and then act to con-
serve them.

Ranching: The View From Here
The West is a region of diverse ecosystems, cultures, and economies. Ranching as a landuse, and 
ranchers as a culture have been with us for over 400 years, dating back to the early Spanish colo-
nists who struggled northward over El Paso del Norte and found a home for their livestock near 
present-day Espanola, New Mexico. Today, more so than at any time in its history, the ranching 
culture is under assault. If what I have presented in this essay is true, that ranchlands are com-
patible with our region’s natural heritage and that herbivory is a necessary ecological process in 
the restoration and maintenance of healthy rangelands, then why are ranchers and livestock 
grazing so vilified? Why have scores of environmental groups banded together for “a prompt 
end to public lands grazing”? 

Could it be because of different values? I began this essay reporting how a conservation biologist 
 wrote a review of livestock grazing that universally condemned it as a land use incompatible 
with biodiversity. In trying to understand how his review differed from what other scientists 
have reported, ranging from the National Academy of Sciences to noted plant ecologists, I ques-
tioned, was it just a difference in values? Might some Westerners want the public and private 
lands free of manure, cows, sheep, and fences because they want them for their own uses, such as 
mountain biking and river rafting? Do some want ranchers and their livestock off the Western 
ranges because they believe what others have told them, that cows and sheep sandblast land and 
that cattle barons are arrogant bastards, intolerant of any but their own kind?

My own sense is that differing values and distorted mythology can obscure facts, and that at the 
end of the day, emotion may trump judgment. Would it make any difference if we found that 
ranchers are stewards of the land, that cows are being used as a tool in the recovery of arid eco-
systems, that open space, biodiversity, and county coffers are enriched more from ranching than 
from the rapidly eclipsing alternative, ranchettes? Perhaps.

What about the far left? The New Federalists who are obsessed with spreading their private-
property rights hysteria? They are as intolerant of community-based conservation efforts in the 
New West that bring ranchers, scientists, and environmentalists together as the Far Left. These 
powerful players in the West, seldom are any of them actually ranchers, throw out incendiary 
 remarks about wildland protection and government land grabs as easily as their counterparts 
reflexively oppose grazing. Thank goodness for those in the radical center who strive to build 
connections across landscapes, that run through human and natural communities, and across 
socio-political chasms. Perhaps the wing nuts at either ends of this human spectrum stir up dis-
sent because they find it easier and more profitable to simplify, divide, demean and demonize.

There are those who say the only difference between ranchers and realtors is, a rancher is some-
one who hasn’t sold his ranch yet. Do ranchers care for the land, or are they developers in sheep’s 
clothing? Certainly, there are quite a few that see their ranch as their last cash crop, their private 
401-k account. On the other hand, mounting evidence suggests that ranchers care for the West’s 
geography every bit as much as those of us in the cities and suburbs. In Colorado the state live-
stock association has formed a land trust. To date, 44 conservation easements, totaling over 
100,000 acres, have been entrusted to it from ranch families. Indeed, in Colorado, the cattlemen’s 
land trust is second only to The Nature Conservancy in acres protected under conservation
Considering the economies associated with Western ranching, it is evident that today’s ranchers are in it for its lifestyle attributes, far more so than as a way to reap great profits.

I overheard a conversation once between an environmentalist and a rancher. The environmentalist was laying it on pretty thick about the woes of cows and sheep on the Western range. In a near-fit of exasperation, the rancher blurted out, “You’re treating us the same way we treated the Indians; you’d have us off our land and relegated to the worst places the West has to offer.” The rancher, perhaps unknowingly, was raising a comparison made by others. Wallace Stegner was among those who saw similarities between the First Americans and today’s ranchers. In one of his most heartrending and evocative essays, “Crow County,” he observed a “cosmic irony” that connected ranchers and Indians:

Out on the plains, the tamer country onto which the Crows were forced in the 1880s turns out to contain six billion tons of strippable low-sulfur coal. An equal amount lies under the grass of the Northern Cheyenne reservation next door... The modern Crows can grow rich, if they choose to adopt white styles of exploitation and destroy their traditional way of life and forget their mystical reverence for the earth. Meanwhile the whites who now live in the heart of the old Crow country, as well as many who own or lease range within the present reservation, fight against the strip mines and power plants of the energy boom, and in the face of rising land costs, high money costs, high machinery costs, high labor costs, and uncertain beef prices work their heads off to remain pastoral... There is a true union of interest here, but it is also a union of feeling: ranchers and Indians cherish land, miners and energy companies tear it up and shove it around and leave it dead behind them.

Stegner’s point seems to resonate. After all, Western ranching has spanned the time scale from the First Americans to the astronauts, avoiding the moving-on mandate of the get-rich-quick industries of mining and logging. Charles Wilkinson, among the most distinguished of our region’s scholars, has exhorted us to, “...extend an honest respect to the ranching community—virtually an indigenous society in the West.”

In the heated argument between rancher and environmentalist mentioned above, I will admit coming to the rancher’s defense. In watching him squirm uncomfortably before an audience of urban, suburban, and recently exurban Westerners, it dawned on me that perhaps we could settle the New West better than we conquered the Old West if we listened to the cultures that had been here before us (and that endure still). Might we have made a better place of this region if we had slowed down enough to listen to the First Americans? Did they have something to teach us about the region’s wildlife, rivers and streams, grass and forests?

So today, in our haste to remake ourselves once more into the Next West, might we avoid some mistakes if we showed respect to the ranching culture? A definitive answer to that question eludes me but my gut says yes, going slow and getting to know one’s human and natural histories is essential to living well on a place.

Perhaps it all comes down to values—of the rancher, the urban environmentalist, the scientist and the government employee. Each of us is in love with the West, its punctuated geography, its rich cultures, its wildlife, and its heart-rending beauty that stretches sometimes further than our imaginings. Ranchers will have to change; they will have to change more than any of us. They can do that, one only needs to look at their history. They have changed in the past, they have adapted, and now they are evolving to fit a land whose demographics, whose economies, and yes, even whose environment is different from what it had been. But we should change as well.
Other than those of us with extremely narrow ideologies, the far right and far left, the rest of us should, perhaps, meet the ranchers half-way, or nearly so. The need of the moment is to find common ground on which to work for a common good. Good-faith efforts, and a retreat from demonization and demagoguery, are what we need today.

If it makes what I have written any more palatable, let me admit where my values come from. My wife and I live in a valley along the northern end of the Colorado Front Range. Our neighbors and friends are ranching families and those who live on ranchettes. Over the years we have come together to dance, eat, neighbor, and chart a common ground. Whether working together in our weed cooperative, developing a place-based education program in the valley school, fencing out overgrazed riparian areas, we are working together to be known more as a place where people cooperate, collaborate, and show communitarian tendencies, than as a place where they engage in ferocious combat, litigation, and confrontation. We are home, we have our hands in the soil, and our eyes on the hills that comfort us. In our imperfect lives, we work together to build a community that will sustain us and our children, for we understand that we belong to the land far more than we will ever own it. We strive together in a cooperative enterprise, to steward our lands for all of God’s children and all of God’s creatures. Perhaps that is why I write as I do.

Endnotes

1. The article in question was written by T. Fleischner and can be found in the 1994 issue of Conservation Biology (8:3) with the distinctive cover of 2 cows and a calf on a piece of western rangeland that indeed looks wasted.

2. The report, the product of a four-year study, is Rangeland Health: New Methods to Classify, Inventory and Monitor Rangelands (Washington, D.C.: National Academy Press, 1994) and concluded that, “All national assessments (of rangeland health) suffer from the lack of current, comprehensive and statistically representative data obtained in the field. No data collected using the same methods over time or using a sampling design that enables aggregation of the data at the national level are available for assessing both federal and nonfederal rangelands. Many reports depend on the opinion and judgment of both field personnel and authors rather than on current data. The reports cited above attempted to combine these data into a national-level assessment of rangelands, but the results have been inconclusive.”

3. The single best account, written in an accessible and enjoyable format is P. Starrs’ Let the Cowboy Ride: Cattle Ranching in the American West (Baltimore, MD: Johns Hopkins Univ. Press, 1998). For anyone interested in Western land use, and its associated human and economic endeavors, this book belongs at the top of your list to study.


7. Alarmingly, outdoor recreation is the third leading cause for the decline of federally threatened and endangered species in the U.S. on all lands, private and public. (B. Czech et al., Economic association among causes of species endangerment in the United States,
BioScience 50:593-601, 2000.), and, on public lands, is second only to water development as the chief culprit for their decline (E. Losos et al., Taxpayer-subsidized resource extraction harms species, BioScience 45:446-455, 1995.). For more information on wildlife and recreation see R. Knight, Wildlife and Recreationists (Washington, D.C.: Island Press, 1995).


Ibid., pp. 40–41. “Proper functioning condition,” is agency and ecological jargon for rating the health of riparian zones. For example, the percent of a stream’s length in which water flow and timing fall within the historic range of variation, or deviates from it, is evidence of proper or improper functioning condition.

Early beliefs of rangelands were based on the static belief in equilibrium theory of degradation caused by overgrazing, and by secondary succession to a stable climax following the removal of grazing. The emerging consensus by ecologists of how ecosystems, like rangelands, actually function is now a non-equilibrium one of vegetation dynamics based on natural disturbances, such as fire and herbivory. The seminal paper on this is by M. Westoby et al. (Opportunistic management for rangelands not at equilibrium, J. Range Management 43:266-274, 1989). To read the story of this transition in thinking, from a stable state without disturbance belief to a more dynamic vision that incorporates disturbance processes, see L. Joyce (The life cycle of the range condition concept, J. Range Management 46:132-138, 1993).

This definitive study was authored by T. Stohlgren and his colleagues and published in Ecological Applications (How grazing and soil quality affect native and exotic plant diversity in Rocky Mountain grasslands, 9:45-64, 1999). Importantly, Stohlgren et al. varied the size of their sampling plots and found that plot size could give different results. They also concluded that most exclosure studies have used poor sampling techniques, particularly with respect to plant diversity (p. 46).

These startling results are presented by A. Knapp and M. Smith (Variation among biomes in temporal dynamics of aboveground primary production, Science 291:481-484, 2001.)


An excellent summary of these findings can be found in C. Curtin’s paper (Ranching, research, and restoration: science and community-based conservation in the Malpai Borderlands, submitted to Conservation Biology).


If the research findings from other scientists I have presented here are indeed true, they further discredit the polemic work of D. Donahue, The Western Range Revisited: Removing


A most amazing statement to this effect appeared in Conservation Biology and said, “Agriculture—both livestock production and farming—rather than being ‘compatible with environmental protection’ has had a far greater impact on the western landscape than all the subdivisions, malls, highways, and urban centers combined.” (G. Wuerthner, Subdivisions versus agriculture, 8:905–908, 1994). This despite the fact that suburbanization is second only to invasive species as the leading cause for the decline of Federally threatened and endangered species on all land, private and public, in the U.S. (B. Czech et al., Economic associations among causes of species endangerment in the United States, BioScience 50:593–601, 2000).

To track the loss of agricultural land in Colorado, visit the Colorado Department of Agriculture’s web site at www.ag.state.co.us.


This study is being conducted by Jeremy Maestas as the principal investigator, Wendell Gilgert, and myself, is in its second field season and compares plant, songbird, and carnivore communities across three different land uses: protected areas, ranches, and ranchette development. Our study sites occur on the same soil and vegetation type, and at the same elevation.

That private landowners will be the key to achieving a representative conservation reserve system in the U.S. is abundantly clear when examining the data in this remarkable article by M. Scott et al. “What are we protecting?” Conservation Biology in Practice 2:18–19.

Studies demonstrating the importance of ranch lands in maintaining regional biodiversity can be found in A. Hansen, and J. Rotella. “Regional source-sink dynamics and the vulnerability of species to extinction in nature reserves” submitted to Conservation Biology, and G. Daily et al. “Countryside biogeography: use of human-dominated habitats by the avifauna of southern Costa Rica,” Ecological Applications 11:1–13, 2001. As Americans we can be a bit parochial in our thinking and might benefit from the infusion of ideas from areas where humans, agriculture, and biodiversity have struggled for coexistence longer than in our nascent West. See J. Pykälä’s paper, “Mitigating human effects on
European biodiversity through traditional animal husbandry,” Conservation Biology 14:705–712, 2000 and listen to his caution, “Traditional livestock grazing and mowing are widely used to maintain high biodiversity or rare species. Their similarities to natural processes are rarely recognized, however, so the importance of traditional animal husbandry as a conservation tool is underrated... Because of the similarities between the effects of natural disturbances and animal husbandry, traditionally managed habitats can harbor many features of pristine habitats.”


Called the RangeNet 2000 Symposium, about 100 lawyers, scientists, and activists gathered in Reno, Nevada in November 2000 to develop an action plan to end all public-land livestock grazing west of the Rocky Mountains.

For a review of ranchers that care about keeping ranches as part of a working landscape, see stories in the Summer 2000 issue of Orion Afield. Included is a story on the Colorado Cattlemen’s Agricultural Land Trust.

By far the most convincing evidence of this statement emerges after reading P. Starrs’ Let the Cowboy Ride.


C. Wilkinson, The Eagle Bird: Mapping a New West, p. 150. Further scholarly evidence that ranching is a distinct culture worthy of our consideration can be found in the archives and activities of The Western Folklife Center (www.westernfolklife.org).