

The Research Ranch—What Do You Do With a Grassland Besides Raise Cows?

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Abstract—For most of the past 10,000 years, semi-arid grasslands of Southeastern Arizona have not been heavily impacted by large herds of hoofed animals. This began to change in the 1500s with the introduction of domestic livestock, primarily cattle. Impacts of this major ecological force on a native system were widespread. In 1968, Frank and Ariel Appleton created an outdoor laboratory, the Research Ranch, to examine the consequences of removing that major ecological force. The Audubon Appleton-Whittell Research Ranch is an 8,000-acre enclosure and living laboratory where short-term research projects are conducted and repeated, and where long-term study sites can be established. Results of these studies are providing sound scientific information that is being used to formulate policy on regional planning and land management issues.

Perhaps the most useful role for the facility continues to be its use as a control for the many “environmental experiments” going on throughout the Southwest as the human population of the region increases. Impacts of road building, recreational usage, conversion of once open spaces to exurban home sites, and a shrinking, but usually locally valued, cattle industry can be evaluated with more insight when compared to conditions on the Research Ranch.

Introduction

The Research Ranch (TRR) was founded by the Appleton family in 1968 when they, along with partners (Arizona State Lands, U.S. Forest Service, and later Bureau of Land Management) converted their 8,000 acre cattle ranch into a foundation and removed all livestock from the premises. Their purpose was to determine the response of the land when grazing by domestic livestock ceased. The goal was and is to enable the biota and physical environmental features of the land to proceed undisturbed. TRR thus serves as a reference site, or control, for the many “environmental experiments” underway in the Southwest, such as ranching, exurbanization, and recreational use.

In 1980, with financial support from the Whittell Foundation, the National Audubon Society assumed responsibility for the site and designated TRR as an Audubon Sanctuary. The sanctuary and living laboratory remains true to the founders’ precepts: conservation of indigenous species, non-destructive ecological research, and education, especially of professional scientists and their advanced students. Scores of scientific papers and several books have been published (Dyson 2001), primarily on two major topics: monitoring changes through time on TRR, and comparative studies with nearby sites whose functions differ from those of the Sanctuary, notably agriculture and real estate development. As an independent research station, TRR accepts proposals from academics, independent researchers, and agency representatives that meet the criteria—non-destructive studies

that will help us understand and protect the environment. Land managers and policy makers have been guided by the results from these studies, further underscoring the value of TRR as a reference area.

Nestled in the Sonoita Plain of southeast Arizona, ecosystems on TRR are primarily grassland and oak savanna. Virtually all grasslands around the globe, including those being treated in this symposium, share the common influences of herbivory, fire, and drought. Many research projects on TRR have focused on one or more of these impacts.

Herbivory

Since the end of the last Ice Age there have been shifts in climatic patterns and the accompanying biota. However, there is evidence that the grassland characteristics persisted throughout the last dozen millennia (Martin 1977). Notably missing here were American bison, that excellent analog to cattle that roamed the Great Plains. Doubtless, bison wandered onto the Sonoita Plain from the grassland-mountain corridors to the east from time to time, but no fossil and historic records on the scale of those in the Great Plains have been found near the Sonoita plain (Lott 2004, Truett 1996, McDonald 1981). In the recent past at TRR and elsewhere on the Sonoita Plain, common native herbivores include white-tail and mule deer, pronghorn, collared peccaries, and a host of other, smaller herbivores, notably grasshoppers.

It is likely that cattle and horses first moved into the region in the 1500s. From the middle of the 19th century to the present, the

region became known as cattle country. Data are not available to describe all the impacts by cattle on a native environment, but certainly there were effects on plant communities and the fauna associated with those communities (Sohn and Qi 2004; Milchunas et al. 1988).

At the initiation of TRR some suggested that the grassland would degenerate into a shrub-land of dying (“decadent”) grasses due to a lack of stimulation provided by domestic grazers (Savory 1988). So far, they are wrong. An inventory of ecological sites indicates healthy plant communities (Breckenfeld and Robinett 2001). More than 500 species of vascular plant have been identified on the Sanctuary (McLaughlin et al. 2001). Although a few sites on the Research Ranch show record species richness (*ibid.*), for the most part the plant species found on the Research Ranch are the same as those found on neighboring ranches. The differences are in patterns of distribution, i.e., some species are more common on grazed versus the ungrazed lands and vice versa (Bock et al. 1984; Bock and Bock 2000). A generalization is that total cover is significantly higher on the Research Ranch (Bock and Bock 1999; Brady et al. 1989; Qi and Wallace 2002; Sohn and Qi 2004). The birds and other animals tend to sort themselves as well. Those animals preferring heavier cover for feeding and nesting are more common on the Sanctuary (Bristow and Ockenfels 2000), while those seeking grassland with less cover are found on the ranches (Bock and Bock 1999). Observations show distinctions among game species may exist as well. Pronghorn are found in both areas, but may prefer sites where grazing continues for general foraging, but seek the Research Ranch for fawning (personal observation).

Fire

Indirect evidence indicates a fire return interval of less than ten years in desert grasslands, prior to introduction of large scale grazing operations (McPherson 1995). Fires, usually consuming a few acres at most, are frequent events at TRR, often ignited by lightning preceding summer monsoons. Only two large fires have occurred on the property since 1968, when livestock were removed: one in July 1987, and the second one at the end of April 2002. Also, there have been some small controlled burns for research purposes in the 1980s. The 1987 burn of 2,000 acres was ignited on the property by lightning, and was stopped at the TRR boundary due to efforts of fire fighters and reduced vegetation cover on the neighboring cattle ranch. After three post-fire growing seasons, the pre-burn conditions were again present (Bock and Bock 2000 and references therein). In contrast, the 2002 fire was of anthropogenic origin. Known as the Ryan Wildfire, this blaze was ignited on a working cattle ranch several miles to the southwest of TRR, burned through several ranches before reaching TRR, covered approximately 90% of the Research Ranch, and continued on to other ranches to the east and northeast, finally stopping after burning nearly 39,000 acres. The effects of this fire are under current study by many researchers who are examining such topics as surface energy balance, infiltration and soil erosion, impacts on native and non-native grasses, encroachment by woody species, and summer and winter bird populations. Preliminary findings by the authors and others suggest that the effects of this fire will

be in evidence longer than three growing seasons and that its effects on vegetation, especially trees and shrubs, were much greater on the ungrazed sides than on the adjacent cattle ranches. Also, distinctive patterns in small mammals and changes in avian communities are being documented. Vegetation changes are under study and some preliminary reports are available (McLaughlin and Bowers 2004a,b).

Drought

We currently are in a prolonged period of drought in southeastern Arizona, although inter-year variation in precipitation makes such generalizations difficult. The link between drought and fire often is cited, especially in light of our growing concerns about global warming. The strongest correlation with the two large fires (1987 and 2002) that we have noted to date is not only with drought conditions, but also with heavier winter rains over a year before each fire (1985-1986 and 2000-2001, respectively) leading to a flush of herbaceous species (forbs), many of which store highly volatile oils. These unique fuels that remained from the growing seasons preceding each fire appear to have formed a heavily combustible fuel source (Bock et al. 2004). The relationship between drought and fire also has been observed at the species level. Native plains’ lovegrass (*Eragrostis intermedia*) was dying in specific places on TRR during this drought in the late 1990s—except in those places that had burned in 1987 (Bock et al. 1995). This suggests the rejuvenating power of fire, perhaps through removing accumulating standing dead grass. This, of course, might be accomplished by the presence of grazing cattle as well (Robinett and Kennedy 2004). Many workers have pointed out the rejuvenating power of grazing in the Great Plains and in Southwestern grasslands (Milchunas et al. 1998 and references therein). During times of drought, this picture is complicated by reduced primary production of plant cover.

Of all the grassland features studied by ecologists, drought likely is the most neglected. Relatively few long-term monitoring programs have been implemented, yet accurate assessments can only be based on long-term data sets. The most significant work has come from climatologists whose field fosters longer term views than the career life spans of ecologists.

The Future

The grasslands are a grossly underestimated source of well-being in the United States. The Great Plains and the Intermountain West including our own Madrean section, contain the corn and wheat belts and the North American rangelands. It never ceases to amaze us how under-valued these areas are by the citizenry at large. Some of these areas have been degraded through our lack of proper understanding of their vulnerability. Testimony to this comes from the Dust Bowl episodes, ongoing topsoil erosion, and desertification of some of our precious rangelands.

Predictions came from a conference of scientists, managers, and ranchers in 1979 when our ranching neighbor, Bill Brophy, pointed to the flaw in our meeting organization. We had not included realtors. He further noted that cattle prices

had been down for so long that ranching was less and less a sound business.

Mr. Brophy had observed some old ranches were being subdivided into smaller pieces for new owners. This process, now called exurban development, differs from the formation of suburbs because the new homes do not move outward from the heart of a city, but rather originate on open land “out in the middle of nowhere” and are unattached to an urban locale. Many big ranches remain intact in the Sonoita Plain, although in the past few decades many privately owned spreads have been subdivided into smaller lots for new owners, especially winter residents, workers who commute to Tucson, and retirees.

TRR provides a reference point (scientific control) against which other land uses in the region can be compared and contrasted. Three sorts of patterns can be studied by monitoring with cross fence and regional comparisons: (1) TRR, one was suggested, should be renamed “the unranch,” (2) the remaining big cattle ranches, and (3) the emerging exurban sites. A current study is comparing and contrasting the biodiversity of these three settings. It is beyond the space provided here to give preliminary findings. However, we know there are surprises in store. All three areas tell an important part of the story of our rich flora and fauna.

The full value of the Research Ranch as an un-manipulated place for comparison with other land uses is yet to be realized. However, its findings to date have been propagated widely from the scientific community to others including exurbanites, ranchers, politicians, and community planners. And this value and role will increase as its promise of being “left alone” continues into the decades and centuries to come. It has been pointed out to us that the National Park system has a clear directive to maintain “natural” ecosystems, the position we are championing. But they, unlike the managers of TRR, must contend with enormous and increasing impacts from the presence of millions of tourists and other recreationists.

Our greatest concern is that the findings obtained from the Sonoita Plain here on this 8,000 acre set-aside will be unaccompanied by other sites in American grasslands and savannas. In 1993 there were 212 million acres of Federal land being used for grazing by domestic stock. Most of this land is in the care of the U.S. Forest Service and the Bureau of Land Management. Some few places among these holdings have been set aside as reference points with their functions similar to those of the Appleton Ranch. However, most of these exclosures are much smaller than 8,000 acres (Turner et al. 1980). Similarly, the agencies often are too short-handed to maintain, let alone monitor, their exclosures. Long-term monitoring of such set-asides is essential. Similarly, monitoring is not popular with academics because it is anathema to those places where we seek most of our research funding. Short-term studies of an experimental nature are built into the academy for ecological researchers—publish quickly and often—or perish. The record for significant control areas appears to be even weaker for non-governmental organizations’ (NGOs) lands. These conservation groups appear often to be loathe to set aside reference lands within their holdings. We are urging here that that both the USFS and the BLM along with the NGOs should make

appropriately large exclosures a high priority. We will reiterate a challenge that was greeted with a serious lack of enthusiasm when it was first presented (Bock et al. 1993). Perhaps we will have better success now.

If even 5% of such public and private holdings were made into reference points where manipulative activities such as agriculture, tourism, and recreation were curtailed and long-term monitoring established, rewards would start immediately and be increasingly revealed with each passing decade. The rewards would result from acknowledgment of what nature can do without human interference. This sort of information is essential to sound resting, rest-restoration, and rest-rotation management strategies. Further, the reference lands contain gene banks of indigenous species that will be essential to agricultural well-being in the ongoing climatic shifts. Also, these will be water preserves, and most knowledgeable Westerners agree that water or the lack thereof defines our future. At first glance, doing nothing but watching (monitoring) how nature works on its own without human interference may appear to be un-American because we are definitely a nation of doers! But careful consideration can convince that this is one of the most active and least implemented actions we can undertake. There is an urgency to our having more reference areas set aside for the multitude of environmental experiments we carry out. Many, if not most, of these are informed by incomplete knowledge. As we Americans enter a period of climatic change, such knowledge may facilitate our maintaining these precious grassland and savanna ecosystems.

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