COAL SURFACE MINING AND SELECTED WILDLIFE—A 10-YEAR CASE STUDY NEAR DECKER, MONTANA

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Abstract: Between 1975 and 1984 extensive wildlife monitoring programs were conducted on, and adjacent to, producing and proposed coal surface mines near Decker, Montana. Specific studies focused on populations of mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), sage grouse (*Centrocerus urophasianus*), and golden eagles (*Aquila chrysaetos*) to determine their responses to mining related activities. Mule deer and pronghorn populations thrived throughout the study period despite increasing mining activity and human disturbance. The East Decker mule deer herd increased from an estimated 90 animals in 1977 to over 600 in 1984. During the same period, the pronghorn herd increased from 20 to over 118 animals. The only negative effect noted was the increased numbers of deer road-killed or poached. Some important sage grouse habitat was lost due to mining, but mitigation efforts for this species were successful. The number of golden eagle territories on or adjacent to mine sites remained stable during the early years of the study and increased slightly (26 to 29 pairs) in the later years. Eagles appeared to adjust quickly to mine-related disturbances. Despite the expansion of mining in the Decker area during the past 10 years, the negative effects initially forecast about mining impacts on these wildlife species have not been realized.

With the advent of the energy boom in the western U.S. during the 1970s came public concern over the impact of coal surface mining on wildlife populations. Early projections indicated that 293,401 ha of land in the northern Great Plains would be disturbed, and that the effects on local wildlife populations would be devastating (Anonymous, 1975). The basic assumption on which these predictions were made was that land permitted for mining would no longer support healthy wildlife populations. "Populations of antelope, mule deer, and sage grouse would be substantially lowered in the vicinity of the proposed mines and with the added impacts of existing and projected mines, regional populations would be noticeably lowered. Mining near Decker would disrupt the most important block of sagebrush habitat in the region, thus reducing populations of species dependent on this habitat" (USDI and MDSL 1979 at p. IV-38). Although this forecast was based on the opinions of wildlife experts, the proximate and ultimate impact of displacing wildlife from native habitats was unknown.

In 1975 the Denver Wildlife Research Center, in cooperation with Kiewit Mining & Engineering (KME) and the Montana Department of Fish, Wildlife and Parks (MDFWP), began to address this issue by initiating a long-term study to assess the impact of coal surface mining on wildlife populations. The studies focused on areas near Decker, Montana. Over the 10-year period, the short and long-term impacts to wildlife were assessable. This paper resulted both from projects sponsored by the U.S. Fish & Wildlife Service (USFWS) and the on-going wildlife monitoring programs conducted by KME personnel as required by State and Federal regulations. Studies were directed toward wildlife species that appeared to be sensitive to development activities or which were of special economic and/or ecological significance to the area.

This paper reviews and summarizes, in a preliminary manner, the highlights of detailed investigations on mule deer, pronghorn, sage grouse, and golden eagles. The conclusions are based primarily on data gathered at the East Decker Study Area (EDSA) where baseline wildlife data were gathered prior to development. The population trends observed on the EDSA are believed to be representative of general changes in big game populations throughout southeastern Montana.

THE STUDY AREA

The study area encompassed 863 km^2 of southeastern Montana and northern Wyoming (Figure 1). The area was selected as being generally representative of the wildlife habitats in the coal-rich Powder River Basin. The extensive mining development proposals for the are created potential for evaluating the direct and indirect impacts to wildlife. At the outset of the study in 1975, 2 coal surface mines existed within the area, and 2 of 7 additionally planned developments became a reality by 1979.

The Tongue River bisects the area flowing from south to north with its tributaries flowing southeast or northwest. Steep to moderately steep south and west aspects are characterized by xerophytic shrub/grasslands. The north and east aspects often feature ponderosa pine (*Pinus ponderosa*)/juniper (*Juniperus scopulorum*), or mesophytic shrubs.

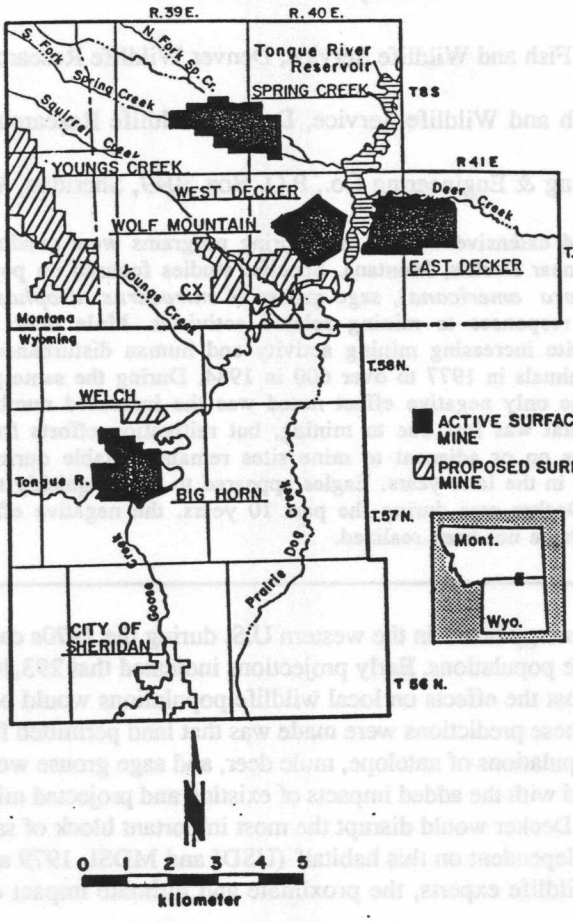

Figure 1. Location of study area along the Montana-Wyoming border.

Gently rolling hills and benches between drainages are characterized by big sagebrush (*Artemesia tridentata*)/grasslands, with interspersed dryland crop fields. Drainage bottoms are typically a mixture of deciduous forest, riparian grasslands, and irrigated hayland.

Within the study area there are 4 coal surface-mines including:

East Decker

East Decker is a 17.5 km^2 site with approximately 9.7 km2 of disturbed ground. Construction of the mine facilities began in 1978. Coal has been shipped from the mine at an average rate of 4.6 million metric tons/year. Only 13.4 ha had been permanently reclaimed at the site by the end of 1984.

Big Horn

The Big Horn Mine is the oldest mine in Sheridan County. Coal has been shipped from the mine since the 1940s. Surface disturbance covers approximately 13.8 km^2 with production at 2.3 million metric tons/year. Permanent reclamation at the mine totals 109 ha.

West Decker

Mining at West Decker began in 1975. Approximately 4.3 km^2 of land has been disturbed at the mine with just over 106 ha of this having been reclaimed by the end of 1984. Production at the mine averages 4.6 million metric tons/year.

Spring Creek

Construction of the Spring Creek mine began in April 1979, with coal production starting in December 1980. The permitted area includes 12.1 km^2 with 2.6 km^2 currently disturbed. The mine production level is 2.2 million metric tons of coal/year. Approximately 22 ha have been reclaimed.

Most of the study area is privately-owned with cattle grazing being the principal land use. The human population is low with the only organized town being Decker, Montana (population about 10).

METHODS

The data generated in this study were collected by ground and aerial surveys and by radio-telemetry. To facilitate analysis and interpretation of data on the distribution and abundance of mule deer and antelope on the EDSA, we divided the study into 3 time periods: 1975–77 pre-mining phase, 1978–79 construction phase, and 1980–84 full scale mining activity (Figure 2). Big game numbers, distribution patterns and movements on the study area were determined by systematic aerial and ground surveys conducted at regular intervals. North-south flight transects spaced 1,000 m apart were flown to cover the 56 km study site. All flights were made in a tandem seat aircraft (Bellanca Citabria) at a speed of about 120 kph and approximately 75 m above ground surface. Ground observations were conducted during all seasons by driving established roads and utilizing observation points. The locations of all sightings were recorded as Universal Transverse Mercator coordinates on a standard Fortran data sheet for future computer analysis. In addition to the flight and ground observation data, 81 mule deer and 34 pronghorn were captured and radio-tagged. Movement data on these animals were useful in evaluating changes in home range size and habitat use patterns resulting from disturbances associated with the developing coal surface mine.

Sage grouse leks were initially located by ground and aerial searches. Thereafter sage grouse numbers were monitored each year by counting displaying males at traditional lek sites. The procedures used for moving the lek on the East Decker Mine were previously reported by Eng et al. (1979). Twenty-six radio-marked grouse provided data on habitat-use patterns and seasonal movements.

The number of breeding (territorial) pairs of golden eagles inhabiting the overall study area was monitored during the period 1975–84. Occupied eagle territories were located during the breeding season (February–June) by searching from the air and ground. Nest sites were checked at regular intervals throughout the nesting season to gather data on reproductive performance. The term, "nesting success" used follows the definition described by Postupalsky (1974). General observations on the responses of eagles to mine-related activities were recorded throughout the study period.

RESULTS AND DISCUSSION

Mule Deer

Prior to initial surface disturbance, relatively few mule deer used the portion of the EDSA that was to become a coal surface mine. During the pre-mining surveys, only 13% of total deer observed (96 of 738) on the EDSA were within the mine permit boundary, which comprised 31% of the total study area. Low use of this area by mule deer was attributed to its vegetative composition and topography. Few shrubs were present and the flat to gently rolling terrain was dominated by bluebunch wheatgrass (*Agropyron spicatum*).

As mine facility construction and initial stripping operations progressed in late 1978 and early 1979, large mounds of overburden and topsoil were created. The earth moving activities increased the habitat diversity on the EDSA both topographically and vegetationally. Deer responded to this habitat change by increasing their use of the changing environment (Figure 3). Seventeen percent of the deer observed during the aerial surveys conducted after the full-phase mining period (1981–84) commenced were within the permit boundary. Although this was only a 4% increase in the percent of the deer use, actual numbers of deer observed on the permit area increased from 86 in 1976 to 516 in 1984. Deer were observed utilizing overburden and topsoil piles as sources of topographic cover and food. Field observations indicated that species such as fireweed summer-cypress (*Kochia scoparia*) and yellow sweetclover (*Melilotus officinalis*) were important food plants to the resident deer herd. Quayle (1985) also reported deer use of revegetated lands on the Caballo Mine south of Gillette, Wyoming.

Full-scale mining activity (i.e., coal removal) began in 1980, with a steady level of human disturbance in and around the mining area. Deer continued to use overburden and topsoil piles within the mine complex and their movement patterns appeared to be adjusted to minimize contact with humans. They accomplished this by establishing travel routes in areas where minimal disturbance was occurring. The rough topography created by mining generally reduced the visibility of deer within the mine site and provided secure resting areas.

Data from radio-tracking indicated that during the late summer and early fall period (July–October) a major portion of the East Decker herd utilized the riparian habitat along the Tongue River Reservoir on a nightly basis (D.E.

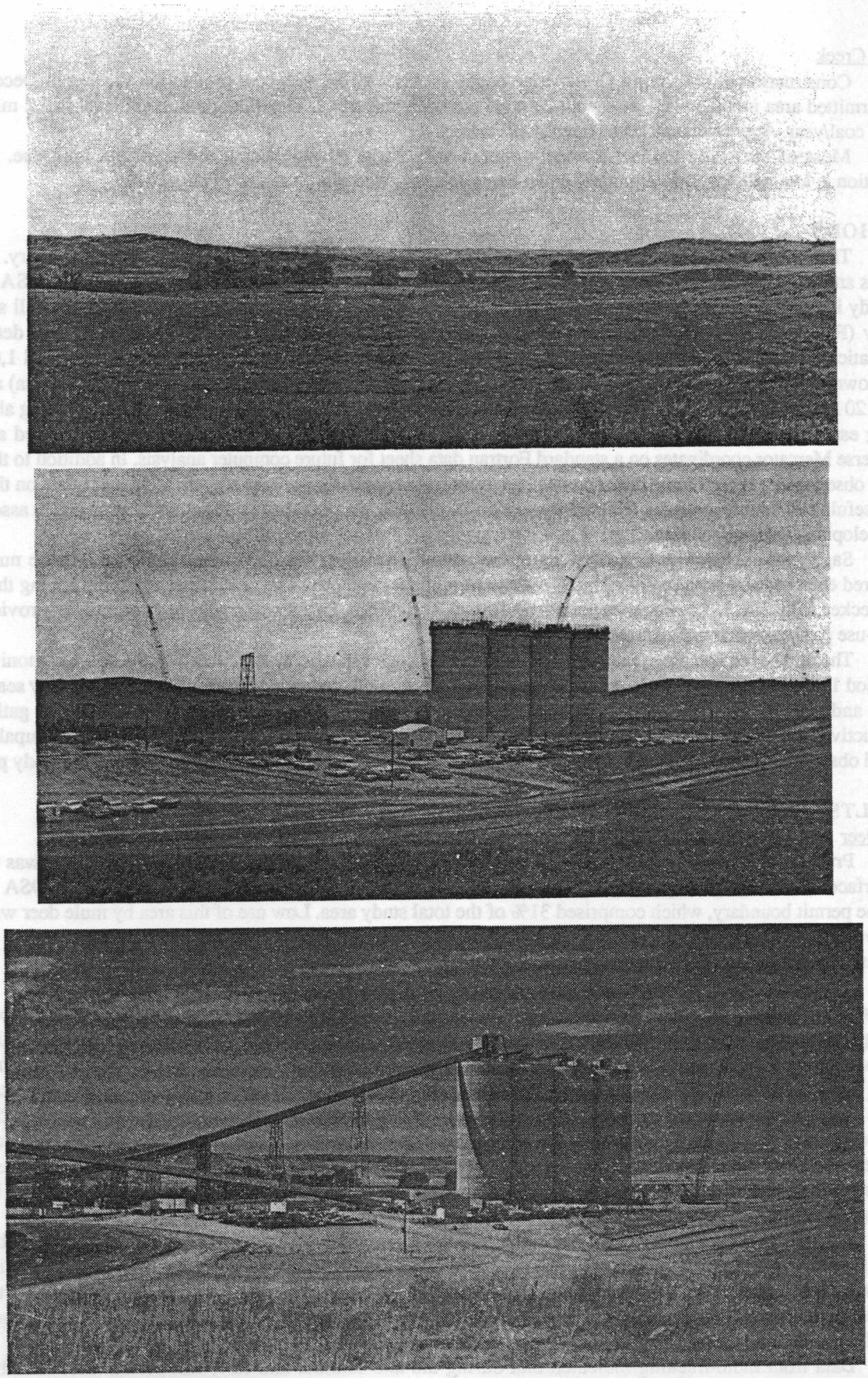

Figure 2. A series of photos taken from the same point showing the development of the East Decker Mine

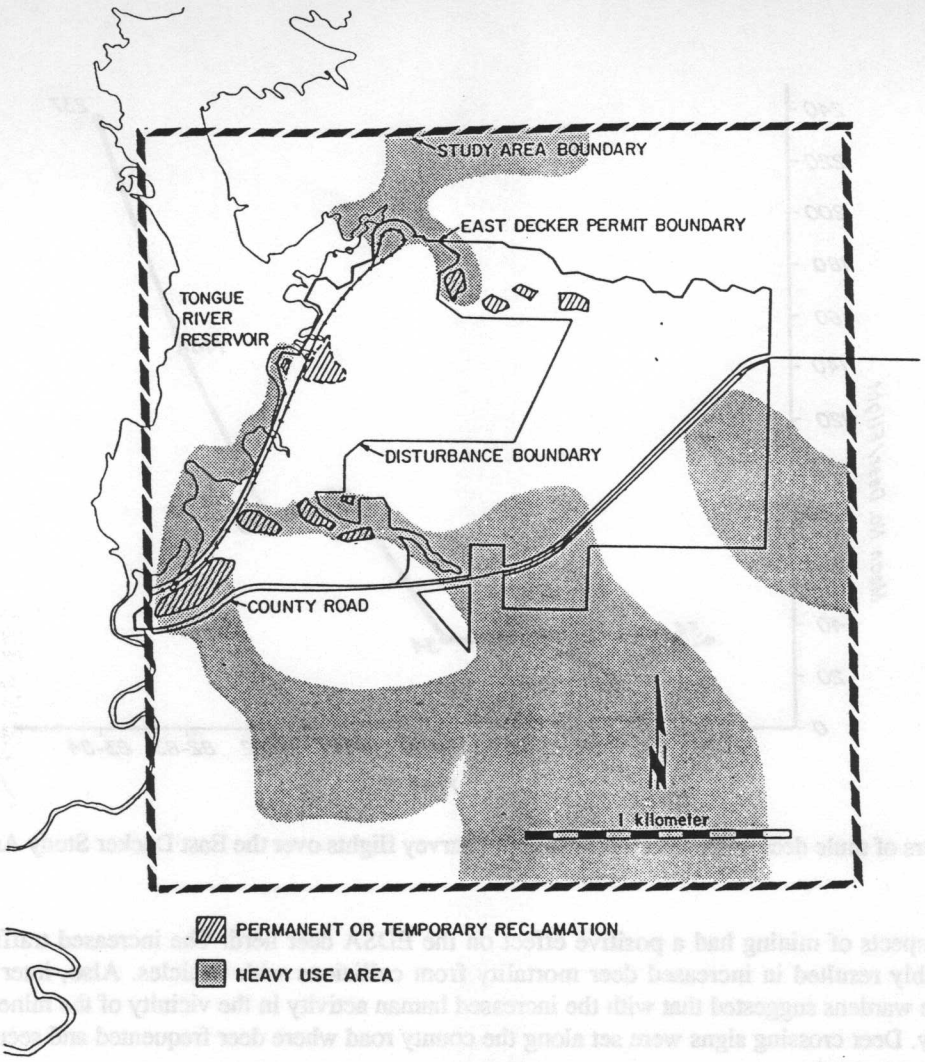

Figure 3. The East Decker Study Area showing areas heavily used by mule deer.

Biggins, unpubl. rep., U.S. Dep. Inter., Fish and Wildl. Serv., Denver, Colo. 1977). The presence of a newly constructed railroad spur along the east edge of the Reservoir, and its regular use by coal trains, did not appear to disrupt deer movements or their heavy use of the riparian habitat (USFWS, KME, unpubl. data).

Some of the early impact statements predicted declines in mule deer numbers in areas associated with developing coal mines. This was not the case in our study. The mule deer population was low in the Decker, Montana area prior to mining activity. Dramatic increases in deer observed during aerial counts occurred as the ED mine was becoming operational (Figure 4). If the count of 79 deer during the winter of 1981–82 is omitted (only a single flight was made that winter), all differences between mean counts from 1979–80 to 1983–84 are statistically significant (t-tests, $P<0.10$). Aerial counts were adjusted by the winter observability factor of 36% calculated by Biggins and Jackson (1984) to provide population estimates. The 7-fold increase in deer counts from 1979–80 to 1983–84 represents a change from 94 to 658 deer.

Several factors contributed to the population increase, some of which were directly associated with mining. Most important probably was reduced mortality of anterless deer from sport hunting. During 1975 and 1976, the MDFWP had buck-only deer seasons for much of southeastern Montana, including the area around Decker. Reduced harvest from hunting during these years coupled with a series of generally mild winters allowed the deer herd to increase. The mining permit area within the EDSA has been closed to all hunting since the mine came under construction in the fall of 1978. However, the remaining portion of the EDSA has sustained a limited deer harvest during each year of the study. Habitat changes resulting from mining seemingly enhanced the area for deer and increased the total carrying capacity of the area.

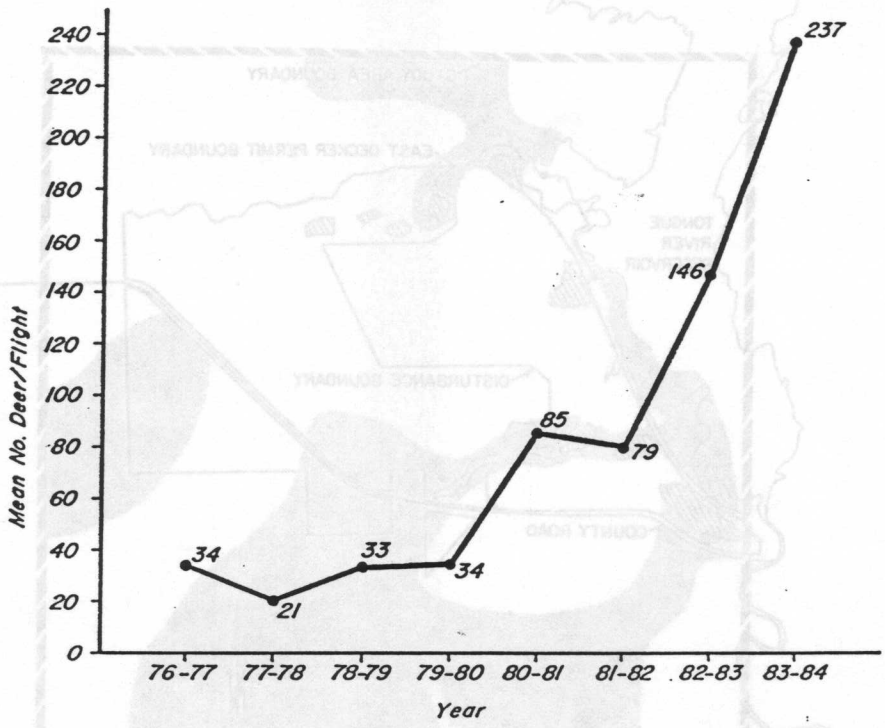

Figure 4. Numbers of mule deer observed on winter aerial survey flights over the East Decker Study Area, 1977–1984.

Not all aspects of mining had a positive effect on the EDSA deer herd. The increased traffic on the Decker highway presumably resulted in increased deer mortality from collisions with vehicles. Also, interviews with local ranchers and game wardens suggested that with the increased human activity in the vicinity of the mines came increased poaching mortality. Deer crossing signs were set along the county road where deer frequented and security patrols were increased to discourage poachers.

The process by which the deer herd became established on the West Decker Mine (WDM) is not well documented. Perhaps it could better be described as the process by which the mine evolved in the presence of an existing deer herd. By the time studies were started in 1975, the resident herd had ample time to become conditioned to increasing levels of disturbance associated with the developing mine. Like the EDM, habitat diversity itself was increased by mining, resulting in a mosaic of interspersed disturbed "weedy" areas, steep spoil piles, settling ponds, and haul roads amongst native tracts of sagebrush, grassland, and juniper sidehills.

Physical barriers created by the mine defines the east and west edges of the herd's range, whereas north-south range boundaries were not defined by physical obstructions. Despite continuous mining and associated activities, deer moved freely throughout the mine's interior (Figure 5). Feeding deer were seen using revegetated areas, native sagebrush-grassland tracts, and weedy patches. Seven fawning sites were documented within the horseshoe-shaped interior of the mine (Figure 6).

Several members of the herd were lost annually due to collisions with vehicles and/or to illegal hunting. Two important factors increased the vulnerability of this herd to these types of mortality: 1) from spring until late fall, deer crossed the highway frequently between the mine and the mud flats of the Tongue River Reservoir, and 2) mine deer had become conditioned to human and vehicular disturbances, making them less wary. Seventeen deer were resident on the mine site in mid-summer, 1976. By November, only 2 animals from the original herd remained. Nine mortalities were documented: 3 died from collisions with vehicles on the Decker highway, 2 were poached, 1 fawn was hit by a coal hauler and 3 were legally taken by hunters. The fate of the other 6 deer was not documented. These types of mortality continued throughout the study and thereby regulated the number of deer living on the mine.

When our studies began in 1975, 10 deer were known to reside on the mine. This herd occupied about 4.0 km^2 of habitat, excluding large barren areas such as the coal pits. A higher density of deer was present on the WDM than on surrounding, relatively unaltered habitat. The number of deer occupying the mine progressively increased from 1975 to the 1984 population of 35.

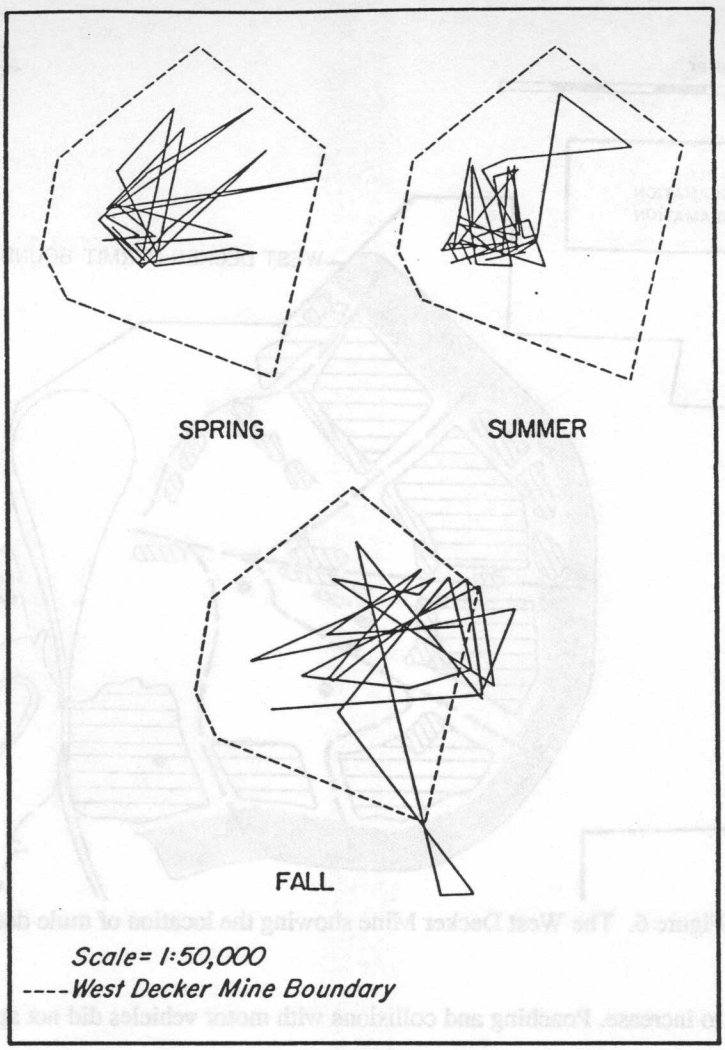

Figure 5. Example of movements of a radio-tagged adult mule deer on the West Decker Mine.

Pronghorn

Pronghorn were distributed throughout the EDSA during all seasons of the year prior to mine development. Thirty-six percent of the pronghorns (144 of 396) sighted on aerial surveys (1976–78) conducted during the pre-mining period were within the permit boundary of the East Decker Mine. As the construction of the mine began in late 1978, field observations indicated that pronghorns avoided the immediate area of the construction site and other areas that were stripped of vegetation. However, they continued to utilize the remaining portion of the mine permit area. During this period, 42% of the pronghorn sightings (268 of 631) were within the permit boundary. As the East Decker Mine continued to develop and expand into the full-scale mining period (1981–84), 49% of the pronghorn sightings (926 of 1901) were within the permit area. Pronghorns used weedy areas on topsoil piles and areas of temporary reclamation. Six percent of the pronghorns observed during this period were on disturbed or reclaimed areas (Figure 7). Sergerstrom (1982 at p. 21) reported that 13% of the relocations of 10 radio-tagged pronghorn using the Belle Ayr coal surface mine south of Gillette, Wyoming, were on revegetated mine lands, and that use of this vegetation type was greater than expected when compared with availability.

Approximately 25 antelope resided on the EDSA in 1976. This herd increased during the construction and full-scale mining period, and by the summer of 1984, the population was estimated to be in excess of 118 animals (Figure 8). We believe the reasons for the population increase are similar to those previously explained for the deer herd. However, the rapid increase between 1982 and 1983 can only be explained by ingress of animals from other areas. The EDM served as a refuge for the resident pronghorn herd, and favorable environmental conditions over the 10-year period

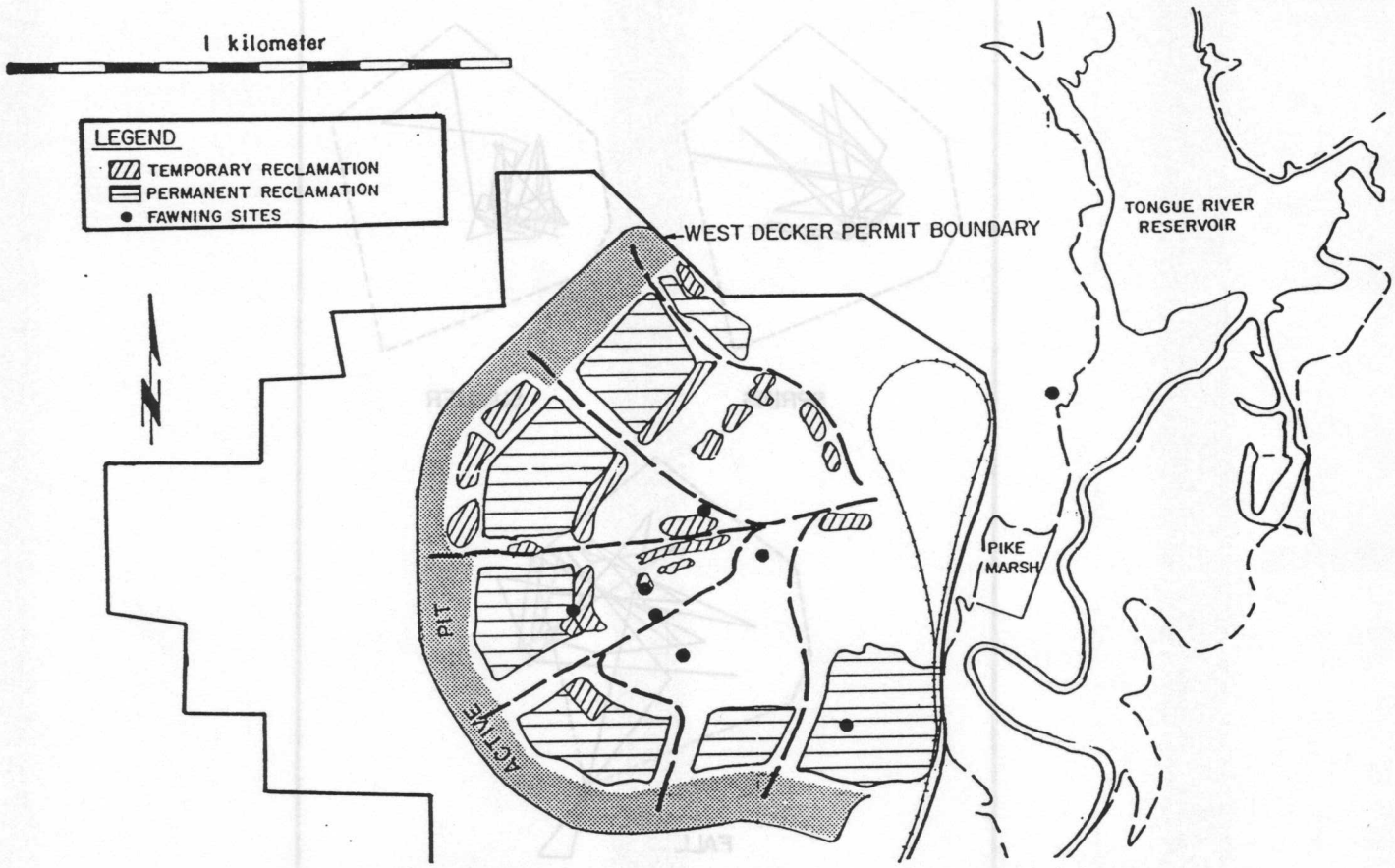

Figure 6. The West Decker Mine showing the location of mule deer fawning sites.

allowed the population to increase. Poaching and collisions with motor vehicles did not appear to be important mortality factors.

Sage Grouse

The presence of an active sage grouse strutting ground referred to as the Penson lek on the EDM presented a direct conflict between the developing mine and the resident wildlife species. Eng et al. (1979) reported on an attempt to resolve this conflict by relocating this lek outside the mining area. By the spring of 1980, all birds previously using the Penson lek appeared to shift to the experimental lek. Counts in subsequent years (1981–84) at the Penson lek, the new experimental lek, and 3 other nearby leks were comparable (Table 1). The Penson lek was last visited by a male grouse in the spring of 1981. In 1982, the Penson lek was essentially destroyed when topsoil and vegetation were removed from the lek site. All breeding activity for sage grouse using the East Decker area appeared to be taking place on the experimental lek.

Prior to disturbance, part of the EDM was used for nesting and brood rearing habitat (Eng et al. 1979). General observations and radio tracking studies conducted between 1980–84 indicated that most of the nesting and brood rearing is now more concentrated near the experimental lek (KME, upubl. data). Relocation of the lek site did not have an adverse effect on the sage grouse population using the East Decker area.

Golden Eagles

Twenty-nine pairs of golden eagles occupied breeding territories on the study area (1 pair/29.8 km2) in 1984. This density is high compared to other areas in Wyoming (Phillips et al. 1984). Despite increasing industrial development and human activity, the number of eagle pairs remained relatively constant over the 10-year period. The only significant population change occurred in 1983 and 1984 when 3 new pairs established breeding territories on the study area. One pair occupied a nest site only 600 m from an active coal mining haul road and spoil area. Additionally, in 1983, a pair of bald eagles (*Haliaeetus leucocephus*) established a breeding territory within the study area. The bald eagles nested along the Tongue River and successfully raised young in 1983 and 1984.

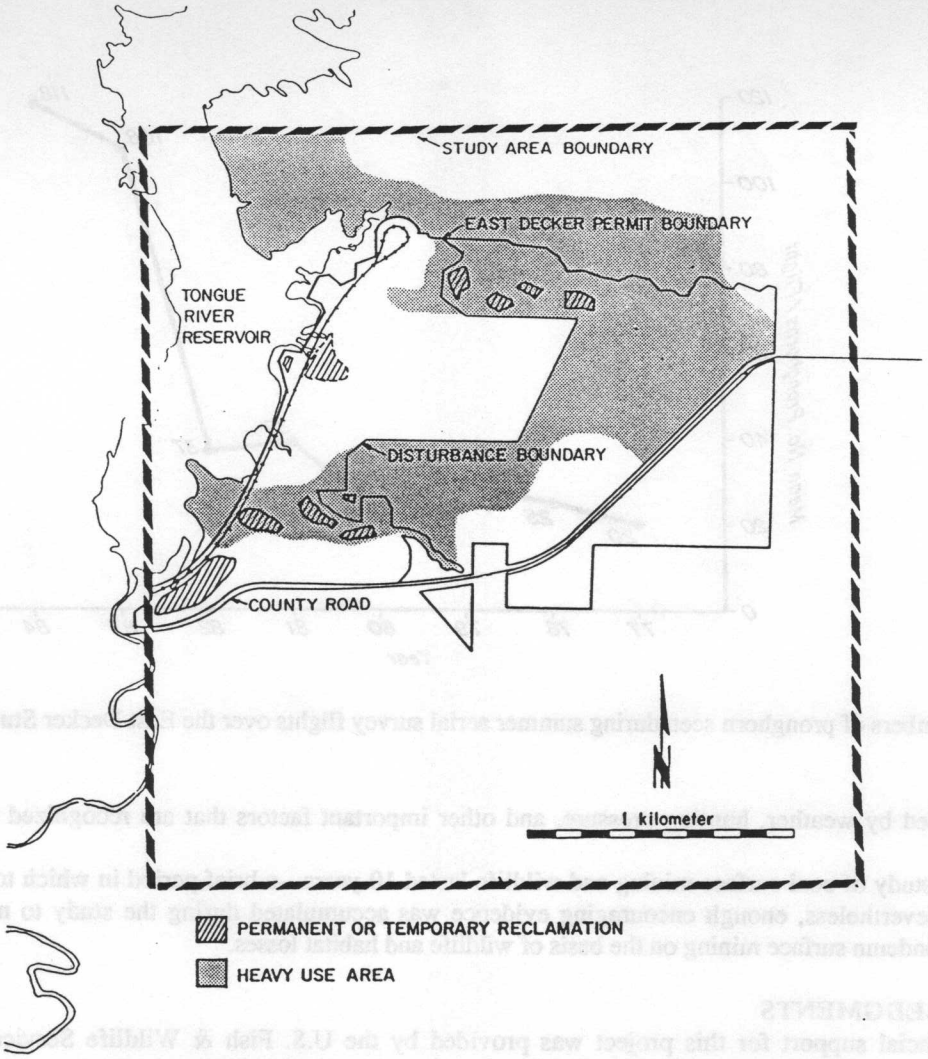

Figure 7. The East Decker Study Area showing areas heavily used by pronghorn.

Reproductive performance of the golden eagle population varied annually, but is comparable to other populations that have been studied in the western U.S. (Phillips et al., in prep.).

The proximity of a pair to an active mine did not appear to decrease nesting success. Four pairs nesting close to active mines had a 10-year average nesting success of 67.5% as compared to 56.6% success for pairs nesting on the remainder of the study area. Areas disturbed by surface mining harbored prey populations which continued to be used by resident eagles. Eagles were observed perching on the top of spoil piles and hunting within the boundaries of established mines.

WILDLIFE-MINING RELATIONSHIPS IN PERSPECTIVE

This paper summarized some results of several research projects designed to examine the response of selected wildlife species to coal surface mining. Scott and Zimmerman (1984) stated that the final outcome of coal surface mining is an unparalleled opportunity for improving wildlife habitat over what originally existed. Environmental statements have seldom mentioned the opportunity for enhancement of wildlife habitats during mining and post-mining reclamation. Mines usually increase the topographic and vegetational diversity which often leads to increased wildlife density and diversity. If the primary postmining land use is wildlife, permanent reclamation can be designed to maximize the mixture of plant species and thereby provide greater habitat diversity than native prairie.

We do not want this to sound like an unequivocal endorsement of surface mining. The fact that populations of our subject species increased or remained the same in the presence of mining (instead of EIS predicted decreases for these species) does not necessarily imply a cause and effect relationship. The influences of mining (both positive and negative)

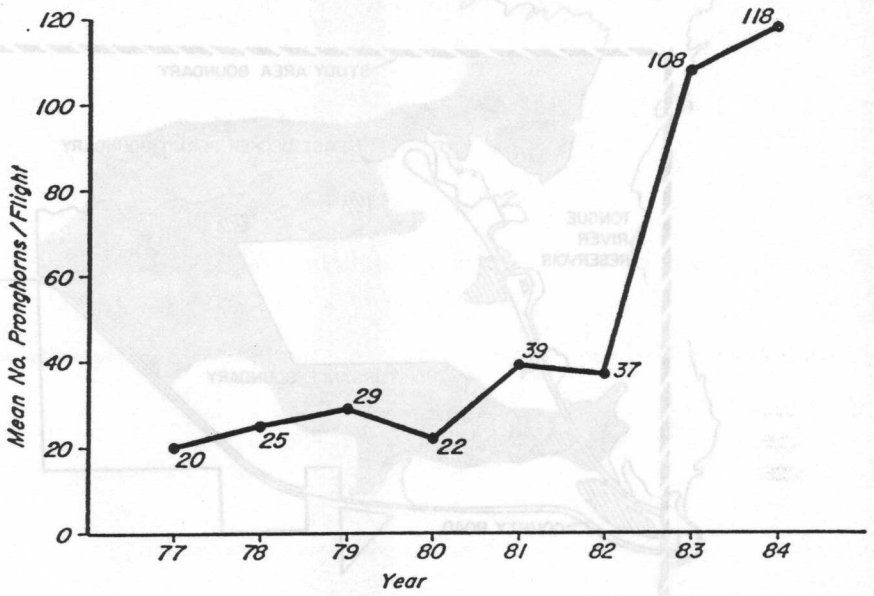

Figure 8. Numbers of pronghorn seen during summer aerial survey flights over the East Decker Study Area, 1977–1984.

may be masked by weather, hunting pressure, and other important factors that are recognized as affecting wildlife populations.

Our study of coal surface mining and wildlife lasted 10 years—a brief period in which to judge the fate of an ecosystem. Nevertheless, enough encouraging evidence was accumulated during the study to make most biologists reluctant to condemn surface mining on the basis of wildlife and habitat losses.

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