

WILDLIFE MITIGATION TECHNIQUES AT SURFACE COAL MINES IN NORTHEAST WYOMING¹

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Abstract. Wildlife issues at surface coal mines in the Powder River Basin of northeast Wyoming have been a topic of discussion since operations first began in the early 1970s. Since then, wildlife monitoring and mitigation programs have evolved to address changing concerns, and incorporate new information and techniques. Over the last 26 years, biologists with Thunderbird – Jones & Stokes (J&S) have developed, enhanced, and/or implemented mitigation measures for numerous avian species of concern, including nesting raptors and mountain plovers (*Charadrius montanus*). The appropriate use of mitigation techniques has yielded proven methods to minimize conflicts between nesting raptors and surface coal mine operations, and thus reduced the potential for work stoppages. By February 2006, J&S had relocated (both active and inactive nests) or created more than 100 nests for seven different raptor species. Nesting raptors used 65% of the previously active nests after mitigation measures were implemented, and 22% of previously inactive nests. The establishment of mitigation programs for other avian species of concern has also benefited companies willing to experiment with innovative reclamation techniques for wildlife habitat. One coal mine supported a unique effort to reestablish mountain plover habitat by translocating black-tailed prairie dogs (*Cynomys ludovicianus*) into man-made colonies in reclamation. Although mountain plovers have not yet been documented in those colonies, the prairie dogs have expanded the original boundaries and maintained the low, sparse vegetation characteristic of mountain plover nesting habitat.

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Introduction

Surface coal mines have been present in the Powder River Basin (PRB) of northeast Wyoming since the early 1970s. Fourteen mines currently operate in that region, with another mine proposed to open within the next 1-2 years. Together, the coal mines in the PRB provide more than one-third of the nation's coal, with several properties planning to expand their leases in the immediate future to address the nation's growing demand for energy resources.

As in other regions, the surface mines in the PRB are governed by numerous state and federal regulations that direct every aspect of their operations. Among those directives are requirements for wildlife inventories and annual monitoring prior to, and during, active mining. In addition to those efforts, each mine must also have an Avian Monitoring and Mitigation Plan that is approved by the U.S. Fish and Wildlife Service (USFWS) prior to initiating disturbance activities near active nest sites or within important nesting habitats.

Over the last 26 years, biologists with Thunderbird – Jones & Stokes (J&S) have developed, modified, and/or implemented monitoring and mitigation measures for numerous avian species of concern at most of the surface coal mines in the PRB. Those efforts have been greatly enhanced over the years through information gleaned from a combination of required and voluntary long-term monitoring programs for those species. The ability to observe nesting pairs over many years has provided our biologists with an understanding of individual home range and habitat needs, tolerance for other species, and the ability of birds to acclimatize to regular human disturbance. Each of those components is invaluable when preparing required mitigation plans for agency review and approval and for the successful planning and implementation of mitigation activities once they are authorized.

Objectives

Raptor mitigation efforts are implemented for a variety of reasons, depending on the goal of the effort:

- Inactive nests relocated to maintain the resource;
- Inactive nests relocated to maintain alternate nests within an active territory;
- Active nests strategically relocated to encourage continued use;
- Artificial nest platforms and snags erected to create new or alternate nesting opportunities.

In all cases, the primary goal is to maintain a given pair within its normal home range despite disturbance or destruction of traditional nest sites (Postovit and Postovit, 1987).

The mountain plover was proposed for federal listing as a threatened species under the Endangered Species Act in 1999. The USFWS removed this species from the listing process in fall 2003 as not warranted for listing. However, mountain plovers continue to be protected by the Migratory Bird Treaty Act. The Antelope Mine in the southern PRB is the only surface mine in that region known to regularly support nesting mountain plovers; nesting pairs have been monitored there annually since 1982. In 2002, the USFWS agreed that the Antelope Mine would restore at least 395 ha of mountain plover habitat to mitigate the loss of such habitat to mining that occurred there from 1982 through 2003, which was the end of the mine's term of permit at the time of the agreement. Rigorous observations over a period of more than 20 years have

documented that mountain plovers in the vicinity of the mine have consistently been most common in black-tailed prairie dog colonies located on and near the permit area. In 2000, the Antelope Mine proactively initiated an innovative pilot program to establish prairie dogs in reclaimed lands to recreate mountain plover habitat. That effort was enhanced in 2002 and 2003 to include the construction of artificial colonies in reclamation to support translocated prairie dogs, with the purpose of creating mountain plover habitat per the 2002 agreement with the USFWS.

Sharing the methods and results, both positive and negative, from these mitigation efforts among a wide variety of operators can facilitate energy development while still providing options for maintaining viable wildlife populations that will persist beyond the life of the mineral and gas reserves in their respective regions.

Methods

Raptors

The most common wildlife mitigation measure employed in the PRB entails relocating raptor nests prior to the advance of surface mine operations. When possible, nests are moved within a territory during the non-breeding season to minimize stress to nesting raptors, and to reduce the risk of nest abandonment or injury to eggs or young. Active nests are relocated when unexpected circumstances require immediate action, or when it is deemed necessary to train a given pair to nest in a new area farther from existing or potential disturbance. Methods for relocating active and inactive raptor nests were first developed for golden eagles (*Aquila chrysaetos*) at surface coal mines in the PRB, as described in several publications (Postovit et al., 1982a, 1982b; Phillips and Beske, 1984; Postovit and Postovit, 1987). Variations of that technique have also been applied to other raptor species throughout the PRB (McKee, 2006) and elsewhere in the general region (Schwarzkoeph, 1980; Stalmaster et al., 1984; Fala et al. 1985). New nest sites for both active and inactive relocations are typically designed to be within view of previous locations to facilitate use after the nests are moved. However, they may eventually be placed beyond that initial boundary through subsequent incremental moves, if necessary. Nest relocations can vary from a matter of meters to more than 1.5 km at a time, depending on the status (active, inactive) of the nest, purpose of the move, terrain in the nest area (i.e., line-of-sight visibility between locations), and known history of a given pair's home range. All relocations are conducted under the authorization of applicable state and federal permits.

Mountain Plovers

The mountain plover habitat restoration project involved translocating black-tailed prairie dogs from various colonies on or near the Antelope Mine permit area. While translocations have been used in the past to restore prairie dog populations in their historical range, and as a tool in black-footed ferret (*Mustela nigripes*) reintroduction programs, the Antelope Mine was the first industrial company to our knowledge to use this technique as a means to restore sensitive wildlife habitat impacted during the course of energy extraction.

The source colonies for the project were selected primarily based on their proximity to the mine and their potential contribution to genetic variability in the relocated populations. Two reclaimed areas were chosen as release sites in 2002, with two additional locations added in 2003. The release sites were selected based on topography, vegetative structure and composition, proximity to historic mountain plover sightings, proximity to each other, future

potential to attract mountain plovers, and accessibility to the public for use as educational exhibits. Prior to site preparations, biologists reviewed pertinent literature (Hoogland, 1995; Robinette et al. 1995; Truett et al., 2001) and contacted individuals with previous translocation experience to determine which capture and release techniques appeared to be best suited for the circumstances at the mine. Those techniques were further modified in 2003 based on results from the 2002 efforts at the mine. As these methods have not yet been published in readily accessible journals, more specific details for this project are presented here.

Preliminary work for the prairie dog project consisted of several activities each year. All sites were mowed prior to construction to simulate vegetative conditions at the source colonies (Fig. 1a). Burrow tunnels and chambers were excavated with a gas powered hand auger, trencher, and hand tools (Fig. 1b). A total of 70 burrow chambers were constructed in four colonies in reclamation over the two years. The mitigation colonies ranged in size from approximately 2.5-10 ha, for a total of 25 non-contiguous ha.



Figure 1b. Excavating burrows in an artificial prairie dog colony in reclamation at the Antelope Mine.

The chambers ranged in size from 31 x 31 x 31 cm, to 61 x 61 x 46 cm. Four to six chambers in each relocation site were lined with either chicken wire or a wooden box (Fig. 1c) to

prevent the prairie dogs from escaping prematurely. The remaining chambers consisted of a wooden lid set on four stakes to keep the hole from caving in when it was reburied. Those sites were left unlined in the hope that prairie dogs would use them as starter chambers once they were released from their containment cages. All chamber floors were lined with grass to serve as bedding material, and connected to the surface with either one or two lengths of 1.5-1.8 m x 10 cm diameter corrugated tubing, depending on chamber size. The tubing was arranged to provide a horizontal turn of about 45 degrees between the surface and the chamber bottom, to simulate natural burrow construction.



Figure 1c. Tube tunnel connecting box-lined chamber to surface in artificial prairie dog colony in reclamation at the Antelope Mine.

Once completed, all chambers and tubing were reburied, with dirt mounded over the chamber and at the tunnel entrance to simulate the look of a natural burrow. A cage measuring 92 x 92 x 46 cm was placed over the top of the tunnel entrances of the 4-6 secure release chambers at each site. The cages were constructed out of 5 x 10 cm woven wire overlaid with chicken wire on all sides to prevent released prairie dogs from escaping through the mesh. The tubing was pulled into the cage through a hole in its floor to further minimize the potential for escapes. Dirt was then spread over the cage floor to prevent injury to animals' feet or teeth, and cages were supplied with food and at least one water bottle. A blanket of woven wire (5 x 10 cm mesh) was also secured over the top of the lined release chambers to prevent predators from digging into them.

Trapping was conducted during June and July in 2002, and July, August, and September in 2003. Forty to 70 live-traps (Havahart[®] and Tomahawk[®]) measuring 19 x 19 x 51-61 cm were distributed in each source prairie dog colony (Fig. 2a). Traps were either grouped at burrows in clusters of 2-8 or laid out in parallel transects of 8-10 traps each. During 2002, traps were baited with rolled oats and tied open for two days to allow the animals to acclimate to their presence in the colony. Peanut butter was also used later in the season. Those pre-trapping efforts proved to be unnecessary and were eliminated in 2003. On trapping days, the traps were set and baited just before dawn, then left open until mid- to late morning; traps were open all day during the cooler

weather of September 2003. At the end of each session, traps were either tied open or tripped shut to prevent accidental captures and mortalities due to heat stress.

Captured prairie dogs were relocated to a release site (Fig. 2b), with placement dependent on their age, sex, family relationship to other translocated animals, and source colony. A few of the prairie dogs captured in 2003 were free-released into existing burrows to supplement colonies created in 2002, but most were placed in the 2003 release cages in groups of 1-5. Prairie dogs were kept in the cages for a period of 4-7 days (Fig. 2c), depending on their age and whether or not unconfined dogs were present in the colony. All confined animals were fed and watered daily. Artificial colonies were monitored daily during the initial capture/release phase to determine retention rates after release. Rations continued to be provided periodically throughout the winter to encourage the prairie dogs to remain in the colonies and maximize survival rates.



Figure 2a. Trapping prairie dogs at source colony



Figure 2b. Transferring prairie dogs to within the Antelope Mine permit area artificial colony in reclamation at the Antelope Mine.



Figure 2c. Prairie dog in acclimation cage with wire blanket over tunnel & chamber in an artificial colony in reclamation at the Antelope Mine.

Results

Raptors

By February 2006, J&S had relocated (both active and inactive nests) or created more than 100 nests for seven raptor species (Fig. 3). Most nest relocations occur during the non-breeding season to avoid negative impacts, but sometimes it is necessary to move active nests. Relocation distances have ranged from a few meters to more than 1.5 km, depending on the species involved, the size and configuration of the home range, and whether or not visual barriers are present between the current and future nest sites.

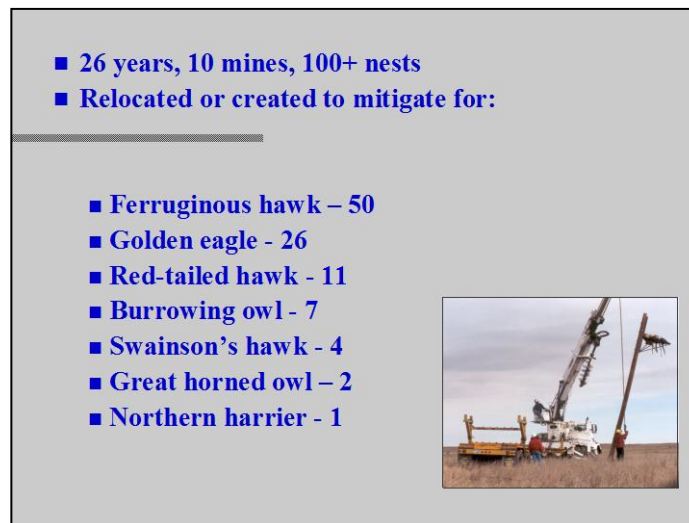


Figure 3. Number of raptor nests relocated or created for mitigation at surface coal mines in northeast Wyoming through 2006.

Techniques for relocating raptor nests are similar across species, but do require modification from time to time. For example, Swainson's hawks (*Buteo swainsoni*) do not appear to accept artificial nest platforms as readily as other species. However, moving the actual nest tree has proven to be very successful over the years (Fig. 4a-4b). Similarly, techniques commonly used on tree nesting species have successfully been applied to ground nesting birds such as northern harriers (*Circus cyaneus*) (Fig. 5a-5c).



Figure 4a. Relocating an inactive Swainson's hawk nest tree at a surface coal mine in northeast Wyoming.



Figure 4b. Relocated Swainson's hawk nest tree at a surface coal mine in Northeast Wyoming.



Figure 5a. Northern harrier nest sites at base of overburden highwall at a surface coal mine in Wyoming.



Figure 5b. Relocating an active northern harrier ground nest at a surface coal mine in Wyoming.



Figure 5c. Relocating an active northern harrier ground nest at a surface coal northeast mine in northeast Wyoming.

Mitigating raptor nests by relocating them is often preferable to simply removing the nest, particularly if the removal occurs during the non-breeding season. For example, birds that successfully nest in a given location are more inclined to return to that site the following year, even if the nest has been removed during the interim. Should the nest site be in a potential area of conflict with mine activities, operators risk delays due to work stoppages to accommodate rebuilt, active nests? By moving a nest to a new location within a pair's territory, rather than simply removing the nest altogether, nesting efforts can be directed to areas where conflicts can be minimized or avoided. Over the last 26 years, nesting raptors used at least 65% of the previously active nests after mitigation measures were implemented, whereas they used only 22% of previously inactive nests (Fig. 6) after they were moved.

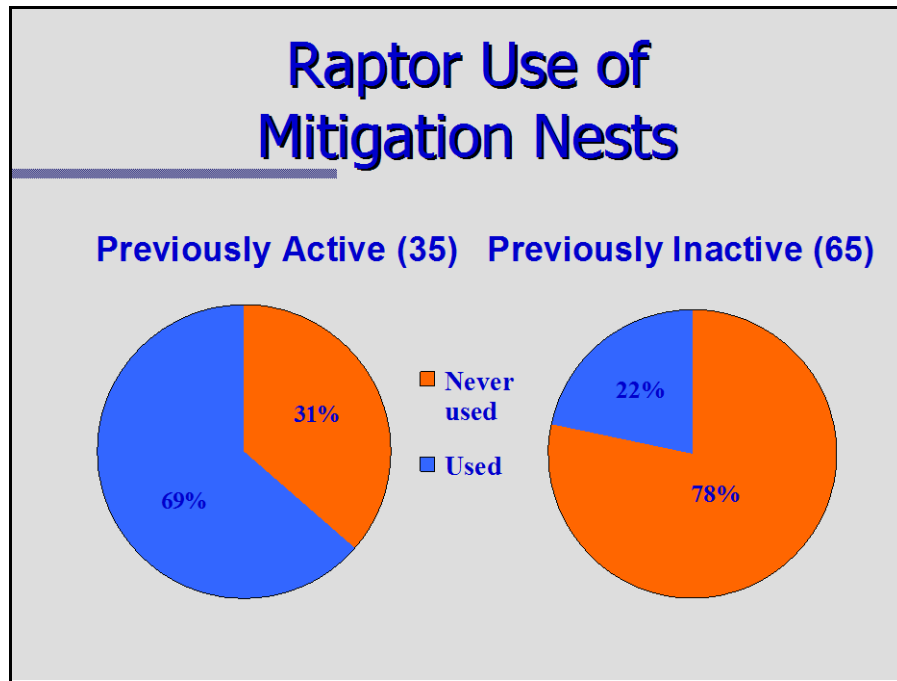


Figure 6. Raptor use of mitigation nests at surface coal mines in northeast Wyoming.

Mountain Plovers

The establishment of mitigation programs for other avian species of concern has also benefited companies willing to experiment with innovative reclamation techniques for wildlife habitat. The Antelope Mine in northeast Wyoming supported a unique effort to establish mountain plover habitat in reclamation by translocating prairie dogs into man-made colonies. One hundred three black-tailed prairie dogs (26 males, 23 females, 54 juveniles) were translocated from three local colonies to four mitigation sites created in permanent reclamation on the mine's permit area during 2002 and 2003. Due to new permitting restrictions, no animals were relocated during 2004-2006.

Post-release retention in the colonies ranged from approximately 25-47% through August 2003. Actual retention rates were difficult to ascertain after that year due to the mixing of animals among the colonies. Retention rates reported in the literature for similar translocations range from 0-50% (Truett et al., 2001). Attrition in the mitigation colonies appeared to be

primarily due to natural dispersal and predation. It is likely that some adults, especially the adult males, left the sites immediately upon their release from the acclimation cages. This is supported by the fact that many of the prairie dogs that remained in the largest colony after their release in summer 2002 were known to be juveniles, as they had been marked upon capture. Numerous potential predators reside at the mine, including golden eagles, coyotes (*Canis latrans*), badgers (*Taxidea taxus*), bobcats (*Lynx rufus*), red fox (*Vulpes vulpes*), and even prairie rattlesnakes (*Crotalus viridis*). Five of those six species were observed patrolling through, or perching near, the mitigation colonies once prairie dogs had been placed there. A bobcat frequented the colonies for a while during 2002 (Fig. 7), and badgers dug out several of the unsecured chambers in both years, especially 2003.



Figure 7. Bobcat outside artificial prairie dog burrow in Reclamation at the Antelope Mine in northeast Wyoming.

Litters have been confirmed in at least one of the two original colonies during each of the last four years (2003-2006). In 2006, twice (34) as many prairie dogs were present in the smallest colony as were originally released (16). Prairie dogs were not present in the largest colony during the past two years (2005 -2006). The latter occurrence can likely be attributed to a recent outbreak of sylvatic plague that was confirmed in a colony approximately 0.6 km to the east in 2004. For whatever reason, the carriers bypassed the smaller colony. It is hoped that survivors in that colony will disperse west and reestablish the former larger site, as well as the two man-made colonies constructed in 2003. Prairie dogs have only been recorded sporadically in those two colonies, appearing to concentrate in the two original sites constructed in 2002.

The mitigation colonies initially ranged from approximately 2.5-10 ha each, for a total of 25 non-contiguous ha. The prairie dogs that have remained in the release area have enlarged several artificial chambers (Fig. 8a), and have also dug numerous new chambers and escape burrows both within and beyond the original colony boundaries (Fig. 8b).



Figure 8a. Prairie dogs at artificial burrow entrance post-release in man-made colony at the Antelope Mine in northeast Wyoming.



Figure 8b. Prairie dog at new natural burrow excavated post-release in man-made colony at the Antelope Mine in northeast Wyoming.

By September 2006, the four-colony complex had expanded to approximately 86 non-contiguous ha. Burrow density at the release sites had increased dramatically by fall 2006, from a total of 70 man-made holes to more than 800 (including the original 70). Along with their tentative efforts to expand the colonies, the prairie dogs are also having an impact on the vegetation in the mitigation area. Numerous burrow entrances within the mitigation colonies are already ringed by bare ground from the animals clipping the grass down to the roots below the surface (Fig. 9). That behavior will greatly contribute to the ultimate goal of creating viable mountain plover habitat (i.e., short, sparse vegetation) in reclamation. Cattle grazing also reduced vegetation height throughout reclamation during 2004 -2006, including the areas immediately adjacent to the mitigation colonies.



Figure 9. Prairie dogs post release in man-made colony in Reclamation at the Antelope Mine in northeast Wyoming.

Conclusions

Results from more than two decades of annual surveys and mitigation have clearly demonstrated the success of proactive efforts on behalf of numerous vertebrate species of concern, particularly avian species. For example, mitigation measures implemented at surface coal mines in the Powder River Basin of northeast Wyoming have contributed to maintaining both the diversity and abundance of nesting raptors throughout the region. Some techniques first implemented for a single raptor pair to avoid conflicts with mining in that region have been used for other raptor species in the area, and elsewhere in the country, with equal success. Additionally, understanding the habitat use of avian species of concern (e.g., mountain plovers) at the Antelope Mine led to a unique method for recreating specialized vegetative conditions in reclamation for those birds. When reviewing these results, however, it is important to acknowledge the role of long-term monitoring in those successes, as the knowledge base gleaned from those efforts greatly enhanced the positive outcome of mitigation measures.

Acknowledgements

Each of the following mines in the Powder River Basin of northeast Wyoming voluntarily exceeds the wildlife monitoring requirements set forth by state and federal regulators. The information gathered at those properties over the last 26 years has generated an extraordinary database that allows qualified biologists to make appropriate decisions regarding wildlife management and mitigation in that region.

Rio Tinto Energy America (Antelope Mine)

Foundation Coal West, Inc. (Eagle Butte Mine, Belle Ayr Mine)

Powder River Coal, LLC (Rawhide Mine, Caballo Mine, North Antelope Rochelle Mine)

Thunder Basin Coal Company, LLC

(Coal Creek Mine, Black Thunder Mine, North Rochelle Mine)

Kiewit Mining Group Inc. (Buckskin Mining Company)

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