PROJECT REPORT

# Reintroducing Prairie Dogs into Desert Grasslands

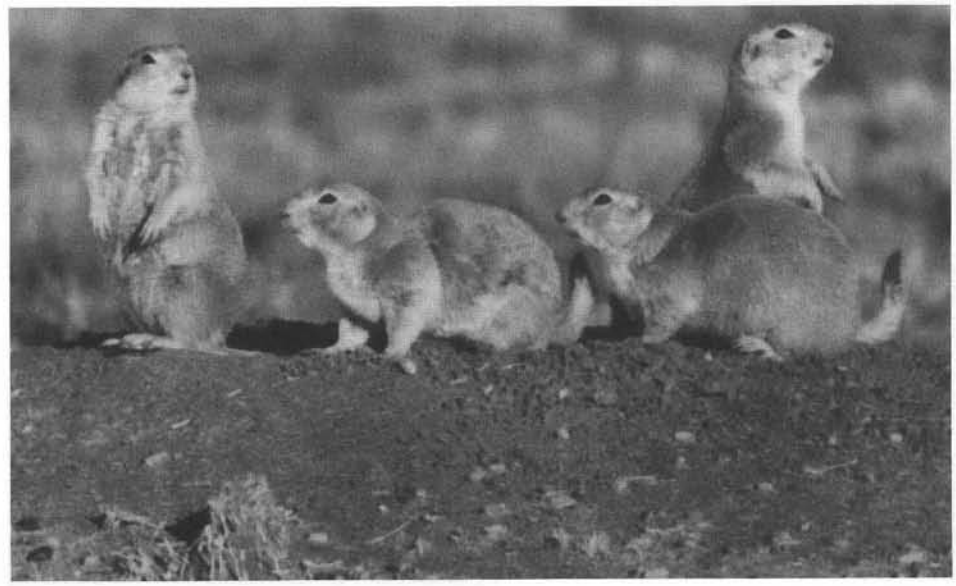
by Joe C. Truett and Tom Savage

Reestablishment is proving to be the key to revitalization of the whole ecosystem on two sites in New Mexico.

Prairie dogs (*Cynomys* spp.) historically occupied much of the short-grass regions of the Great Plains and Rocky Mountain West from Canada to Mexico (Hall, 1981:412-415). Early naturalists found that prairie dogs were a conspicuous part of the grassland biota, some estimating them to number into the billions (Foster and Hygnstrom, undated). But during the last hundred years they have declined to a small fraction of their original abundance because of poisoning programs and later from infection with the introduced bacterium *Yersinia pestis*, which causes sylvatic plague (Miller et al., 1994).

Early travelers and settlers encountered the black-tailed prairie dog (*C. ludovicianus*), the most abundant and widespread of the four species found in the United States, over much of the shortgrass region of the Great Plains and southwestern deserts (Fig. 1). It symbolized early western grasslands as prominently as bison (*Bison bison*) or pronghorn antelope (*Antilocapra americana*). But by 1990, this once-common animal had dwindled to a remnant of its original numbers (Miller et al., 1994).

Current interest in the recovery of prairie dogs matches, in intensity if not in general popularity, that of the early ranchers and government agents in eradicating them. Two recent collections of papers (Clark et al., 1989; Oldemeyer et al., 1993), both assembled by agency effort, and a technical book (Hoogland, 1995) at-



**Like bison, prairie dogs are an emblem of the North American prairies—and subject of increasing efforts to reestablish and restore dwindling populations. Shown here are black-tailed prairie dogs the authors and their colleagues reintroduced to a former prairie dog town on the Armendaris Ranch in southern New Mexico. The team found that prairie dogs prefer sites with old burrow complexes, which they quickly reoccupy and restore.** *Photo by Joe. C. Truett*


**Figure 1. Shaded area indicates range of black-tailed prairie dogs in early historic times, with area in southern Arizona and New Mexico where the animals have been extirpated in recent years indicated by diagonal lines. The dashed line indicates the boundary between the nominate subspecies *Cynomys ludovicianus ludovicianus* and the subspecies *C.l. arizonensis* that was subject of the reintroduction efforts. Dark squares indicate transplant locations.**

test to the current scientific interest in conserving prairie dogs. A reintroduction program for the Utah prairie dog (*C. parvidens*) has been ongoing since 1972 (Coffeen and Pederson, 1993). The function of black-tails and other prairie dogs as keystone species modifying habitats to the benefit of numerous other species (Whicker and Detling, 1988; Miller et al., 1994) has added to the interest in their recovery.

Because black-tailed prairie dogs have been eliminated over major portions of their original range, population recovery will be slow unless aided by reintroduction efforts. Published accounts of transplant methodologies for black-tailed (Kohn, 1979; Lewis et al., 1979) and other prairie dogs (Coffeen and Pederson, 1993) remain few. Perhaps more importantly, the ecological consequences of reintroductions seldom have been documented.

In this paper we describe a recovery project aimed at reestablishing black-tailed prairie dogs in desert grasslands of southwestern New Mexico. We applied conservation and restoration theory to accomplish the relatively uncommon end that Michael Morrison (1995) calls "the work of restoration." Although we focused mainly on reestablishing prairie dogs rather than on testing methodologies, we nonetheless gained useful insight into appropriate methods for, and the ecological consequences of, reestablishment. Partly by design and partly by taking advantage of opportunities as they came along, we made enough observations to develop working hypotheses about (1) enhancement of immediate survival and short-term productivity of transplanted animals, (2) management of transplanted populations to control dispersal and growth, and (3) some of the ecological consequences of prairie dog reestablishment in southwestern grasslands.

## Background

Early this century, millions of black-tailed prairie dogs inhabited desert grasslands in southeastern Arizona and southwestern New Mexico (Bailey, 1931:124). Some taxonomists (see, for example, Hall, 1981: 412) have recognized this southwestern form as the only subspecies (*Cynomys ludovicianus* ssp. *arizonensis*) distinct from the nominate form (Fig. 1). By the early 1980s, this subspecies was extinct in Arizona and west of the Rio Grande River in New Mexico (Hubbard and Schmitt, 1984), and scarce elsewhere in the United States.

In 1994, Tom Waddell, the manager of the Armendaris Ranch near Truth or Consequences in southwestern New Mexico, requested the senior author to devise a plan to reestablish black-tailed prairie dogs in locations on the ranch where they previously had existed. Ultimately the reintroduction program expanded to include sites on the Ladder Ranch, about 30 miles southwest of the Armendaris. Both these ranches are owned by media executive R.E. Turner, who manages his ranches to recover some of the rangeland biodiversity lost because of past management practices. In the following sections we describe the program, which commenced on the Armendaris Ranch in spring 1995, and on the Ladder Ranch in spring 1997.

## Methods

We sought New Mexico sources of *C. l. arizonensis* by interviewing regional taxo-

nomic authorities, natural historians, prairie dog researchers, and personnel at the U.S. Bureau of Land Management in Las Cruces and the U.S. Army on White Sands Missile Range. We then checked out reported colonies on the ground and by helicopter to check the status of known colonies and to evaluate rumors of additional ones.

We selected two release sites on each ranch in areas historically inhabited by prairie dogs. We located sites on the Armendaris Ranch by relying on the memory of a long-time resident, by matching terrain features with those in the source colony, and by locating collapsed burrow systems built by long-extinct populations. At the Ladder Ranch, Claudia Oakes, a biologist who is researching historical distributions of prairie-dog colonies, and Steve Dobrott, the ranch manager, found old burrow sites. All release sites were in valley bottoms with deep soils, and supported lightly-grazed stands of tobosagrass (*Hilaria mutica*), alklali sacaton (*Sporobolus airoides*), burrograss (*Scleropopon brevifolius*), and other native perennial grasses.

In preparing release sites we relied in part on reports by others (Kohn 1979; Lewis et al., 1979; Coffeen and Pederson, 1993). We built 0.4-hectare (1-acre) holding pens with 3-foot, 1-inch-mesh chicken wire, reinforced with a chicken-wire footing inside the fence and a 12-volt electric-fence wire 10 centimeters (4 inches) above ground level inside and outside. We initially mowed the grass inside the pens to a height of about a 6-centimeters (2.5-inches).

Within each release pen, where entrances to collapsed burrows were still evident, we enlarged the openings with a hand trowel or trenching shovel. At one release pen on the Armendaris Ranch, we used a 15-centimeter (6-inch) auger to make artificial burrows about 1 meter (3 feet) deep and angled at 45° into the ground. In all pens we set up automatic waterers regulated by float-valves.

We trapped prairie dogs at the source colonies with No. 202 48x15x15-centimeter (19x6x6-inch) Tomahawk collapsible, single-door traps placed near active burrows as described by Coffeen and Pederson (1993). We placed the traps, wired them open, and baited them for two or three days before trapping began. This conditioned the animals to the traps, enhancing the per-day trapping success and reducing holding times for captives. Horse sweet feed—a mixture of crushed corn, oats, barley, and molasses—proved an effective and readily-obtainable bait. We dusted trapped animals with Sevin insecticide to kill fleas, as recommended by Coffeen and Pederson (1993). Then we placed each trap and its occupant in a ventilated, custom-made wooden cabinet constructed to fit under a pickup (for shade during daytime) and inside its bed (for transport). The cabinets moderated the temperatures to which the animals were exposed and kept the animals calm by restricting their ability to see movements of humans and other prairie dogs. During the one or two days that the animals remained in these cabinets, we offered them dry food (alfalfa pellets and cavy pellets) and wet food (cabbage and carrots). Some ate various combinations of this food; others did not eat.

We transported animals in a covered pick-up bed during cool periods of the day and released them early in the morning. To release animals, we placed traps with opened doors within 0.2 meters (8 inches) of and facing burrow entrances. Following release of animals, we monitored them periodically each day for the first few days, then more sporadically thereafter. Usually an observer with binoculars and a spotting scope watched from 50-200 m away. We usually stocked the feeders (metal dog-food dispensers) with commercially-available cavy pellets or rabbit pellets (which are less expensive), but the animals readily ate a wide variety of food ranging from alfalfa pellets to several brands of dry dog food.

On the Armendaris Ranch, we made comparisons of several kinds in conjunction with the releases and subsequent monitoring of the animals. In the pen with augered holes, we compared their acceptance of bored holes with acceptance of old, collapsed prairie-dog burrows. In the same pen, within a few weeks of the initial release, we provided hatches (openings) at the base of the perimeter fence to allow animals to escape. We did not provide escape hatches in the other pen. We fed animals in one pen throughout the first year; those in the other pen we fed only during the first few months. Four animals that escaped through the hatches soon formed a

**Chicken-wire fencing with buried footing and a 12-volt electric-fencing wire near bottom effectively contained reintroduced populations, slowing dispersal and protecting populations from predation during the first several months of residence. The box is a passively-ventilated cabinet designed to minimize stress on animals during holding and transportation.** *Photo by Tom Savage*

small satellite colony about 0.6 kilometers (0.4 miles) away. This colony received no supplementary food or water during the first year.

Circumstances differed between ranches, allowing additional comparisons. On the Armendaris Ranch, animals that had been trapped in widely-separated burrow systems (and so were unfamiliar with each other) were released into the same pen, but on the Ladder Ranch we avoided mixing animals from different sites, hoping to maintain a measure of social solidarity. As it happened, a severe drought prevailed on the Armendaris Ranch prior to and during the year following the releases, but the Ladder Ranch had better-than-average precipitation for several months before and after the release period, and this also allowed us to make some useful comparisons.

## Behavior, Survival, and Productivity of Transplants

We obtained prairie dogs from two sources in the historic range of *C. l. arizonensis* in New Mexico—the Malpais colony near Carrizozo and the MacGregor Range colonies north of El Paso, Texas. We transplanted animals from the Malpais colony to the Armendaris Ranch between June and September 1995 and animals from the MacGregor Range colonies to the Ladder Ranch in late June 1997.

We released more than twice as many animals on the Armendaris Ranch as we released on the Ladder Ranch. The source colony for the Armendaris releases was sufficiently large that we trapped 71 animals, releasing approximately half in each pen; because the population available for the translocation to Ladder Ranch was much smaller, we took only 30 animals there. The ratios of male:female:young-of-year animals was about 1:2:3 for each release site on each ranch.

Transplants preferred collapsed burrow systems to the holes we augered, despite the apparent effort often required by the animals to enlarge the collapsed tunnels. Animals released into the augered holes typically quit these holes within a few minutes; those released into old burrows stayed there initially for tens of minutes to hours, sometimes digging vigorously and long to get beyond a foot or so into the burrow. Even when we enclosed the entrances to the augered holes with bottomless mesh-wire cages so as to contain the released animals, the animals soon escaped by digging under the cage edges, or left when we removed the cages two or three days later. We suspect that animals abandoned augured holes at least partly because they could easily see out of the straight-bore configuration.

Approximately half the animals in the Armendaris pen with escape hatches moved outside soon after the hatches were opened. We closed the hatches after about two weeks, and sign indicated that a few of the escapees subsequently tried to re-enter. A month after hatch closure, we found four of the escapees together when we made a routine survey for survivors; they had moved 0.6 kilometers (0.4 miles) down the valley, enlarged some old abandoned burrows, dug some new ones, and established themselves. This satellite colony (the "Ishmaelites") has been in that location ever since. We failed to find other survivors among the escapees, and presume that all of them died.

The prairie dogs in the Armendaris pen that we provided with ample food reproduced the first spring (1996) after their release, approximately doubling their number. Those in the pen not so heavily subsidized did not reproduce, nor did the prairie dogs in the Ishmaelite colony, which we did not feed prior to the summer of 1996. It may be that the Ishmaelites failed to reproduce the first year because of poor nutrition or partly or wholly because of their ages—most or all could have been one-year-olds, which seldom reproduce. The extreme drought conditions during the entire year following the Armendaris reintroductions (less than 5 centimeters [2 inches]) precipitation compared with an annual average of about 20 centimeters (8 inches) probably adversely affected reproduction, especially among the unsubsidized animals.

**Like comb-foundation in beekeeping, degraded burrows at historic prairie dog towns are quickly reoccupied by reintroduced animals and encourage them to establish residence.** *Photo by Tom Savage*

Interestingly, animals released on the Ladder Ranch proved less inclined to disperse than those released on the Armendaris Ranch. Animals in both the Ladder Ranch release pens found routes to the outside within two days by way of old burrows that by-passed the fence below its footing. Thereafter, several animals from each pen made exploratory forays up to 300 meters (270 yards) away from the pens. But although the Ladder Ranch transplants bypassed the fences sooner than did the Armendaris transplants, most returned within a few hours or days, entering by the same routes they had used to escape.

Several factors may have en-

couraged the Ladder Ranch transplants to stay put. Two animals observed returning to the pens after an outside foray went directly to the feeders and ate for several minutes, suggesting that the food subsidy may have been a factor. This possibility is reinforced by the existence of greener forage inside the pens, because of prior burning and (in one pen) supplemental watering of the grass. Another factor may have been the social coherence maintained at the Ladder Ranch where we had avoided mixing animals from different capture localities. As evidence of this coherence, Ladder Ranch animals inside the pens often met at the fence with animals that had escaped to the outside. Finally, the height and density of vegetation surrounding the Ladder Ranch release sites appeared to us somewhat greater than at the Armendaris Ranch sites, and this may have discouraged emigration from the site.

The Ishmaelites at the Armendaris Ranch may have hibernated for a period during their first winter on the site. When we checked the area late that winter and early in the spring we found no signs of prairie-dog activity. Wind-blown plant parts and spider webs choked burrow entrances. We found no fresh signs of digging for grass roots, though such signs had been evident the preceding fall and were evident at the other release sites all winter and spring. During this late-winter/early-spring period we never saw the Ishmaelites during visits, but always saw animals at the other sites. We assumed the Ishmaelites had died. However, in mid-spring three of the animals reappeared. Whether we were observing evidence of hibernation in a species not commonly believed to hibernate (Hoogland, 1995) is unclear, but the severe drought may have induced at least an extended period of inactivity.

Animals at all three sites on the Armendaris Ranch reproduced during their second spring (1997). Those associated with each of the two pens approximately doubled in number between early spring and early summer. (The population that had reproduced the previous spring had declined during winter to little more than its previous size.) The three adults at the Ishmaelite colony produced at least 14 young, the large increase presumably reflecting in part the influence of the food subsidy we provided during winter 1996-97 coupled with the abundant supply of natural food in the winter and spring of 1997.

**Burrowing owls, long since absent from reintroduction sites, reoccupied them within months after reintroduction of prairie dogs, exemplifying recovery of the ecosystem as a result of reestablishment of this one keystone species. Other effects on the desert grassland ecosystem evident within two years after reintroduction include dramatic changes in vegetation and seasonally selective use of the reintroduction sites by pronghorn antelope, ornate box turtles, and several bird species.** *Photo by Joe C. Truett*

Observations of animal movements, of signs of digging, and of droppings all showed that the Armendaris animals seldom if ever ventured into the tall (about 50 centimeters, or 20 inches) grass after the first few months. We removed the perimeter fence at one pen a year following the transplant; the prairie dogs breached the fence at the other pen within two months of the transplant, and the Ishmaelite colony never had a fence. But expansion at all of these colonies occurred only in areas with relatively good visibility at prairie-dog height (about 20-25 centimeters, or 8-10 inches). When we mowed areas peripheral to the colonies in early summer 1997, animals quickly moved into new-mowed areas to feed and excavate burrows. Observations by others (Smith, 1967; Knowles, 1986) likewise suggest that black-tailed prairie dogs avoid dense vegetation in favor of places with good horizontal visibility at prairie-dog height. Our observations also agree with those of others (Whicker and Detling, 1988; Hoogland, 1995:100) that, once prairie dogs invade an area, they maintain the low stature of the vegetation by clipping.

Circumstantial evidence indicated that the perimeter fences reduced the risk of predation of prairie dogs during the first several months. During this period the animals were especially vulnerable because they had excavated few deep burrows. Distribution of sign (tracks and droppings) indicated that coyotes were present at all release sites, but that they did not get inside the pens for several months following releases. Badgers left sign immediately outside one pen but never inside. At the Ladder Ranch, one adult male prairie dog was killed (but not consumed) by a diamondback rattlesnake (*Crotalus atrox*), which we removed. Subsequently two larger diamond-backs (about 100-centimeters [40-inches] and 130-centimeters [50-inches] long) were found dead at the fence, apparently having been electrocuted by the electric wire while attempting to exit.

## Responses of Other Biota

The reintroduction of prairie dogs affected plants and other animals, sometimes dramatically. Changes to date show most

clearly at the Armendaris sites, where introduced colonies have existed for two years longer than at the Ladder Ranch. The most highly visible changes are in the composition and stature of the vegetation and in the use of the colonies by other animals.

The introduced prairie dogs clipped and uprooted vegetation, changing in the process its abundance and composition in ways generally similar to those reported by others (Klatt and Hein, 1978; Kroeger, 1986; Whicker and Detling, 1988, 1993). On the Armendaris Ranch, perennial grasses we initially mowed never regained the height or cover they originally had, and during the two years following the introduction, forbs increased in abundance relative to grasses. During dry periods, the animals appreciably reduced the cover of perennial grasses, particularly tobosa grass and especially near heavily-used burrows, by digging up and feeding on the grass roots. At the same time, the grazing lengthened the season of greenness of the grass that survived, mainly by promoting earlier green-up following rains and in spring.

The most dramatic response by other animals was the colonization of the Armendaris release sites by burrowing owls (*Speotyto cunicularia*). Burrowing owls probably existed on the sites historically, but did not occupy them at the time of our release of prairie dogs, and we saw no breeding burrowing owls elsewhere on the ranch at any time during many hours of reconnaissance in 1996 and 1997. The first spring and summer (1996) following the prairie dog introductions, burrowing owls (one pair per site) colonized and successfully raised young at each of the three sites. The second spring and summer (1997) the owls increased in abundance: two broods were reared at the Ishmaelite colony, two at one pen site, and three at the other pen site. Thus during the second spring after the reintroduction, seven breeding pairs reared young in the slightly more than one hectare (2.5 acres) of prairie dog town available. Some owls overwintered at each site.

Periodic observations suggested that several other species also used the newly established colonies in preference to adjacent areas without prairie dogs. Pronghorn antelope, mourning doves (*Zenaidura macroura*), horned larks (*Eremophila alpestris*), and western kingbirds (*Tyrannus verticalis*) seemed to prefer release sites for feeding during some seasons, and we found ornate box turtles (*Terrapene ornata*) resting in the shade of burrow entrances on hot summer days. Closer observation would probably have disclosed other species attracted to the sites, since prairie-dog towns are known to benefit numerous vertebrates (Reading et al., 1989).

## Management Implications

Observations made during this reintroduction effort indicate:

1. Managers can reduce immediate dispersal and increase the initial survival of transplanted prairie dogs by taking one or more of the following actions: (a) obtaining animals from as small an area as possible in the source colony, (b) providing a nutritional supplement during the first few months at the release site, (c) holding released animals within, and excluding predators from, suitably-sized pens for the first year, or until the prairie dogs have excavated extensive burrow systems, and (d) siting releases where pre-existing burrows indicate suitable habitat and can provide a start for burrow excavation.
2. Because animals are reluctant to move into thick, tall grass at the periphery of colonies, expansion of the colonies after removal of perimeter fences can be rather precisely controlled where grasses are a foot or more high by managing grass height in surrounding areas.
3. Management for a rapidly-expanding colony calls for two actions: (a) mowing or burning tall grasses at the colony periphery to provide new acreage for the expanding population to colonize and, (b) providing supplemental food to promote reproduction. Mowing or burning is required if the grass is tall and thick; supplemental feeding is not necessary but will almost certainly accelerate population growth and colony expansion.
4. Reestablishment of prairie dogs can be used to create or enhance habitat for burrowing owls and some other species.

Observations at our release sites suggest that burrowing owl populations on the Armendaris Ranch may be severely limited by the scarcity of suitable burrows. This population-limiting mechanism for burrowing owls may be operative as well in other areas and for some other species that use prairie dog burrows, and it may be offset by reintroducing prairie dogs.

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