

COOPERATIVE LAND STEWARDSHIP IN THE BORDERLANDS OF THE SOUTHWESTERN UNITED STATES

Gerald J. Gottfried, USDA Forest Service, Rocky Mountain Research Station
Phoenix, Arizona;
Carleton B. Edminster, USDA Forest Service, Rocky Mountain Research Station
Flagstaff, Arizona;
and
Ronald J. Bemis, USDA Natural Resources Conservation Service (ret.)
Douglas, Arizona

ABSTRACT

The Southwestern Borderlands project area of southeastern Arizona and southwestern New Mexico cover a unique, relatively unfragmented landscape of approximately 323,756 ha (800,000 ac). The region contains exceptional biological diversity with communities ranging from desert scrub to high-elevation mixed-conifer forests. Fifty-three percent of the land is in private ownership and the remainder is administered by federal and state agencies. Agroforestry practices in this dryland region are characterized by multiple-use management systems. The main activities are cattle grazing, hunting of native wildlife, camping, and ecotourism related to the unique fauna. A small amount of wood is harvested for local use. Land stewardship for sustained productivity and ecosystem health is the goal of all parties. The Malpai Borderlands Group was formed by local ranchers concerned about the growing trend of landscape fragmentation and the need to increase productivity and biological diversity on the area's grasslands and oak and juniper woodlands. The ranchers realized that their objectives could best be accomplished by forming cooperative partnerships with government land management agencies, conservation organizations, and the academic and federal research communities. Many of the cooperative activities are attempting to re-introduce fire into the region's ecosystems as a keystone natural process and to evaluate the impacts on the area's natural resources. Prescribed fire is used to reverse the trend of encroaching woody species by reducing stand densities and creating mosaics of grass and wooded areas that were more typical of the landscape prior to Euro-American settlement. A variety of cover conditions will benefit rangelands, watershed condition, and wildlife populations.

Keywords: Arizona, cooperative land stewardship, ecosystem management, multiple resources, New Mexico, Southwestern Borderlands.

INTRODUCTION

The Southwestern Borderlands project area of southeastern Arizona and southwestern New Mexico cover a unique, remote, and relatively unfragmented landscape of approximately 323,756 ha (800,000 ac). The relatively remote region is recognized for its exceptional biological diversity, with communities ranging from desert scrub to high elevation mixed conifer forests, and for its natural scenic beauty. Fifty-three percent of the land in the Borderlands is in

private ownership and the remainder is administered by federal and state agencies. Natural landscapes and ecosystems throughout the United States are coming under increasing pressure from traditional producers, conservation and environmental organizations, governmental entities, and especially from growing urban populations. The demands for increased recreational opportunities, especially in the mountains, have grown as urban residents attempt to escape the summer temperatures. An obvious consequence of population growth and affluence has been landscape fragmentation as large privately owned ranchlands and other landholdings are subdivided into small parcels for primary or secondary home sites. Fragmentation of landscapes and land ownerships is a threat to the natural environment and to rural societies in the region. Subdivisions have potentially adverse impacts on wildlife habitats and migration corridors, regional hydrology, and traditional rural economies and lifestyles (Gottfried 2004). Ranches are often lost to subdivision because of economic conditions, exacerbated by droughts and fluctuating livestock prices. A viable local economy, where people can earn a decent living while caring for the land, is indispensable to reducing fragmentation.

Land stewardship for sustained productivity and ecosystem health is seen as a goal of all parties in the Borderlands. The application of agroforestry practices will support these goals. The objective of this paper is to discuss cooperative land stewardship activities in the Borderlands. Research activities in the region will be highlighted since it is recognized that sound management must be based on sound science.

THE SOUTHWESTERN BORDERLANDS

Location

The Southwestern Borderlands project area is located within the Madrean Archipelago, a region of the Basin and Range Physiogeographic Province between the Rocky Mountains to the north and the Sierra Madre Occidental to the south. The Borderlands Region includes southeastern Arizona, southwestern New Mexico, northeastern Sonora, and northwestern Chihuahua and is characterized by networks of mountain islands separated by valley grasslands or deserts (DeBano et al. 1995). This location between two major biological provinces accounts for the region's great biological diversity where individual mountain ranges can support more than 1,000 native plant species. Elevations in the project area range from 1,160 to 2,590 m (3,800 to 8,500 ft). The region receives approximately 55 percent of its precipitation during the summer monsoon period mostly from convective storms. The biogeography, ecology, biology, hydrology, and management of the Madrean Archipelago are described fully in numerous articles and presentations including those in the proceedings of the first and second Madrean Archipelago/Sky Islands Conferences in 1994 (DeBano et al. 1995) and in 2004 (Gottfried et al. 2005). The unique regional characteristics have fostered a number of advocacy organizations dedicated to protecting the region's natural and aesthetic resources

The Southwestern Borderlands project area includes the San Bernardino and San Simon Valleys in Arizona, the southern Peloncillo Mountains, which straddle the Arizona-New Mexico border, and the Animas Valley, Animas Mountains, and part of the Playas Valley in New Mexico. The area is under multiple ownerships and administrations. Fifty-three percent is in private ownerships; 23 percent is in state ownership by Arizona or New Mexico; 16 percent is

administered by the USDA Forest Service's Coronado National Forest, 7 percent is administered by the Bureau of Land Management, and 1 percent is administered by the Fish and Wildlife Service. The international border forms the southern edge of the region, although the neighboring area in northern Mexico is geologically and ecologically similar. This complex ownership pattern requires that the management and research programs be based on a partnership among private and public interests and that desired future conditions be developed through an evolving adaptive ecosystem management process.

Agroforestry

Agroforestry practices in this dryland region are characterized by multiple-use management systems and generally fall within the silvopastoral model for the southwestern United States that provides both grazing and tree products (Ffolliott et al. 1995). The main land use is cattle grazing on private lands and lands leased from the Coronado National Forest, Bureau of Land Management, or from the state governments. Other activities include hunting of native wildlife, camping, and ecotourism related to the unique fauna of the Borderlands. This is the area, for example, where a rare jaguar (*Panthera onca*) was observed in 1996 (Glenn 1996). Some ranchers supplement their incomes by providing hunting guide services. However, trees are also important. While there is concern about the encroachment of woody species onto grasslands, mesquite (*Prosopis* spp.) pods, which have high sugar contents, provide a nutritious food for livestock, especially during periods of drought. Wooded areas provide thermal cover during extreme weather in summer and winter months. A small amount of wood is harvested for local use, primarily firewood and fenceposts. Mesquite has a potential to produce high-quality wood for furniture and craft items within a silvopastoral agroforestry system (Felker 1998), but most of the trees in the Borderlands, except along drainages, are too small for this purpose. The root systems of this genus are noted for their association with nitrogen-fixing bacteria and their value for soil stabilization. There is a demand for special woodland products such as beargrass (*Molina microcarpa*) that is harvested for export into Mexico, where it is made into high quality brooms. The beargrass is harvested by contractors working under permits with the USDA Forest Service or agreements with the landowners. Border pinyon (*Pinus discolor*) nuts and oak (*Quercus* spp.) acorns are traditional food items among segments of the population and are harvested for personal consumption although the demand in this area appears less than in other parts of the Southwest. An acceptable mix of trees and herbaceous species, with proper livestock management, will provide watershed stability.

MALPAI BORDERLANDS GROUP

The Malpai Borderlands Group (MBG), a nonprofit organization, was formed by local ranchers in 1992 who were concerned about the growing trend of landscape fragmentation and the need to increase productivity and biological diversity on the area's grasslands and oak and juniper woodlands. A specific goal, as stated by Bill McDonald (1995: 483), the Executive Director, is "...to restore and maintain the natural processes, including fire, that create and protect a healthy, unfragmented landscape to support a diverse, flourishing community of human, plant, and animal life in our Borderlands Region." The ranchers realized that their objectives could best be accomplished by forming cooperative partnerships with government land management agencies,

which administer 47 percent of the land in the area, conservation organizations, and the academic and federal research communities. The Nature Conservancy is an active participant in the MBG's activities, and the USDA Natural Resources Conservation Service (NRCS), which does not administer any land here, has provided a fulltime person to assist the ranchers in Arizona and New Mexico.

The MBG is dedicated to cooperative land stewardship within the ranching community. The group attempts to prevent landscape fragmentation by purchasing conservation easements from interested landowners. The easements allow owners to continue their ranching activities, and only restrict the right to subdivide their land for commercial and housing development. The leases are linked to the property and remain in effect even if the property is sold (Gottfried 2004). A member of the group developed the concept of "grassbanking." A grassbank is grass made available to another rancher's livestock in return for a conservation value (an easement) equal to the value of the grass (McDonald 1995). This allows a rancher to rest his range while continuing to maintain his livestock and livelihood. The MBG pays the owner of the grassbank for utilization of the pasture. The concept has been adapted by other rancher and conservation organizations in the Southwest.

The MBG has been actively involved with outreach efforts to ranchers from throughout Arizona, other parts of United States, and some foreign countries. It sponsors annual science meetings that bring ranchers, agency land managers, general public, environmental organizations, and the scientific community together to discuss research progress and needs and an agency meeting to keep the large number of federal and state agencies informed about current activities. The MBG sponsors vegetation monitoring activities to assess vegetation and weather conditions and the impacts of management and it sponsors research related to the interactions of livestock, fire, and wildlife. It works with associated ranchers on projects designed to stabilize and protect ephemeral stream channels that traverse eroded rangelands.

PRESCRIBED FIRE

Fire was the main natural disturbance in the Borderlands prior to the arrival of Euro-Americans and tended to retard the encroachment of woody species and keep the grasslands more open and productive. The grass cover on many sites has disappeared or is degraded because of the impacts of past overgrazing and woody plant encroachment. Watershed conditions have often suffered because of these past activities. Cattle production became the primary industry after the suppression of the Apache Indians and the construction of the transcontinental railroad in the 1880s when more than 60,000 cattle grazed in Hidalgo County, New Mexico, and Cochise County, Arizona (Hadley et al. 1999). The overgrazing coincided with three periods of extreme drought that resulted in the rapid depletion of range resources that is still apparent today. The encroachment of trees, such as mesquite, and other woody species can be linked to the reduction in the occurrence of natural wildfires that killed seedlings. Fires that are ignited usually cannot spread because of the patchiness of the vegetation. Aggressive fire suppression by the land management agencies also has contributed to the lack of fire. Suppression was initiated on many fires that were not endangering lives or improvements but could have benefited ecosystem health and sustainability.

The MBG and its cooperating governmental agencies are actively attempting to reintroduce fire into the Borderlands. The Peloncillo Programmatic Fire Plan developed by the Coronado National Forest identifies the prescribed fire and wildfire suppression philosophies of the ranchers and landowners in the mountain range so that land managers may anticipate appropriate suppression actions. (Allen 1999). The plan, which was established with consultations with the US Fish and Wildlife Service, also attempts to set standards that will protect important threatened and endangered species of plants and animals and their habitats. Mexican land management agencies were also consulted because of the proximity of the international border and the potential risks to its citizens. Three large landscape-level prescribed fires have been ignited in the region since 1995 with objective of breaking up the tree cover and creating mosaics of tree and grass dominated sites. These fires involve intensive interagency cooperation during the planning and operational phases. The Baker Canyon II Fire in 2003 burned 18,615 ha (46,000 ac) of federal, state, and private grasslands and woodlands in the southern Peloncillo Mountains and has the distinction of being the largest successful management ignited prescribed fire in the United States.

RESEARCH

The Southwestern Borderlands Ecosystem Management Project

An intensive research effort is being conducted in the region by a partnership of organizations to establish a basis for cooperative land stewardship. The primary partners are the Malpai Borderlands Group, the Animas Foundation, federal and state agencies, environmental organizations, and universities. Many of these groups support basic or applied ecological or related research by university or independent scientists. An important contribution is being made by the USDA Forest Service's Rocky Mountain Research Station which established the Southwestern Borderlands Ecosystem Management Project in 1994. The ecosystem unit's mission is to: "Contribute to the scientific basis for developing and implementing a comprehensive ecosystem management plan to restore natural processes; improve the productivity and biological diversity of grasslands and woodlands; and sustain an open landscape with a viable rural economy and social structure in the region." A main force behind the establishment of the project was the broad support of the Coronado National Forest, the MBG, The Animas Foundation, The Nature Conservancy, the NRCS, the Bureau of Land Management, and The University of Arizona's School of Renewable Natural Resources (Edminster and Gottfried 1999, Gottfried and Edminster 2005).

Initial Problem Areas

The objectives of the project are to fulfill the mission goal of contributing to the scientific basis for developing and implementing a comprehensive ecosystem management plan for the Borderlands. To accomplish the mission, the Project identified two problem areas (Gottfried and Edminster 2005):

1. Provide the scientific basis to establish the desired future condition for the planning region based on highest quality biological science integrated with desired social and economic conditions within the context of private and agency partnerships.

2. Plan and implement a long-term systematic program of basic and applied research and monitoring to integrate past and future research findings and contribute to developing guidelines for sustaining a viable rural economy and landscape.

Focus Areas

Three focus areas were identified within these problems (Gottfried and Edminster 2005). The first was to determine what was known about the region and to summarize and synthesize the existing information. A key effort was the development of an annotated bibliography of literature pertaining to the northern Madrean Archipelago (Ffolliott et al. 1999). Other studies documented the role and importance of human and natural disturbances on plant communities; an archeological synthesis of pre-historic and early historic evidence; the status of wildlife information, and a comparison of hydrological information for major watersheds in the general region. A related study examined the cultural and environmental history of the region.

The second focus was to develop a comprehensive landscape inventory and monitoring system to serve research and management needs. Several studies have been completed in this category; they include the mapping of current vegetation using Thematic Mapper satellite imagery and ground validation; delineation and interpretation of geomorphic surfaces, integrating geology with the NRCS soil maps; photographic monitoring of landscape changes; and a digital archive of the long-term records at the Santa Rita Experimental Range.

The third focus area was the initiation of specific research studies identified as having a high priority to filling gaps in the existing knowledge base. Many of the studies in this focus group are designed to support the Peloncillo Programmatic Fire Plan by determining information to aid in its development and sound implementation. Some of the research is designed to determine past fire regimes or the consequences of reintroducing programmatic prescribed fire onto the landscape. A cross-section of the fire-related studies include a reconstruction of fire regimes in the southwestern United States and northern Mexico; effects of different fire frequencies on fuel accumulations in forests, woodlands and savannas and effects on nutrient budgets within grasslands; understanding the spatial patterns of fire regimes and fire behavior at landscape scales; effects of prescribed fire on vegetation, bird populations and selected endangered species; techniques for fuels visualization, mapping, and fire spread modeling; and developing riparian ecosystem recovery priorities for the region.

Two efforts concerned the impacts of fire on threatened or endangered species; one examined the impacts of fire on *Agave palmeri*, an important source of food for lesser long-nosed bats (*Leptonycteris curasoae*), and the other studied populations and impacts of fire on the New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*). This information was used as part of the planning and approval process for the Baker Canyon II Fire in 2003.

Major Landscape Studies

The Southwestern Borderlands Ecosystem Management Project and its cooperators have initiated three major long-term landscape-scale research studies. The studies will continue into the future.

The studies are experimental treatments to restore degraded Apacherian grasslands, the Cascabel Watershed study, and the McKinney Flats fire and grazing interactions study.

Rangeland Restoration

The objective of the rangeland restoration study is to improve the cover of native perennial grasses on mesquite (*Prosopis glandulosa* var. *glandulosa*) dominated semidesert grasslands and to create sufficient grass cover so that sites can be maintained by periodic prescribed fires (Gottfried et al. 1999). This is a joint study with the NRCS, and is being conducted on three ranches and on state lands in Arizona or New Mexico. The three treatments being tested are a control; mechanical crushing of mesquite with no grass seeding; and crushing of mesquite with seeding of locally adapted native perennial grass seed. Initial results showed that the seeded blocks had the best results; unfortunately, the continued drought in the region has compromised the treatments because of subsequent mortality and the lack of natural regeneration. The lack of winter rains has also prevented the establishment of an annual grass cover to help carry the fires. However, vegetation cover and production changes are being monitored in anticipation of better climatic conditions. An associated study is examining the feasibility of using cattle as a restoration tool on a site where mechanical treatments are not possible due to archeological values.

The Cascabel Watersheds

One of the major questions posed by the programmatic fire plan has been the effects of cool season compared to warm season prescribed burning. The region generally has burned naturally during the warm season prior to the onset of summer monsoon rains. These fires tend to have relatively high intensities. Some people maintain that cool season burning would be less harmful to the ecosystem and some of the component species. There also is a lack of knowledge about the hydrology of oak savannas and woodlands. A landscape-scale study was established on 12 small instrumented watersheds that support typical oak savannas on the east side of the Peloncillo Mountains of the Coronado National Forest and adjacent private lands (Gottfried et al. 2000). The objective is to examine the effects of seasonal burning on as many ecosystem attributes as possible. Studies are also being conducted to determine the impacts of burning on erosion and sedimentation; overstory and understory vegetation; small and large mammal, bird, and reptile populations; and soil nutrient dynamics. Scientific partners include the NRCS; Rocky Mountain Research Station's riparian and watershed project at Flagstaff; The University of Arizona's School of Natural Resources; and the Arid Lands Project.

McKinney Flats

The McKinney Flats Fire and Grazing Interactions Study is being conducted by the nonprofit Arid Lands Project (Curtin 2005), the Animas Foundation, and The University of Arizona. The Southwestern Borderlands Ecosystem Management Project, along with the MBG, the Animas Foundation, and the Bureau of Land Management are sponsors of this research. The objective is to better understand how fire and livestock grazing can be used as management tools to sustain ecological processes, biological diversity, economically viable ranching, and to restore degraded habitats in southwestern grasslands. One component of this study examines the interactions between prairie dogs (*Cynomys ludovicianus*), livestock, and vegetation.

Dissemination of Results

Scientific information is only useful if it can be disseminated to other scientists and to managers. The Rocky Mountain Research Station through the Southwestern Borderlands Ecosystem Management Project was the main organizer and sponsor of the 1994 and 2004 Madrean Archipelago Conferences that brought together representatives of a large and diverse group of agencies, university, and conservation organizations to exchange information and to examine future activities and goals (DeBano et al. 1995, Gottfried et al. 2005). The project has also organized and supported a number of other regional and international conferences that have been discussed by DeBano and Ffolliott (2005).

The Project's scientific accomplishments in the 10 years since 1994 include a total of 175 scientific publications, theses and dissertations, conference proceedings, and GIS-based maps and reports. There also have been formal and informal tours of research sites for scientists and public and private land managers.

The Future

The Project is embarking on its second decade and will build on the established 10-year research foundation. The basic mission statement will remain the same; however, there will be a shift in specific assigned problems. Research will continue to develop an understanding of the effects of rangeland health restoration techniques, including mechanical treatments and prescribed fire, and interactions with grazing management strategies on the components of Borderlands grassland, savanna, and woodland ecosystems. This research is critical because of the need for both management and restoration guidelines to evaluate the ecological consequences of competing human demands. The second problem will attempt to increase our understanding of the effects of fire at a landscape level on ecosystem components, including soils, water, vegetation, wildlife, and cultural resources. This problem not only includes the determination of prescribed fire effects but also the ability to assess fuel conditions and predict fire behavior and effects before ignition. Monitoring the effects of land management activities is a required activity for public land managers and is desirable for private landowners; this is the third problem. Monitoring is a key component of the adaptive management process. Managers often lack appropriate and comprehensive methods for evaluating the status of Borderlands ecosystems and the impacts of their activities. Monitoring methodologies need to be integrated to encompass a wide range of biological and physical conditions and trends as well as past and future management goals. The value of monitoring data for discerning long-term changes on the land requires that they be stored in well-documented and accessible archives for scientists and managers alike.

COOPERATORS

Sound land stewardship would not be possible without cooperation among a large group of individuals and organizations. The list of private and agency partners includes: the Malpai Borderlands Group; The Animas Foundation; many individual ranchers and land owners; Coronado National Forest-Supervisor's Office and Douglas Ranger District; Natural Resources Conservation Service; US Fish and Wildlife Service-Ecological Service Division and San

Bernardino National Wildlife Refuge; Bureau of Land Management; Arizona and New Mexico Land Departments; Arizona and New Mexico Game and Fish Departments; Whitewater Draw and Hidalgo Conservation Districts, Fort Huachuca; US Border Patrol; and the Secretaria de Media Ambiente, Recursos Naturales y Pesca of Mexico. The MBG has enlisted support from local ranchers, and philanthropies and interested individuals from throughout the United States.

The Southwestern Borderlands Project could not have been successful without the cooperation and support of a large number of land managers, and their help is greatly appreciated. Most of the research is conducted by university and private scientists under joint venture agreements. The research partners include the Rocky Mountain Research Station; Agricultural Research Service; US Geological Survey Desert Laboratory; The Nature Conservancy; New Mexico Heritage Program; Audubon Society; Desert Botanical Garden; The University of Arizona School of Natural Resources; Arizona State Museum; Arizona Geological Survey; the Forest Service's Southwestern Region's Terrestrial Ecosystem Survey; Arizona State University; New Mexico State University; University of New Mexico; California State University; Indiana State University; University of Notre Dame; Oklahoma University; University of Sonora; Arid Lands Project; and Society for Ecological Restoration.

CONCLUSIONS

Stewardship refers to caring for the land and its resources to maintain healthy ecosystems for future generations (Dahms and Geils 1997). Sound land stewardship is not easy because of the interactions of science, management actions, economics, sociology, and political demands and priorities. It can be more difficult where multiple ownerships and governmental administrative entities must work and interact together. Real land stewardship is difficult, or impossible, without cooperation among all parties. Cooperative efforts are necessary since it is unusual that activities on one property will not affect the neighboring lands and because government actions can have a major impact on private decisions. The Southwestern Borderlands project area represents a place where governmental, ranching, and private parties are attempting to work together for good of the land and its resources. The Malpai Borderlands Group's activity to enhance ecosystem productivity and health benefits the land while it benefits its members. Unfragmented landscapes are becoming rarer, and efforts to reduce the wave of subdivisions are supported by many people throughout the region, both landowners and urban dwellers. Agroforestry practices can provide a basis for successful land stewardship.

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