INTRODUCTION

This chapter describes the existing conditions, uses and resources that could be affected by any of the alternatives described in Chapter 2. Each resource or program discussed is keyed to the issue(s) it relates to, in order to provide the reader a more complete description of the environmental impact statement (EIS) area.

TOPOGRAPHY (Issues: General, Visual Resources)

The Blackleaf EIS area is dominated by the Rocky Mountain Front (RMF) which rises 3,100 feet above the surrounding foothills and plains. The Front lies in the western portion of the EIS area and contains such notable topographic features as Choteau Mountain (8,216 ft.), Mount Werner (8,090 ft.), Mount Frazier (8,315 ft.), Old Man of the Hills (8,225 ft.) and a portion of Walling Reef. A number of deeply incised canyons cut through the area; the most notable being the North and South Forks of Dupuyer Creek, Blackleaf Canyon, Muddy Creek Canyon; and in the southern portion of the EIS area, the North and South Forks of the Teton River (see Figures 3.1 and 3.2).

Immediately east of the RMF the low foothills, rolling prairies and Antelope Butte dominate the topography. The majority of the creeks flow west to east through these plains. Other minor creeks include Cow Creek, Blind Horse Creek and Chicken Coulee which flow west to east. Pamburn Creek and Clary Coulee flow in a north-south direction and empty into the North Fork of the Teton River.

The easternmost portion of the EIS area is mostly rolling prairie with some small coulees.

CLIMATE (Issues: General, Oil and Gas Operations)

The EIS area is characterized by relatively hot summers and cold winters with temperatures ranging from over 100 degrees Fahrenheit (°F) in the summer to -35°F during the winter. The mean annual temperature of the area is 42.5°F. Winter can be severe and the ground normally freezes to a depth of approximately 36 inches.

Terrain is an important factor in the precipitation pattern in this area. The Continental Divide causes rain shadow effects along the east side of the Divide, resulting in precipitation averages of 30-40 inches at the higher elevations and 10-20 inches in the foothills and on the plains. Much of this precipitation falls as winter snow and/or spring rains. Snowfall depth will vary, based on elevation.

Wind is a major environmental factor for this area and wind speeds average 15 miles per hour with a prevailing east movement. Winter and spring chinook winds often raise the temperature 20 to 30°F in a matter of hours and can deplete much of the stored snow in the foothills and plains. Timber in the area is often wind pruned and sculptured by the prevailing winds.

AIR QUALITY (Issue: Air Quality)

Air quality is excellent due to the presence of Class I air shed directly upwind and the lack of pollutant sources in the EIS area. Upwind and west of the EIS area are the Great Bear (Class II) and Bob Marshall (Class I) Wilderness Areas. The EIS area is in a Class II air quality area established by the Clean Air Act Amendments of 1977 - Prevention of Significant Deterioration (PSD) Requirements.

A Class I air quality area is defined as any area which has the highest degree of protection from future degradation. The Clean Air Act designated each national park over 6,000 acres and each national wilderness area over 5,000 acres as Class I areas. A Class II area is any area cleaner than federal air quality standards and designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area. A Class III area is any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in Class III areas.

Figure 3.1 GIS Topography of the Blackleaf EIS Area.

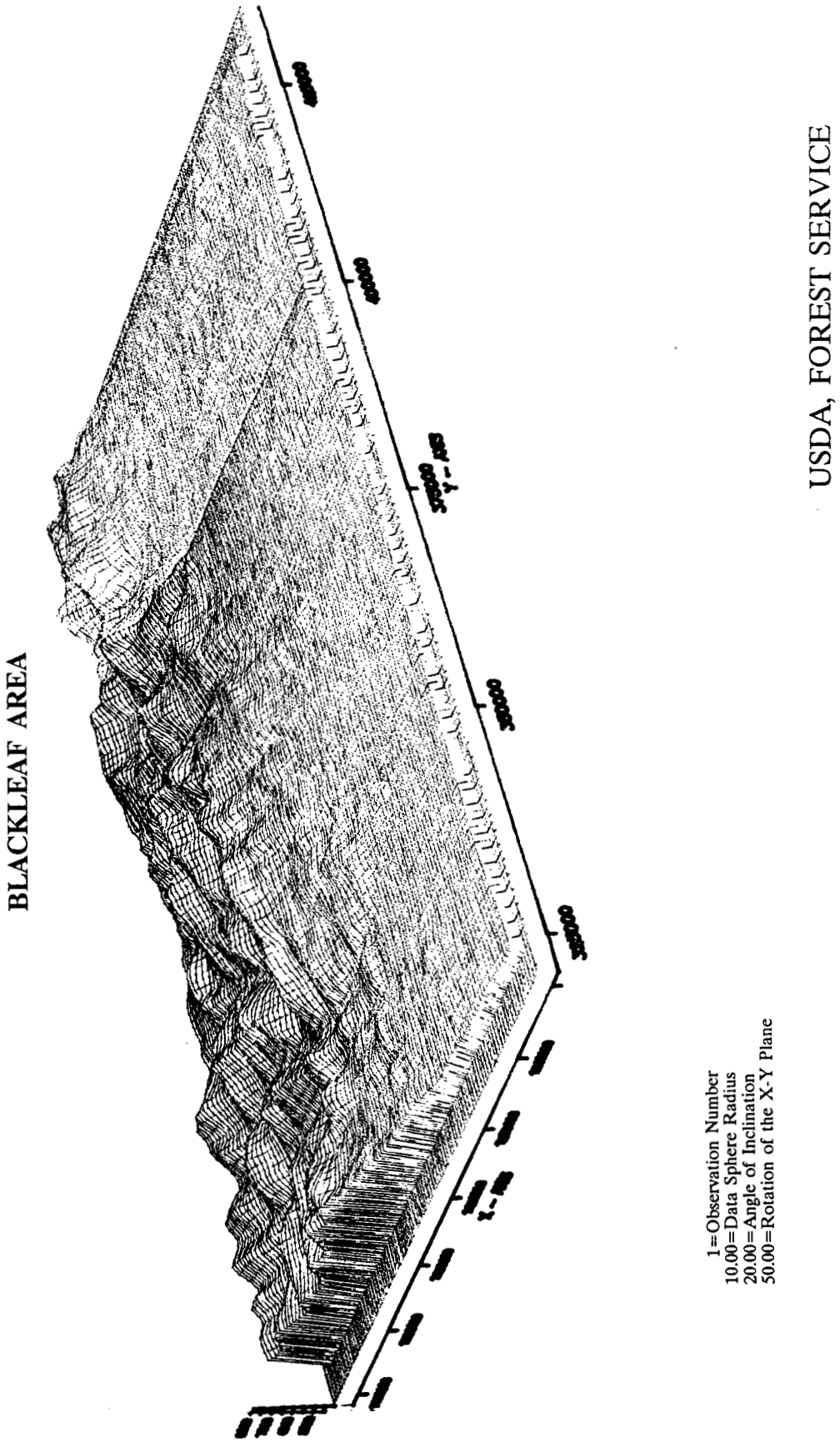
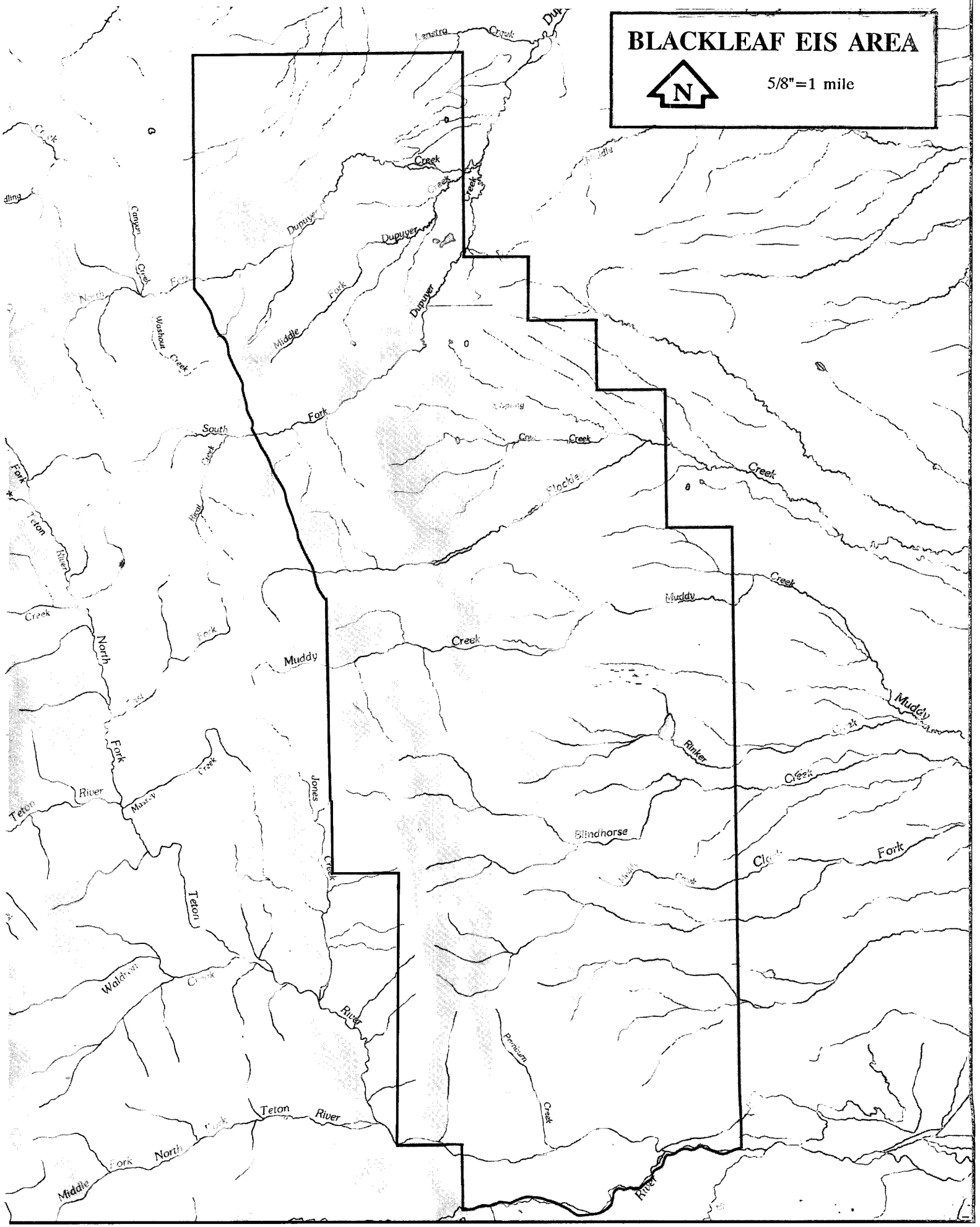


Figure 3.2 Shaded Relief and Drainages of the Blackleaf EIS Area.



Low level emissions occur from the gas production facilities associated with the producing wells described in Chapter 2. Hydrogen Sulfide (H2S) and fugitive hydrocarbon gases are the most significant pollutants emitted. Hydrogen Sulfide and SO2 are lethal at higher concentrations, (more than 1,000 parts per million (ppm)) and being heavier than air will flow downslope. For a complete discussion of H2S (effects, characteristics and chance for a blow-out) please refer to Appendix H. Extremely low concentrations of these pollutants (0.01 ppm to 10 ppm) will create nuisance odors. Some minor H2S leakage (less than 0.2 ppm) may occur around shut-in wells, old plugged and abandoned well holes, and on tanks not having vapor recovery apparatus. These emissions lie well within federal standards and do not threaten the requirements of the Class II area.

Daily emissions of H2S typically measure less than 0.2 ppm immediately adjacent to the facilities, but may cause a sulfur odor. However, these amounts are unmeasurable by typical field monitoring equipment.

Hydrogen Sulfide monitoring by oil and gas operators and BLM personnel occurs routinely at wellsites and any measurable levels results in corrective action.

Dust from vehicle traffic on dirt roads in the summer causes short-term degradation, but is localized and sporadic in nature. Smoke from summer forest or range fires will occasionally infiltrate the region with smoke and wood smoke from the widely scattered ranch buildings may be visible on autumn or winter days.

PALEONTOLOGICAL RESOURCES (Issue: Oil and Gas Operations)

Paleontological resources consist of fossil plants and animals derived from past life on earth. The fossils discussed below are believed to be in the EIS area.

Brachiopods are marine animals whose soft parts are enclosed within a two-valved shell. They were first found in Cambrian time and are very abundant in the fossil record (Clarkson, 1979). They occur within the limestone and dolomite cliffs.

Corals are abundant in the geologic record and range from Cambrian to present time. They are found in the dolomite and limestone outcrops.

Belemnites are the internal shells of extinct squid-like animals, and have the appearance of a bullet and range from 2 to 4 inches in length. They are common in shales and sandstones and are similar to the shells of a modern squid or cuttlefish.

Pelecypods are bivalves with a shell consisting of a pair of calcareous valves between which soft parts of the body are enclosed. They are very abundant in the fossil record and are present in marine and fresh water environments today. They have existed since Ordovician time.

Ammonites consist of a coiled up shell with a squid-like animal living within the shell. In some places along the Rocky Mountain Front they are common and are up to 1 1/2 feet in diameter. They first appeared in the fossil record in the Cambrian period and became extinct in the late Cretaceous. Their modern day equivalent is the coiled nautilis.

Leaf fragments, petrified wood, organic burrows and trails are located in various shale beds and fine grained sandstones and are generally inconspicuous and hard to find.

Coquina consists of a mass of broken, abraded shell fragments which are cemented back together and can be found in the limestone cliffs.

Gastropods are snails and slugs living in the sea, fresh water and on land. They first appeared in the fossil record in the Cambrian and presently are more abundant than at any time in the past.

Scattered reptile (dinosaur) bones are present in various Cretaceous Age formations. The context in which these fossils are found is significant in establishing the social behavior of dinosaurs (Horner, 1984).

Dinosaur bones would be the only fossils expected in the EIS area that would be significant by the following definitions:

1. Significant. A find shall be judged significant if it:

    a. is a vertebrate or;

    b. provides important information on the development of biological communities or interaction between botanical and zoological species or;

    c. provides important information on evolutionary trends relating living inhabitants to extinct organisms or;

d. demonstrates unusual or spectacular circumstances in the history of life; or

e. is a rare species in danger of depletion by the elements, vandalism, or conflicting resource development and/or is not found in other geographic locations. Other criteria may be added by individual forests or cover local situations such as petrified forests, concentrations of petrified stumps, etc.

2. Nonsignificant. An individual fossils find is defined as nonsignificant if:

a. the species occurs extensively throughout a large geographic area;

b. it does not provide additional scientific data not found in other specimens of the same species; and

c. it is an invertebrate or paleobotanical fossil and does not meet the criteria defined under Significant.

CULTURAL RESOURCES (Issue: Oil and Gas Operations)

The remains of prehistoric cultural activities within the EIS area vary with topographic zones. There is a low probability of buried cultural remains or permanent campsites in the steep sided canyons or on the narrow ridges to the west. Native peoples may have visited the area for spiritual purposes, tool stone materials, plant collections or mineral mining.

Between these steep zones and the alluvial fan remnants to the east, cultural remains may be related to game and plant procurement. The frequency and complexity of cultural resources will increase in the eastern portions of the EIS area. The topography and natural resources of this portion of the EIS area are more favorable to activities such as camping, which leave a more permanent archaeological record. The development of deeper and buried soils improves the potential for the presence of buried cultural horizons.

The principal cultural resource inventory done in the vicinity of the Blackleaf study area is a reconnaissance level survey supported by the Nature Conservancy (Craighead, 1979) to assess archaeological values on a 38,000 acre study area in the vicinity of their Pine Butte Swamp preserve. The archaeological sites discovered through this inventory tend to confirm the previously reported site types present for the Rocky Mountain Front, including numerous tipi ring sites, stone piles, evidence of bison hunting (drive lines), stone tool manufacture, and sacred sites such as vision quests and burial grounds. In addition, trail markers probably representing the Old North Trail, a north-south travel route stretching from Canada to Mexico, are present.

To identify contemporary cultural concerns of the Indian people in the vicinity of the EIS area, personnel from the BLM consulted with Blackfeet Indians knowledgeable about the Indian cultural and religious concerns. The Indians identified no areas of concern. Therefore, this topic will not be further analyzed in the EIS.

SOILS (Issue: General, Oil and Gas Operations)

Soils in the Blackleaf EIS area have been inventoried and described at the land type level, a third order soil survey as defined in Land System Inventory (USDA Forest Service, 1976, RI-76-20). This land type inventory is a soil survey that uses landform, habitat type, and soil to characterize mapping units; and to contrast their suitability for more commonly applied land management practices. A complete description of the land types and their suitability ratings can be found in Appendix I.

The Blackleaf EIS area consists of a series of generally parallel north-south trending ridges and valleys. The ridges are mostly formed of limestone and the valleys are underlain by sandstones and shales. The original geologic structure has been extensively modified by glaciation in the Rockies and most present landforms were shaped or altered by alpine or valley glaciers.

VEGETATION (Issues: Wildlife, Visual Resources, T&E Species)

Vegetation in the EIS area varies from broad, rolling prairie grasslands at lower elevations, to dense coniferous forests and alpine rocklands at higher elevations. About 25% of the area is dominated by grasses, either as prairie grassland or meadows. Coniferous forests occupy about half of the Blackleaf EIS area, with dense forests (40-100% crown cover) on 34% of the area and open forests (10-40% crown cover) on 14% of the area. Miscellaneous aspen, cottonwood and other forest areas of low canopy cover (less than

10% crown cover) occupies about 5% of the area. Wet meadows, riparian vegetation, fen and aquatic vegetation occur on about 5% of the area in scattered locations. Rockland, talus and scree are mostly associated with high elevations and occur on 14% of the area. The remainder of the area consists of small areas of alder and berry shrubfields, forbfields, snowchutes and vegetated talus.

The major grass species are rough fescue, Idaho fescue, bluebunch wheatgrass, western wheatgrass, Richardson's needlegrass, western needlegrass, Kentucky bluegrass, timber oatgrass and junegrass. Lower elevation forests are dominated by limber pine, Douglas-fir, Rocky Mountain juniper and common juniper. Englemann spruce, white spruce and aspen are common in moist, cool habitats along streams and mountain slopes. Lodgepole pine, subalpine fir and white-bark pine become more prominent at higher elevations.

Important forb and shrub species include cow parsnip, Angelica, bluebells, false hellebore, horsetail and various willow species along streams and moist areas. Grassland-forb and shrub species include lupine, balsamroot, sticky geranium, harebell, sugarbowl, shrubby cinquefoil, northern bedstraw, yarrow, fringed sagewort and hairy goldenaster. On the forested mountain slopes the more prominent forbs and shrubs include arnica, twinflower, Richardson's geranium, meadow-rue, clematis, tobacco-root, russet buffaloberry, spirea, snowberry and various huckleberry species.

The Montana Natural Heritage Foundation conducted a rare plant inventory in the Blindhorse ONA in June, 1988. No threatened or rare plants were found. No plants classified as threatened or endangered under the Endangered Species Act of 1973 are known to exist in the rest of the EIS area. However, there are rare plants of limited distribution that may require special management consideration to maintain diversity within the species gene pool. Rare plants are those species of limited distribution which are susceptible to elimination by modification of relatively small areas of habitat. Appendix J lists the rare plants with a high probability of occurring in the EIS area.

Antelope Butte Swamp, on lands administered by MDFWP, is a unique natural feature containing very important grizzly bear habitat and a high probability of rare plants. Pine Butte Swamp, a similar feature approximately eight miles south of Antelope Butte Swamp (but out of the study area), supports 12 plant species ranked sensitive in the state by the Montana Natural Heritage Program.

The only known location of any plant species listed in Appendix J, within the Blackleaf EIS study area, is on National Forest land, but outside of the area of possible development under any of the four alternatives considered. Surveys for rare plant species would be needed in advance of development to ensure that these plants or their habitats would not be disturbed by development.

Noxious weeds are rapidly spreading throughout Montana and the Blackleaf EIS area. Leafy spurge, Spotted knapweed and Canada thistle are all present in or adjacent to the EIS area.

LIVESTOCK (Issue: Local Economy, Private Landowners)

There are 530 cattle and 67 horses permitted on five Forest Service (FS) allotments and one allotment administered jointly between the FS and BLM in the EIS area. The FS grazes its own horses on two additional allotments where no other livestock are permitted. Additional livestock are licensed by the Montana Department of State Lands. The MDFWP does not allow livestock grazing on the Blackleaf Wildlife Management Area.

These are the animal-unit-months (AUMs) permitted by each agency:

Agency	AUMs
FS (Lewis & Clark NF)	1,188
Montana State Lands	433
BLM	291
Total	1,912

The Chicken Coulee Allotment Management Plan (AMP) is managed jointly by the Bureau of Land Management and Lewis and Clark National Forest and was first implemented in 1974. The management objectives of the plan are to improve the condition of the rangeland, wildlife habitat (emphasis on grizzly bear and mountain sheep) and watershed condition. Rangeland improvements such as fences, spring development and pipelines and livestock exclosures (to establish riparian grizzly habitat and protect spring developments) have been installed to manage livestock grazing.

Both the FS and BLM have invested rangeland improvement money in this AMP. Currently a four pasture rest rotation grazing system is in effect, allowing each pasture in alternate years complete rest during the growing season. Approximately 233 cow-calf pairs are grazed each year in the remaining three pastures for the period of July 1 through

September 30. Since the plan was implemented in 1974, range studies have shown an improvement in ecological condition of the vegetation.

Appendix K details the Chicken Coulee AMP and the allotments administered solely by the FS.

WILDLIFE (Issues: Oil and Gas, Recreation, Wildlife)

The Rocky Mountain Front (RMF) has always been known for its exceptional wildlife values and most recently for its oil and gas potential. Resource managers saw the possible conflicts between oil and gas development and wildlife, so in 1980, an Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program was initiated. A principal goal of this program was to sponsor study efforts whereby wildlife management guidelines, based on sound scientific findings, could be developed to aid land managers in their planning of human activities along the RMF. Guidelines have been used as developed and approved and were eventually printed and distributed (BLM et al. 1987). Hereafter, this document will be referred to as the Guidelines.

This interagency effort initiated baseline studies on mule deer, elk, bighorn sheep, Rocky Mountain goat, grizzly bear and raptors. In addition, numerous studies on most of these species had been undertaken previous to the formation of the interagency group and are available as a data base. The Montana Department of Fish, Wildlife and Parks (MDFWP) also conducts yearly population, habitat, and harvest trend studies on the RMF for those species that are hunted. Figure 2.10 in Chapter 2 shows the specific seasons of use for these species.

Concurrent with the interagency monitoring program was the development of a cumulative effects model to facilitate computer analysis of impacts to the threatened grizzly bear from man's activities (Forest Service et al. 1986). Data is displayed by a Geographic Information System (GIS). Appendix G defines this modeling process in greater detail. The biological/geographical boundary for this system is the Bear Management Unit (BMU). The EIS area lies within the Birch/Teton BMU, which consists of 322 square miles.

Aquatic Environment

Fisheries are limited along the RMF because most drainages scour so severely during spring runoff that bottom organisms are not plentiful and streamside vegetation has been destroyed. Also, many of these streams dry up in the late summer and those that don't, often exhibit poor water quality and high temperatures in their lower reaches.

However, there are trout fisheries (cutthroat, brook and rainbow) and mountain whitefish in most of the perennial creeks in the EIS area (see Table 3.1 and Figure 3.3) (Bill Hill, MDFWP, personal communication). The native cutthroat, commonly called the Upper Missouri River cutthroat or westslope cutthroat, is listed by the State of Montana as being of special interest or concern, and listed by Region 1 of the Forest Service as a sensitive species. In addition, rainbow trout have been planted in Ostle Reservoir which lies on the south side of Antelope Butte.

Beaver activity is evident in some drainages, including the Antelope Butte swamp proper. Other furbearers found in these habitats include the muskrat and mink.

Limited waterfowl production occurs in Antelope Butte Swamp and other pothole areas along the eastern portions

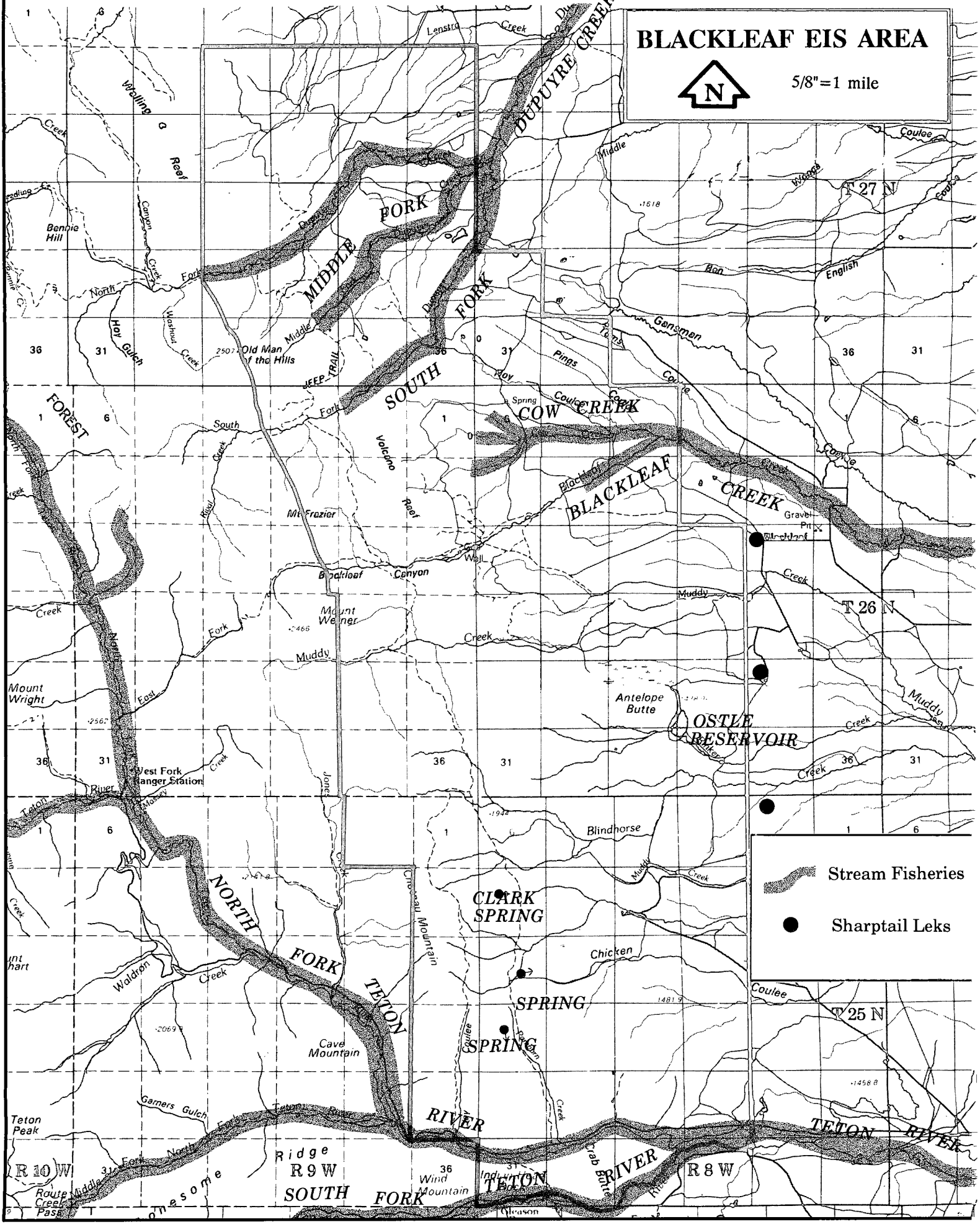
TABLE 3.1

EXISTING FISHERIES SPECIES IN THE BLACKLEAF/TETON EIS AREA[1]

Location	Cutthroat	Brook	Rainbow	Mountain Whitefish
Dupuyer Creek		X	X	X
No. Fk. Dupuyer Creek	X	X		
So. Fk. Dupuyer Creek	X	X (below falls)		
Middle Fk. Dupuyer Creek	X			
Cow Creek	X	X (on lower end)		
Blackleaf Creek		X		
Teton River	X	X	X	X
Ostle Reservoir			X	

[1]BLM, 1989

Figure 3.3 Known Stream Fisheries and Sharptail Grouse Leks.



of the EIS area. No waterfowl inventories have been undertaken, but casual observation indicates that teal, mallards and shovelers are the most common nesters.

Upland Game Birds

Three species of forest grouse (blue, ruffed and spruce grouse) are common to the EIS area, but no specific studies have been undertaken to document their abundance or habitat preferences. Research from other areas (Mussehl et al. 1971) indicates the habitats existing along the RMF would be used by all three grouse species throughout the year. It is especially important to blue grouse in the spring, as they winter at high elevations, but descend in early spring to semi-open timber for breeding and brood raising. Ruffed grouse prefer the dense cover of mixed conifer and deciduous trees and brush which are common throughout the riparian areas of the RMF, especially where the mountains meet the prairie.

In addition, there is one specie of prairie grouse (sharp-tailed grouse) inhabiting the EIS area. They are common to the area, and three "leks" (breeding/dancing grounds) have been located (see Figure 3.3). It would not be uncommon to see Hungarian partridge near the prairie/agricultural borders, or even an occasional ringnecked pheasant in the riparian/agricultural areas, but neither bird nor preferred habitat is prevalent in the area.

Mule Deer

Mule deer are the most numerous big game animal on the RMF and this area is considered one of the most important mule deer wintering areas in the state, as evidenced by the large number of deer wintering here (see Table 3.2 and Figure 3.4).

TABLE 3.2

MULE DEER WINTER RANGES[1]

Location	Total Winter Range km2	Primary Winter Range km2	Numbers Year of Survey 1980[2]/1986[3]	Numbers/km2
Scoffin Butte[2]	16.8	10.2	800-1,000/600	47.7-59.6[2]
Dupuyer Creek[2]	31.7	13.4	900-1,100/250	28.4-34.7[2]
Blackleaf-Teton[2]	73.4	20.9	400-500/450	5.5-6.8[2]
Swanson Ridges[4]	29.2	0.0	0-0 /300	0.0-0.0
Total	151.1		2100-2600/1600 less Swanson Ridges	

DEFINITIONS

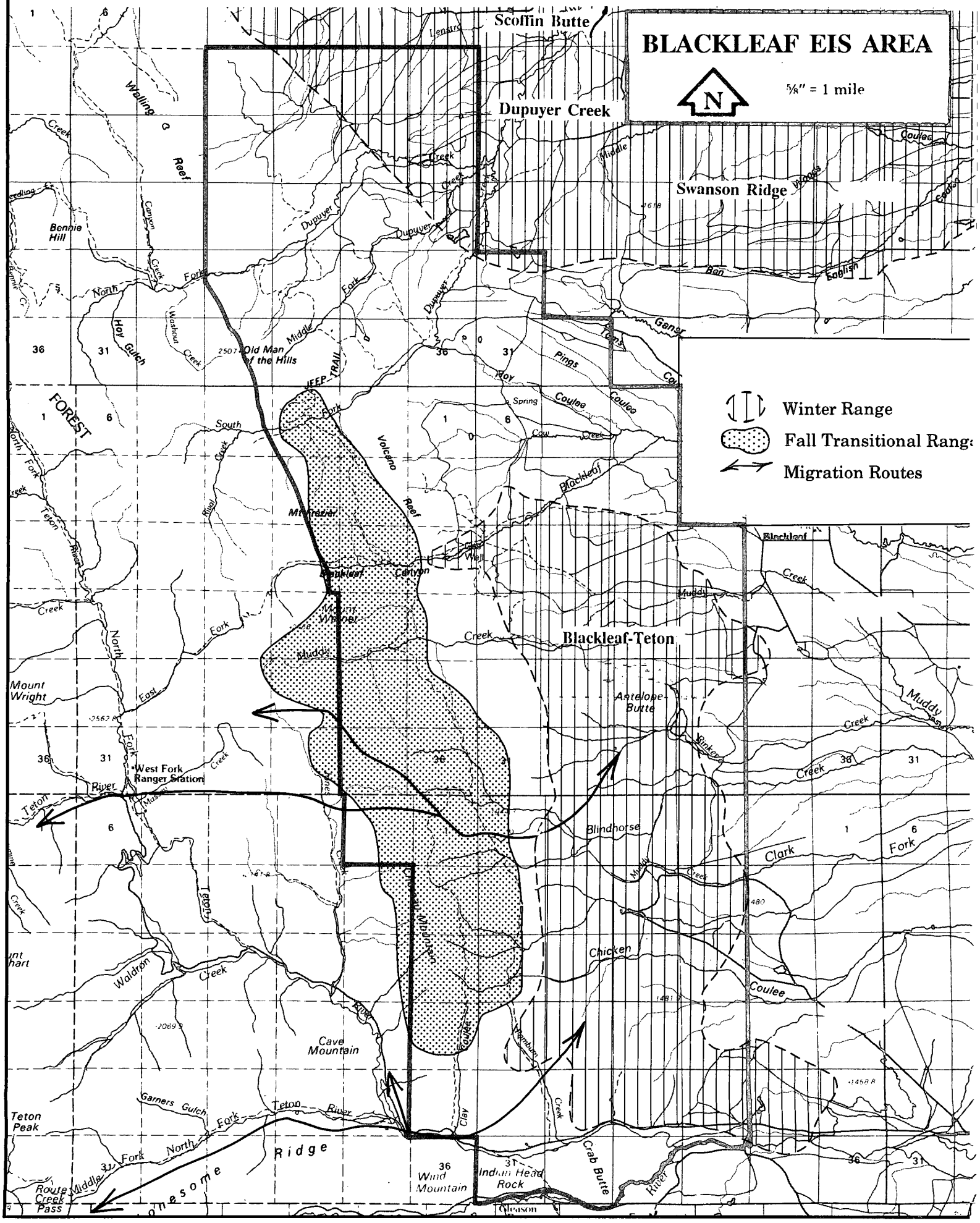
Primary Winter Range: Area where most mule deer are distributed during a "normal" winter; on the East Front this area is generally the lower face and beginning portion of the prairie where the Limber pine savanah is common.

Secondary Winter Range: The area that is usually adjacent to primary winter range but receives noticeably less use by mule deer during the "normal" winter; however, these areas often receive considerable use by deer in the spring. These areas are generally further from timber cover than primary winter range areas.

Total Winter Range: Primary and secondary winter range combined.

[1] *BLM/MDFWP, 1989*
[2] *Data from Kasworm, 1981*
[3] *Data from Olson (Personal Communication), 1986*
[4] *Data from Olson, 1984*

Figure 3.4 Mule Deer Winter Ranges Associated with the Blackleaf EIS Area.



Six primary and secondary winter ranges have been described along the RMF and associated transition ranges have also been described. Of these winter ranges, portions of three (Blackleaf-Teton, Dupuyer Creek and Scoffin Butte) lie within or nearby the EIS area (Kasworm 1981). A fourth range, Swanson Ridges, is occupied at moderate to high mule deer population levels (Olson 1984). The size of winter ranges and estimated population numbers and densities are given on Table 3.2. The number of mule deer wintering on each of the four winter ranges varies from year to year. A 1986 survey (Olson MDFWP, personal communication) revealed fewer deer than in previous years (see Table 3.2).

Important characteristics of highly used winter ranges, as compared to adjacent low use areas, are that winter ranges are consistently lower in elevation, have a wider availability of aspect classes, and have a greater percentage of the total land surface in moderate and steep slope categories. Although analyses are still incomplete, high density winter ranges appear to differ from low density winter ranges primarily in elevation. High density winter ranges are situated in areas that allow mule deer to move to relatively low elevations and still find broken terrain, favorable cover conditions, and aspect/slope configurations that promote snow melt during chinook conditions (Olson 1984). Important cover and forage areas identified on winter range include the habitat types of limber pine/rough fescue (*Pinus flexilis/Festuca scabrella*) and limber pine/juniper (*P. flexilis/Juniperus sp.*). The use of winter range feeding sites increases when these two habitat types are near the shrubby cinquefoil/rough fescue, rough fescue/Idaho fescue, rough fescue/bluebunch wheatgrass, big sagebrush/rough fescue, wet meadow riparian and swamp habitat types.

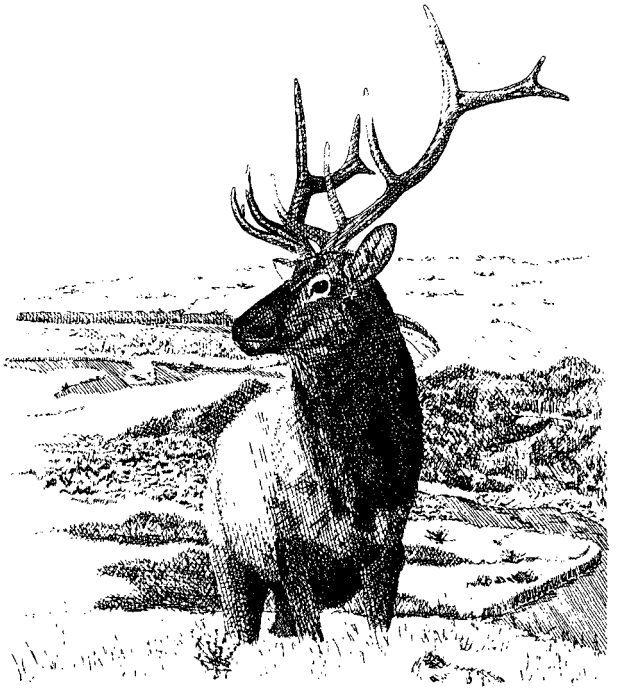
Additional information from mule deer monitoring studies on the RMF is available in two theses (Kasworm 1981) (Ihsle 1982), four annual reports to the BLM (Kasworm and Irby 1979) (Kasworm et al. 1980) (Mackie and Irby 1982) (Irby and Mackie 1983), a MDFWP report to the FS (Hook et al. 1982), and numerous MDFWP Job Progress Reports. The most recent summary of mule deer ecology on the Front is contained in Ihsle-Pac, et al. 1988.

White-tailed Deer

No specific inventories or research has been initiated for white-tailed deer on the RMF. However, healthy populations do exist within riparian areas including river corridors and swampy areas. Antelope Butte Swamp in the central portion of the EIS area is an important whitetail area. In addition, all forks of Dupuyer Creek, Cow Creek, Blackleaf Creek, Blind Horse Creek, and Pamburn Creek are whitetail concentration areas.

Rocky Mountain Elk

Depending on the severity of the winter, approximately 180 elk winter in and adjacent to the EIS area (see Figure 3.5) (Olson 1986, MDFWP, personal communication). Radio telemetry research indicates that during abnormally mild winters, some elk choose to remain on summer ranges in the upper reaches of the Middle Fork of the Flathead River, some 20 air miles to the west of the Continental Divide. Elk that migrate west of the Divide to the Flathead drainage probably make up 50-60% of the expected total on the winter range. The number of wintering elk in the EIS area therefore, may vary from winter to winter.



Radio telemetry research has shown that two major herds winter in and adjacent to the EIS area. One segment remains in the Cow Creek-Scoffin Creek drainages and numbers approximately 100-120 animals. The other herd can be found on the Blackleaf Wildlife Management Area and consists of approximately 60-80 elk. Collared elk in one herd unit have not been observed on the other unit, so it is apparent that there is no, or very little overlap between these herds during the wintering period (based on observation and telemetry data).

More recently, winter/spring inventories conducted in 1989 yielded an estimated population of 325 elk. It appears that the total elk herd is increasing (Olsen, 1989, MDFWP, personal communication).

Elk in the EIS area migrate to several different summer ranges; a portion of the herd travels northward to the Badger-Two Medicine drainages, some are found in the Middle Fork Flathead drainage, others stay on the east side of the Divide at higher elevations, and some are known to be permanent residents of the Front. Migration corridors include the Blackleaf, South Fork Dupuyer, North Fork Dupuyer and Birch Creek Canyons.

Calving areas include the entire EIS area from Dupuyer Creek to the Teton River, and calving is known to occur near Twin Lakes, on the Blackleaf Wildlife Management Area, Cow Creek, and all forks of Dupuyer Creek. No definite perimeters can be drawn around the calving grounds due to lack of intensive research, but the most probable grounds are shown on Figure 3.5.

In general, most of the migratory animals are on the winter range by January 1, although herd units often seem to form in early December. Elk are commonly seen along the Front until May 15.

Bighorn Sheep

Three bighorn sheep population units have been identified in the EIS area; Ear Mountain, Choteau Mountain and Walling Reef (Andryk 1983). The last two lie within the EIS area. The Walling Reef population appears to be expanding its range to the north, south and west. It was started from a transplant of 37 sheep from the Sun River in March 1976. The Ear Mountain unit seems to be expanding north and west, and it is undetermined whether the Choteau Mountain unit (a product of expansion by the other two units) is expanding.

Bighorn winter ranges and lambing areas are shown on Figure 3.6 (Andryk 1983).

Population estimates for Ear Mountain, Choteau Mountain, and Walling Reef herd units were made in August 1982, and January 1983, and averaged 100, 35 and 70 bighorns respectively.

Important winter-spring habitat components include; open grassland and old burn cover types with elevations of 5035 to 5537 feet, which are less than 300 feet from rocky terrain (escape cover).

Important summer and fall habitat components include open rocky bluff and cliff sites, and elevations of 6640 to 8050 feet. Timbered sites are also used during fall. Grass-forb communities appear to be of lesser importance on summer ranges than on winter-spring ranges (Andryk 1983).

Additional distribution and habitat information about bighorn sheep can be found in several sources including (Erickson 1972), (Frisina 1974), (Andryk 1983), (Hook 1984) and the Interagency Rocky Mountain Front Wildlife Guidelines (BLM et al. 1987).

Rocky Mountain Goat

The RMF range contains one of the largest contiguous populations of mountain goats in the state. Studies conducted for the mountain goat portion of the Interagency RMF studies concluded that mountain goat distribution and population numbers have diminished since the 1950s (Joslin 1986). An important segment of this overall population occurs in the EIS area and its population trend was also down. This segment is called the Teton-Dupuyer herd (see Figure 3.7) and population estimates range from 53 to 113 mountain goats, or in other words, one goat per 1 to 2 square miles in occupied habitat (Joslin 1986).

Mountain goat habitats have been classified as occupied yearlong (includes both summer and winter seasons), suitable low occupancy and transitional. Kidding-nursery and breeding areas have been delineated within occupied yearlong habitats and mineral lick locations have been plotted (Figure 3.7). Concentration areas, or samples of areas where goats were consistently observed have also been defined (Joslin 1986).

Figure 3.5 Elk Habitat in the Blackleaf EIS Area.

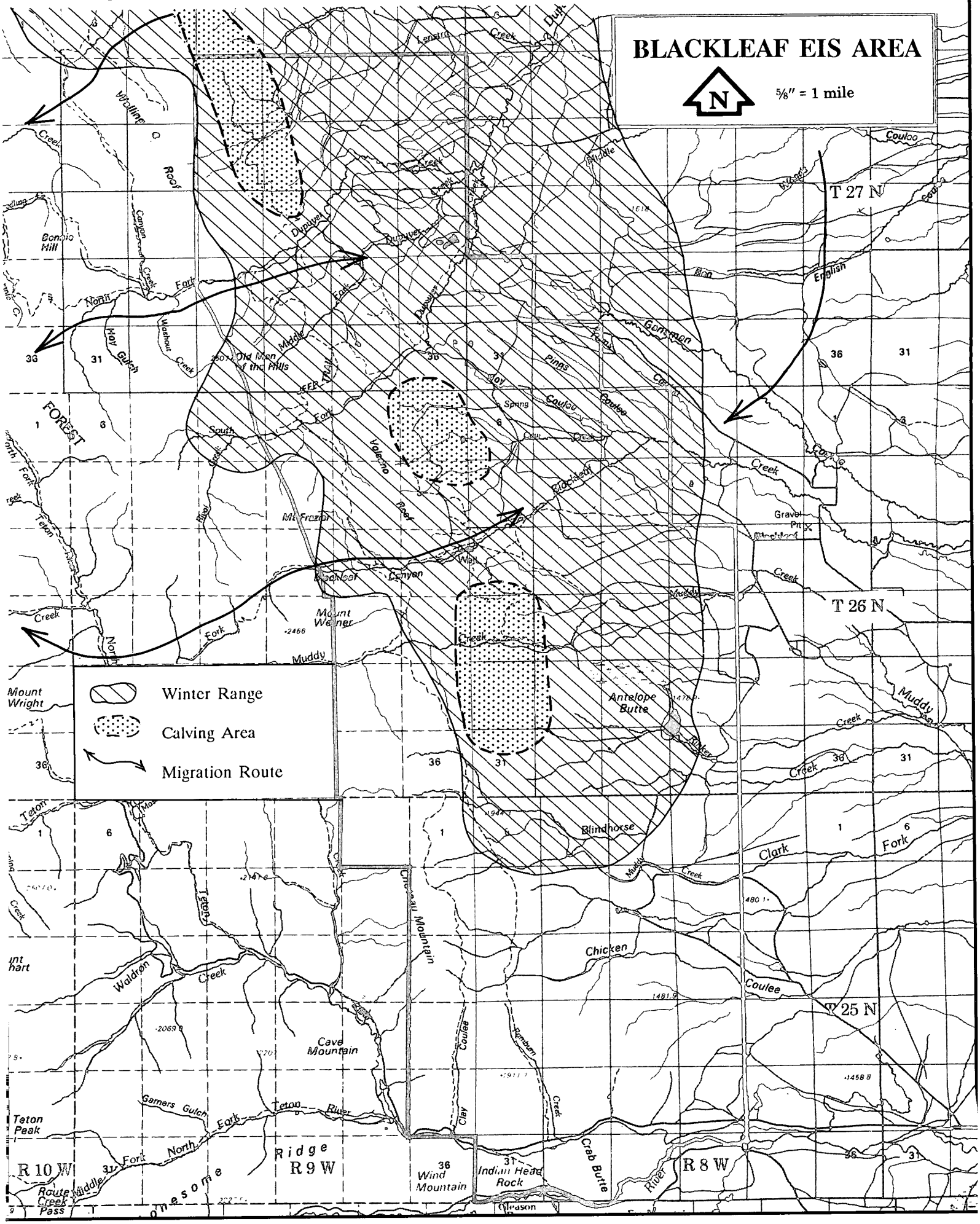


Figure 3.6 Bighorn Sheep Habitat in the Blackleaf EIS Area.

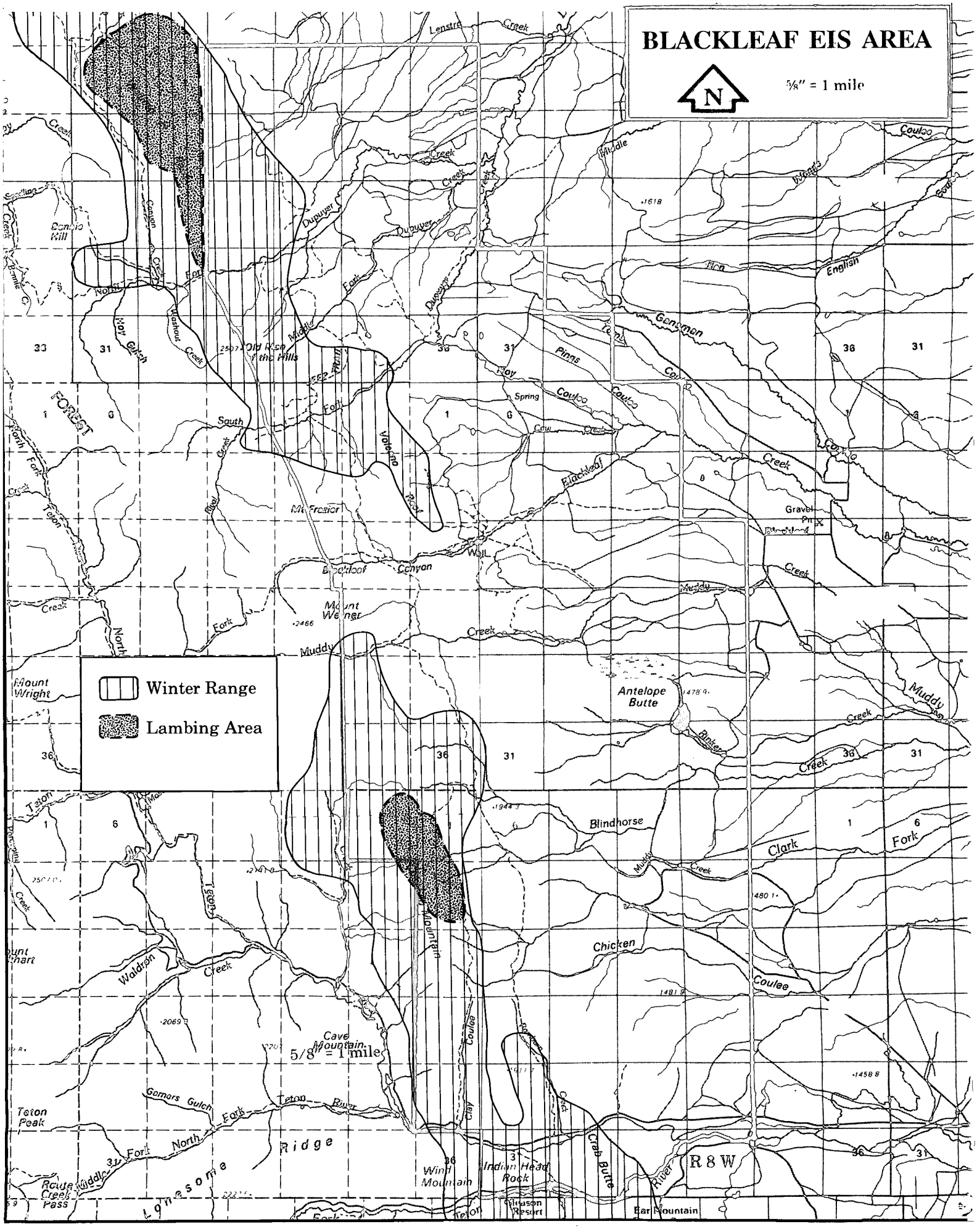
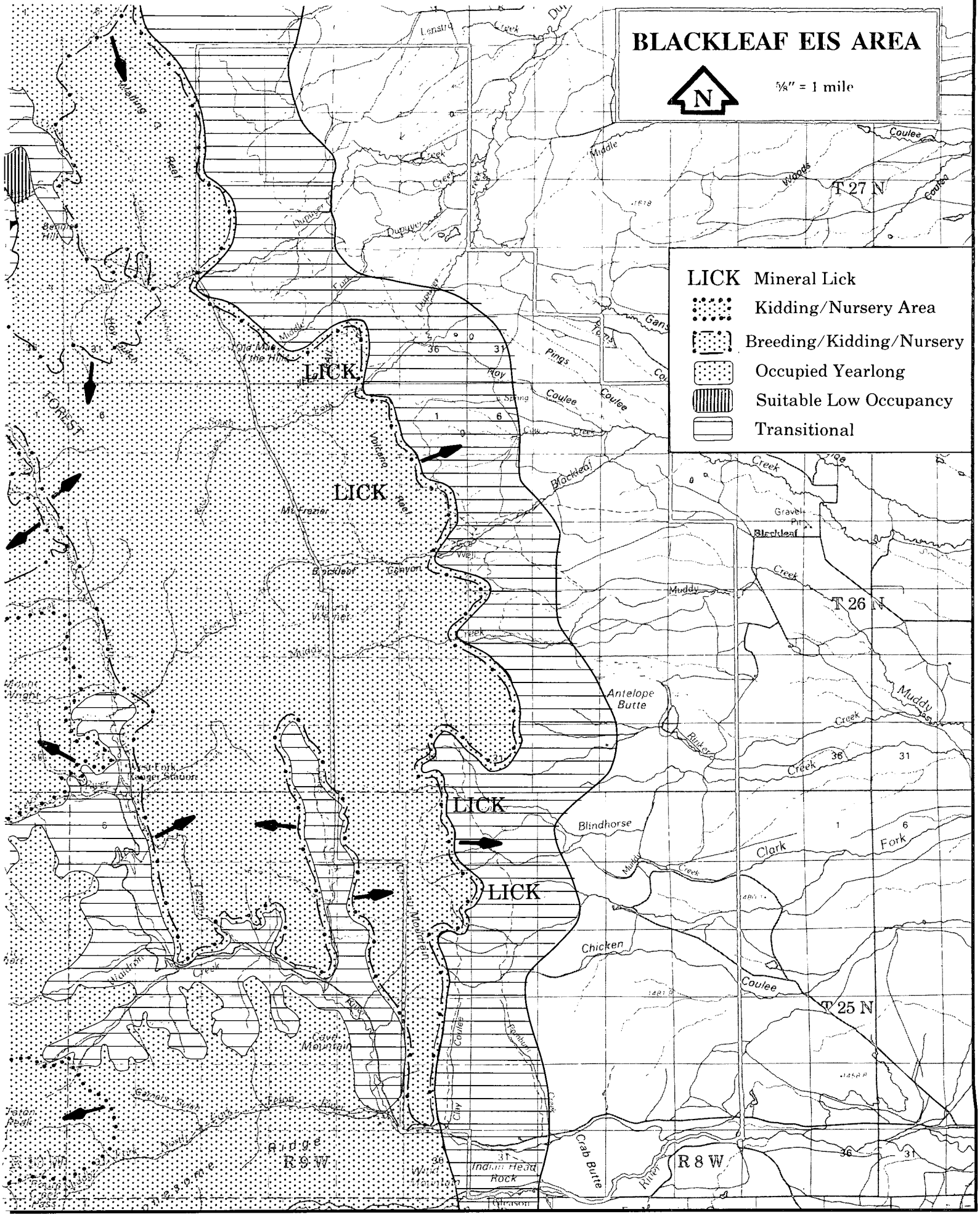


Figure 3.7 Mountain Goats in the Blackleaf EIS Area.



Most of the environmental features conducive to preferred mountain goat habitat occur in the western portion of the EIS area. Slopes greater than 70% and elevations over 7,000 feet are preferred however, discrepancies in the perception of what constitutes mountain goat habitat can occur (Joslin 1986).

Mineral licks within the EIS area (see Figure 3.7) are more than simply locations where goats congregate to lick salt. They are important physiographic features which influence the home range size and configuration of each goat using the area. For example, the Blackleaf mineral lick influenced the movements and home ranges of all 34 marked mountain goats in the Teton-Dupuyer segment. Extreme care should be exercised when managing man's activities near mineral licks (Joslin 1986).

Black Bear

Black bear distributions developed from radio locations, trappings, and sightings are shown on Figure 3.8. As evidenced by this figure, the EIS area is important to black bear during all seasons (Aune et al. 1986). Riparian areas such as Antelope Butte Swamp plus the diverse habitats found along the face of the Front are of high value to black bear.

Mountain Lion

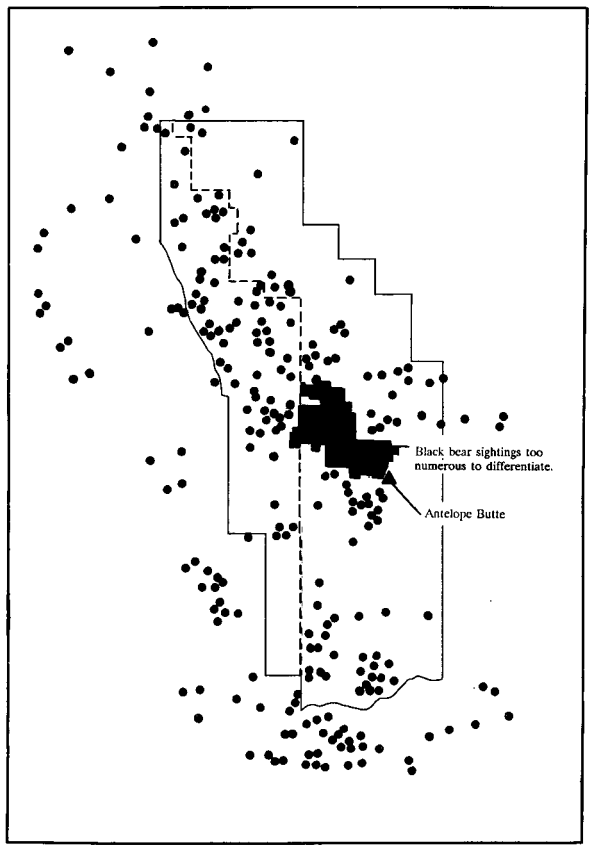
Lions occur along the RMF, as they do in most places in Montana where mountain-foothill mule deer winter ranges are prevalent. Population densities have not been determined.

Furbearers

Bobcat, pine marten and wolverine are the principle furbearers that may occur in the EIS area. Bobcats have been observed using Antelope Butte Swamp, but their relative abundance is unknown. Lynx may also occur, however neither thick stands of lodgepole pine nor large populations of snowshoe hare occur, which may indicate the area is not especially suitable for lynx (Koehler et al. 1979).

Wolverines occupy large seasonal and yearly ranges in northwestern Montana and prefer mature and intermediate timber stands for cover in association with carrion or prey areas such as cliffs, slides, blowdown, basins, swamp and meadows (Hornocker and Hash 1981). These habitats do occur on the RMF, however they probably function as

Figure 3.8 Black Bear Distribution in the Blackleaf EIS Area as Represented by Observational Data Collected from 1976-198(



Enlargement of Figure 36. of the East Front Grizzly Bear Studies; Aune K. & B. Brannon 1987 showing only the Blackleaf EIS Area.
(note: there is no differentiation in sighting season.)

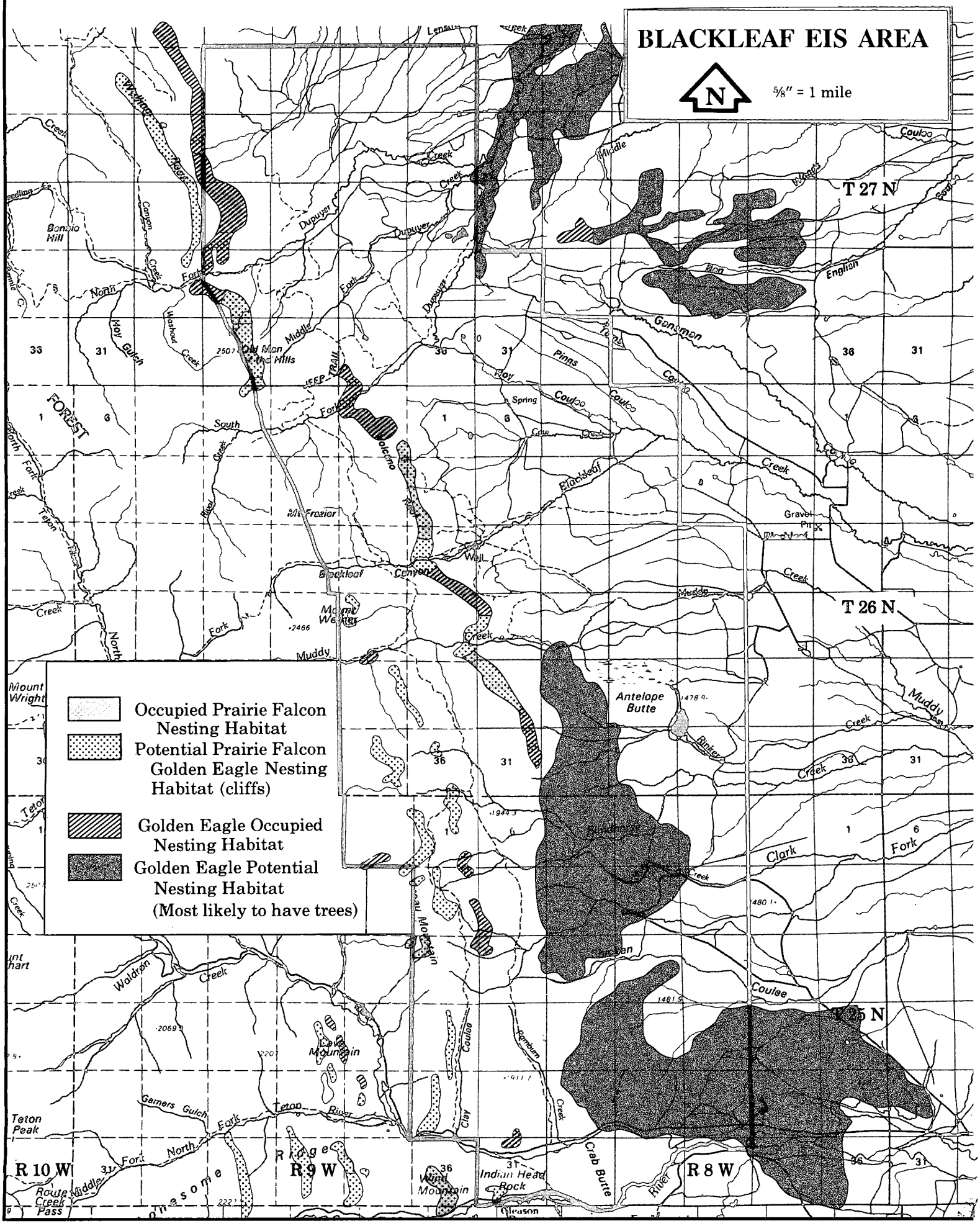
buffers to the vast expanses of wilderness to the west which are necessary for wolverine survival and not as key wolverine habitat. Wolverine tracks were recorded twice, in 1990, in the North Fork of Dupuyer Creek.

Raptors

Golden eagle, northern harrier, prairie falcon, Swainson's hawk, red-tailed hawk and American kestrel are the most common diurnal species using the EIS area. Goshawk nesting territories were not located by Dubois (1984) within the EIS area. The great horned owl and northern saw-whet owl are the most common nocturnal species (Dubois 1984).

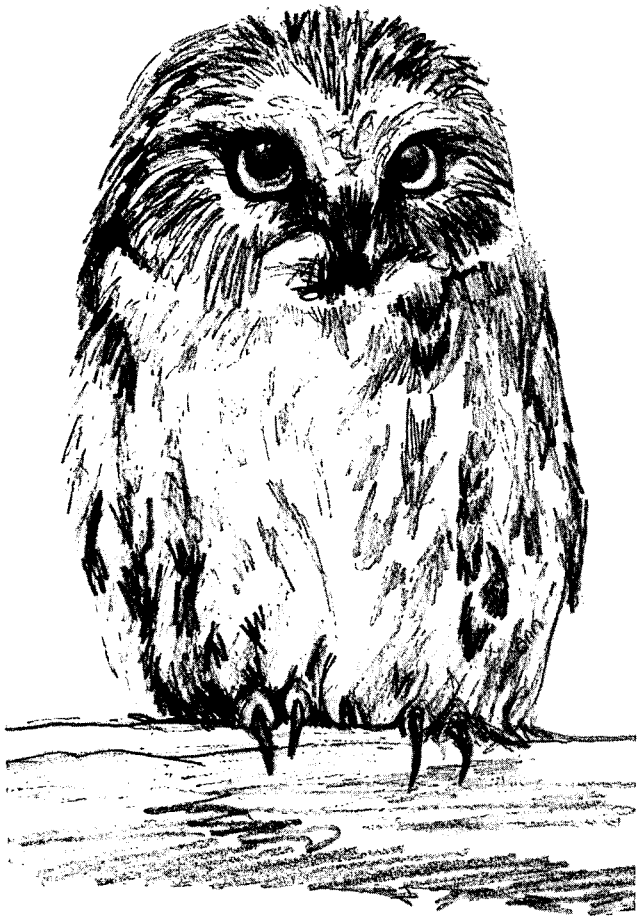
Cliff and riparian habitats are the most important nesting habitats for these species. Important habitat delineations for

Figure 3.9 Prairie Falcon and Golden Eagle Cliff Nesting Habitats found in the Blackleaf EIS Area.



the two most common raptors (prairie falcon and golden eagle) are shown on Figure 3.9. Eighteen prairie falcon nests and 19 golden eagle nests have been identified on National Forest lands.

Figure 3.10 shows the bald eagle winter concentration areas and potential peregrine falcon nesting areas.



Other Species

Numerous small mammals and birds occupy the variety of mountainous, prairie and snag habitats found in the EIS area, but species specific information is limited. However, species listings do exist and include Flath 1984, Skaar 1985, a list made by Kristi Dubois during her raptor study and filed at the BLM Great Falls Resource Area, and a listing provided for the RMF counties by the Montana Natural Heritage Program in 1986.

THREATENED OR ENDANGERED WILDLIFE SPECIES

Four wildlife species classified as threatened or endangered under the Endangered Species Act of 1973 (50 CFR 402, 43 CFR 870) occur in the EIS area. They are the threatened grizzly bear and endangered gray wolf, bald eagle and peregrine falcon.

Grizzly Bear

The grizzly bear of the RMF thrives on the transitional edge between the grassland shrub habitat type and the mountainous forest habitats. This area serves as the last plains habitat occupied by grizzlies. This edge contains habitat components important to the grizzly during all seasons, except for the winter denning period. The EIS area encompasses much of this transitional edge. The riparian types such as those occurring in the Antelope Butte Swamp are key foraging and security areas. Figure 3.11 shows the spring seasonal constituent element, of critical importance to the grizzly as well as denning habitat (Aune 1987 and Brannon). Figure 3.12 shows this element in relation to grizzly bear distribution from observations between 1980 and 1987.

Population estimates of grizzly bears on the RMF portion of the Northern Continental Divide Ecosystem range from 62-93 bears. This figure does not include the Badger-Two Medicine Unit, which is estimated to contain an additional 16-20 individuals (Dood et al. 1986). The 322 square mile bear management unit (BMU) and the EIS area probably support three breeding age females and a total population of 21 grizzlies. A much more in-depth discussion of grizzly bear biology is given in the Biological Evaluation/Biological Opinion (see Appendix L).

Figure 3.9 Prairie Falcon and Golden Eagle Cliff Nesting Habitats found in the Blackleaf EIS Area.

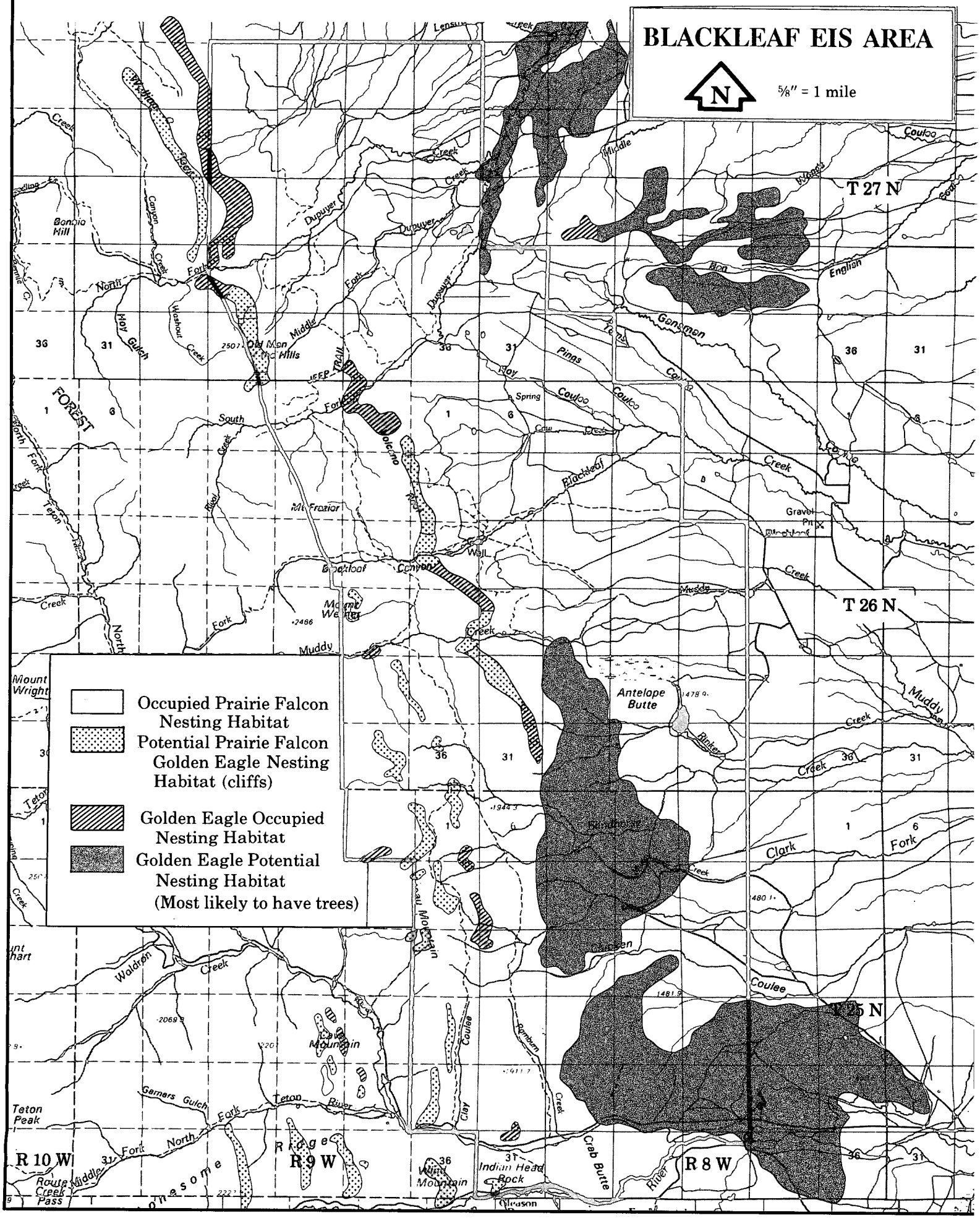


Figure 3.10 Threatened and Endangered Species.

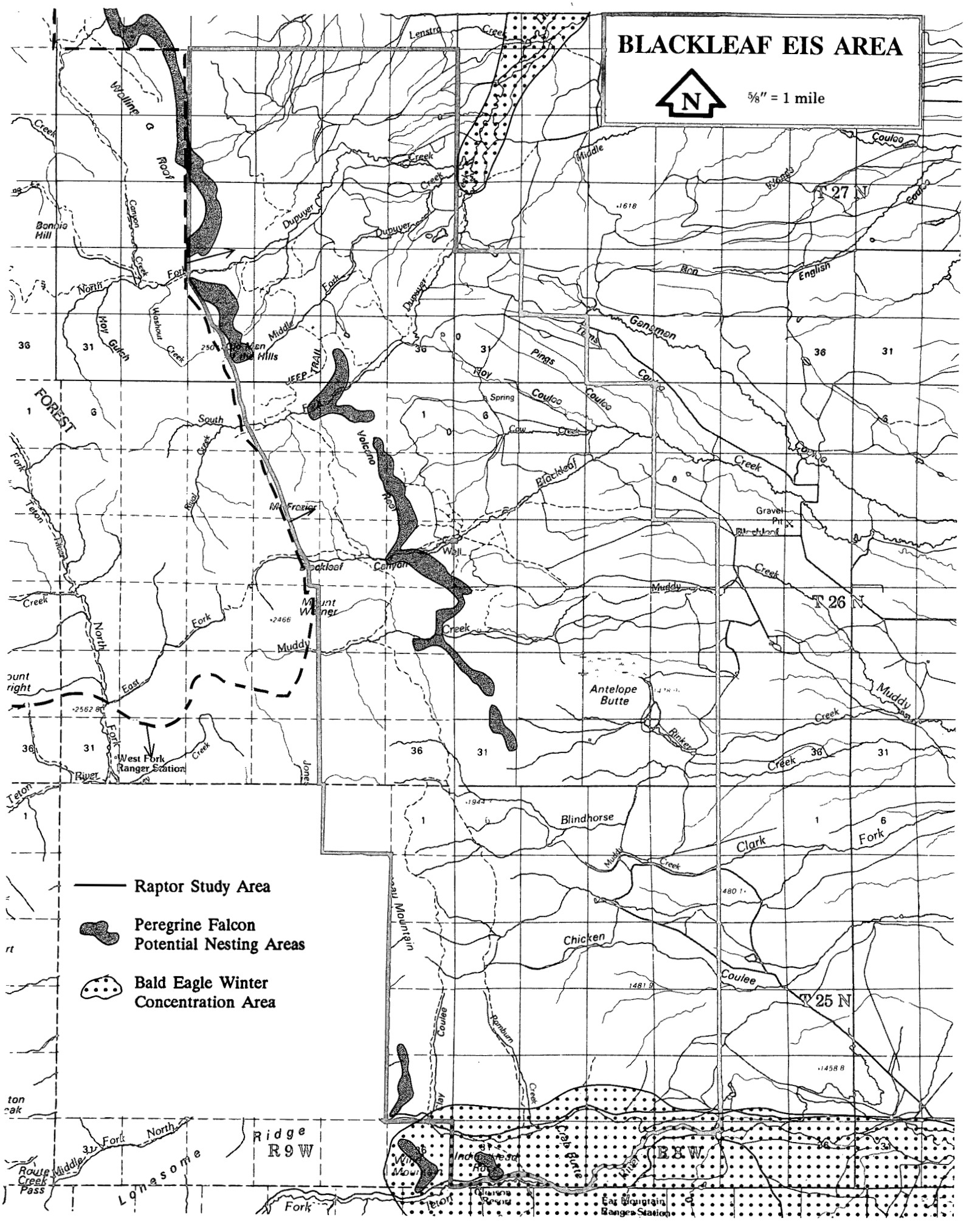


Figure 3.11 Grizzly Bear Spring and Denning Habitat in the Blackleaf EIS Area.

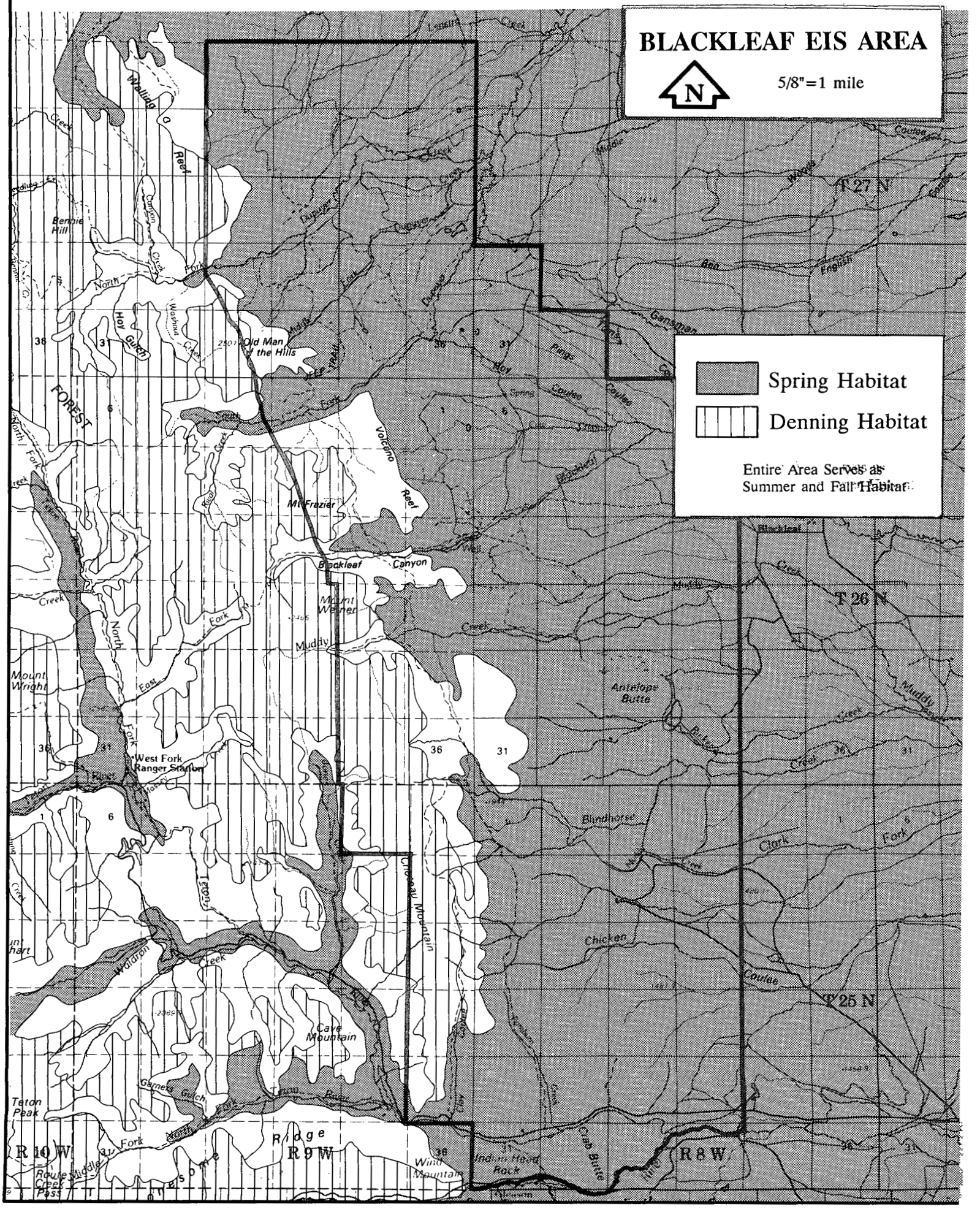
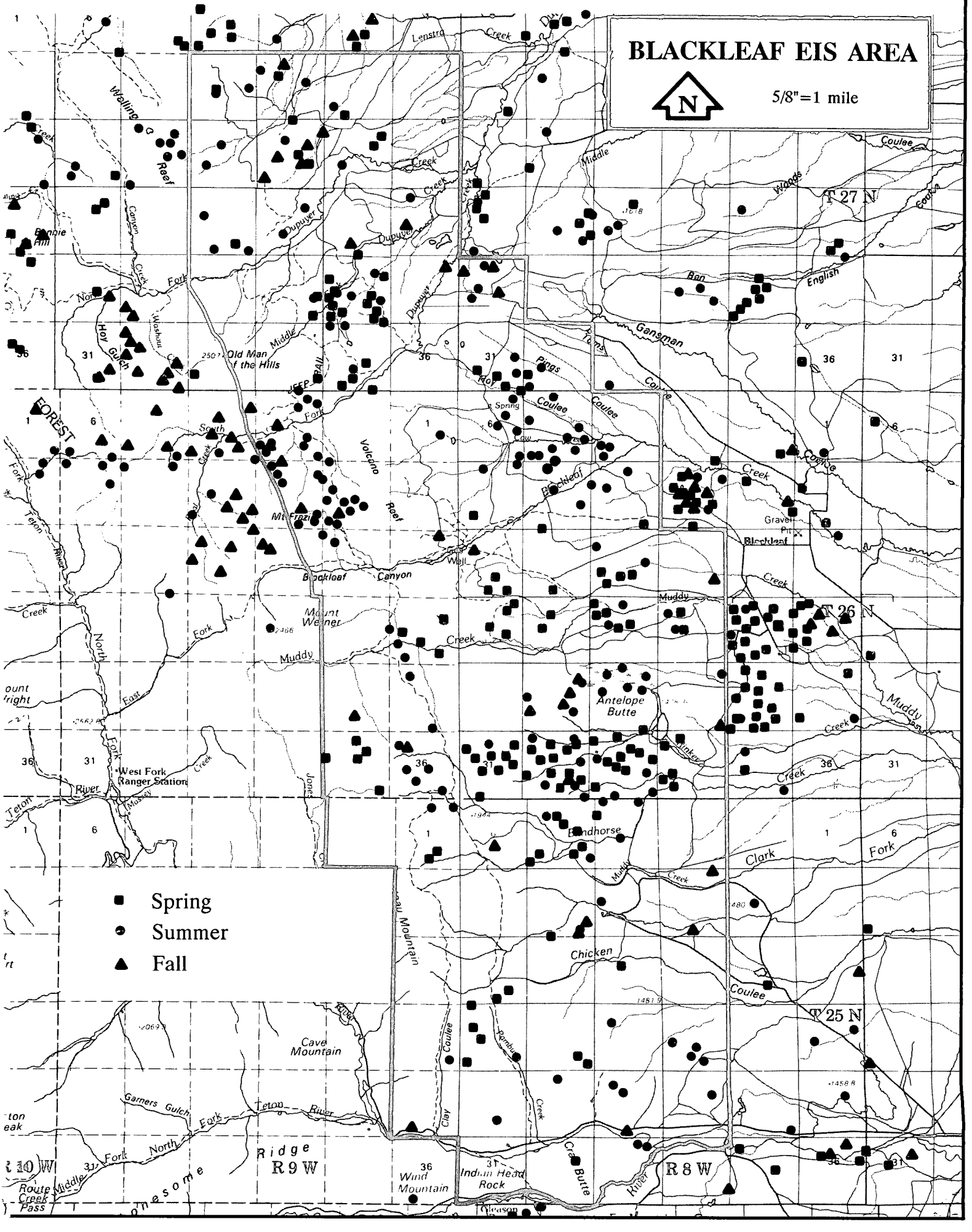


Figure 3.12. Grizzly Bear Distribution 1980-1987 in the Blackleaf EIS Area.



Studies of the grizzly bear on the RMF began as early as 1974 and have continued until the present (Schallenberger, 1974, 1976, 1977; Schallenberger and Jonkel, 1978, 1979, 1979a, and 1980; Aune and Stivers, 1981, 1982, 1983, 1985; Aune, Stivers and Madel, 1984; Aune, 1985; Aune, Madel and Hunt 1986; Aune and Bronnon 1987; and Aune 1989).

Gray Wolf

The Wolf Ecology Project, University of Montana (Mattson and Ream 1978) has gathered wolf occurrence information on the Rocky Mountain Front. Most wolf observations were made prior to that project but with the recent advent of the "magic pack" in Glacier National Park (Robbins 1986, Ream et al. 1985, Ream 1985) it does appear that significant occupation by wolves down the Rocky Mountain Front could become a reality. Recent efforts by Forest Service personnel have revealed wolf use in the Dupuyer Creek area. Surveys completed in 1990 showed the area being used by a pack of five wolves. In 1991, the area is still being used by a pack of at least three wolves. The Rocky Mountain Front is excellent wolf habitat because of its large number of ungulate winter/spring ranges and because of the large expanse of wilderness (Bob Marshall Wilderness Complex) behind it. A more in-depth discussion concerning wolf recovery is given in the Biological Evaluation/ Biological Opinion (see Appendix L).

Peregrine Falcon

No nesting peregrine falcons are known along the RMF, however the area does offer suitable cliff habitat, should reintroduction of captive bred young birds be pursued (Dubois 1983). The best peregrine habitats are those cliffs which are close (within 3.0 miles) to extensive riparian habitat; over 165 feet in height and 0.6 miles in extent; with numerous nesting ledges; and the majority of the cliff under 7,590 feet elevation (Dubois 1983). Cliffs in the EIS area which meet those requirements include Muddy Creek and Blackleaf Creek Canyons, Rinker Creek, North and South Forks of Dupuyer Creek, and the northern portion of Walling Reef (see Figure 3.10).

A more in depth presentation of peregrines and the RMF is given in the Biological Evaluation/Biological Opinion (see Appendix L).

Bald Eagle

No known bald eagle nest sites have been documented, however bald eagles are present on the RMF from September through April as uncommon winter resident and migrant. Eagle observations are normally south of the EIS area where fisheries and open water are more common (Dubois 1984).

FOREST SERVICE SENSITIVE SPECIES

Western Big-eared Bat

Reel (1989, p. 38-39) displays the distribution of the Western big-eared bat to occur within the EIS area. Their preferred habitat for roosting or hibernaculars are caves and mine tunnels. Occasionally, tree cavities are used for roost sites. The area has not been surveyed to determine the actual presence of the big-eared bat; however, there are some known caves along Volcano Reef that could serve as potential habitat for the bat.

Boreal Owl

The nocturnal species recorded within the Blackleaf EIS area by Dubois (1984) were: great horned owl, short-eared owl, great gray owl, northern saw-whet owl, and western screech-owl. Three other species were recorded by other

observers: snowy owl, burrowing owl, and northern pygmy owl. The boreal owl was not located within the EIS area.

Boreal owls tend to higher elevations (5,000 to 8,000 ft.) within old growth spruce-subalpine fir-lodgepole habitats (Reel, 1989, p. 20). The main area of proposed development lies between the grasslands at 4,700 feet to the first major limestone reef that rises to approximately 6,700 feet. Timber stands that dominate the landscape within this area are young stands of limber pine, Douglas-fir, and lodgepole, with pockets of spruce along the riparian zones. The past fire activity along the limestone reefs have eliminated large stands of old growth forest (based on photo reconnaissance of area). Boreal owls would more likely be present in timber stands towards the western edge of the EIS area (along the second reef from Choteau Mountain to Old Man of the Hills). Recently (March 24, 1991), the boreal owl was recorded in Green Gulch, which is southwest of the EIS area and lies behind the first major reef complex south of the South Fork of the Teton River. This area is more typical of the preferred habitat than the EIS area. Because of absence of preferred habitat in areas of development there will be no further effects analysis completed for the boreal owl.

Ferruginous Hawk

In Dubois's raptor study (1984), ferruginous hawks were present. However, the nest sites were in the eastern half of her study area which lies to the east (outside) of the Blackleaf EIS area. Because of the absence of the ferruginous hawk within the EIS area no effects analysis will be completed.

Harlequin Duck

Surveys for harlequin ducks have been conducted for the past two years (1989, 1990) on the Rocky Mountain Ranger District. Surveys have established the presence and production of harlequin ducks on the District. No harlequins have been located in the Blackleaf EIS area; however, the North and South Forks of Dupuyer Creek may be potential habitat. Bill Hill, MDFWP fisheries biologist, has stated in a personal communication that he has never seen harlequin ducks on these streams during any of his fisheries survey work.

Westslope Cutthroat Trout

Table 3.1 and Figure 3.3 show the known occurrences of westslope cutthroat trout within the EIS area. However, through electrophoresis testing of fisheries it has been determined with 95% confidence that Cow Creek has a pure strain of westslope cutthroat trout present. In order to be 100% confident further testing would be needed. The sampling completed on the North Fork of Dupuyer revealed that the trout sampled were 95% westslope cutthroat trout and 5% rainbow. This degree of hybridization indicates that the trout population is not a pure strain of cutthroat trout.

TETON ROADLESS AREA (Issues: Visual Quality, Recreation)

This section discusses the entire Teton Roadless Area and includes areas outside the EIS area. When this section addresses the Blackleaf-Dupuyer Unit, it is addressing that Unit of the Teton Roadless Area.

Forest Plan Recommendation

The analysis of roadless lands documented in Appendix C of the FEIS for the Lewis and Clark National Forest Plan described each roadless area, the resources and values considered, the alternative land uses studied, and the effects of management under each alternative. Portions of some roadless areas were recommended for inclusion in the National Wilderness Preservation while other areas were assigned various non-wilderness prescriptions.

The proposed natural gas development activities are within the 15,360 acre Blackleaf-Dupuyer Unit of the Teton Roadless Area. Of the 63,133 acres in the Teton Roadless Area, the Forest Plan recommended Wilderness designation for 10,870 acres. The remaining 52,263 acres, including all of the Blackleaf-Dupuyer Unit were assigned to Management Areas E, G, H, and O.

Teton Roadless Area Overview

The Teton Roadless Area is part of the 866,330 acre Bear-Marshall-Scapegoat-Swan Roadless Area (1-485) that surrounds the Great Bear, Bob Marshall, and Scapegoat Wildernesses. The Flathead, Helena, Lewis and Clark, and Lolo National Forests all manage land within the Bear-Marshall-Scapegoat-Swan Roadless Area.

The Teton Roadless Area is a 63,133 acre contiguous parcel of National Forest System lands that contains the headwaters of the Teton, Muddy and Dupuyer Creek drainages. On

the west and north, the Teton Roadless Area boundary is adjacent to the Bob Marshall Wilderness. A series of high peaks (8,000-9,400 ft.) from Walling Reef south to Rocky Mountain define the western and northern boundaries. The Forest boundary and the North and South Fork Teton Roads define the eastern boundary. The Bureau of Land Management, Montana Department of Fish, Wildlife and Parks, and Boone and Crockett Foundation manage most of the lands adjacent to the Teton Roadless Area's eastern boundary. The southern boundary is a rocky divide between the Teton and Deep Creek drainages.

Teton Roadless Area Characteristics and Wilderness Features

The effects of non-wilderness management for the Teton Roadless Area were evaluated in terms of the roadless characteristics and wilderness features listed in the capability discussion of Appendix C, Forest Plan (pages C-11 to C-22). The effects of natural gas development on the Teton Roadless Area are examined with respect to the following six Roadless and Wilderness characteristics (natural integrity, apparent naturalness, remoteness, solitude, special features, and wilderness manageability), "special-values-special-places", and cumulative effects (Our Approach To Effects Analysis, Forest Service, Northern Region, July 1990). Other values found in this area, such as wildlife, are discussed in separate sections. Please refer to the table of contents.

Natural Integrity

Natural integrity is the extent to which long-term ecological processes are intact and operating. Impacts to natural integrity are measured by the presence and magnitude of past and present human activities (e.g. roads, mineral developments, and fire suppression activities).

When observed as a whole, the Teton Roadless Area is relatively free from human-induced changes. The major physical human intrusions to the Teton Roadless Area are 75 miles of trails, 3 trailheads, 15 miles of allotment fence, 4 spring developments, and 1 producing gas well with associated pipeline and separation facilities.

Domestic livestock grazing is permitted on 29,000 acres, including all of the Blackleaf-Dupuyer unit. The short duration of the grazing season on these allotments minimizes impacts to long-term ecological processes.

The most significant human activity affecting the Teton Roadless Area's natural integrity is fire suppression. During the past 70 years, wildfire suppression has altered the vegetation of the area. The historic, natural fire regime created a vegetational mosaic that was dominated by early successional habitats. Subsequent fire suppression increased the amount of area dominated by large, unbroken stands of mature forest.

Apparent Naturalness

"Apparent naturalness" is a landscape that looks natural to most people. Although long-term ecological processes may have been interrupted, the landscape appears to be dominated by the forces of nature. If the landscape has been modified by human activity, the evidence appears to be the result of natural forces.

Except for isolated pockets, all of the Teton Roadless Area meets the Forest Service criteria for apparent naturalness. Outside these pockets, allotment fences and trails would be the only regularly observed products of human disturbance.

Within the Blackleaf-Dupuyer Unit there is a 60-acre pocket in the Blackleaf Canyon that has not retained its apparent naturalness. There is a 1/4-mile stretch of gravel road that bisects this area. At the road's end, is a gas well (1-13), two 10 foot high, 200 barrel capacity condensate tanks, and a building housing separation facilities. This development and the road would be noticed even by the most casual observer.

Remoteness

"Remoteness" is the perceived condition of being secluded and inaccessible." Physical factors that can create "remote" settings include topography and distance from roads.

Numerous steep, high mountains, lack of roads, and low trail density have created remote conditions for virtually all of the Teton Roadless Area. Remote conditions are particularly high in the Blackleaf-Dupuyer Unit. Here, the combination of sheer, limestone reefs and sparsely populated foothills to the east, create the feeling that one is completely separated from modern environs. The perception of remoteness has not been retained in the 60-acre parcel in Blackleaf Canyon.

Solitude

Solitude is a personal, subjective value defined as isolation from the sights, sounds, presence of others, and the developments of man. Indicators of solitude are numbers of

people one may expect to encounter in an area in a day, or the number of parties camped within sight and sound of other visitors.
Rugged terrain, few access roads, and relatively low recreational use provide abundant opportunities for solitude in most of the Teton Roadless Area. Because of light recreational use and limited public access, the Blackleaf-Dupuyer Unit (TA) provides exceptional opportunities for solitude. One exception in this area is the Blackleaf Canyon, where a public road and natural gas facility combine to make the presence of others a common occurrence.

There are several areas (Our Lake, West Fork Teton, and Headquarters Pass) in the Teton Roadless Area that have a high level of recreational activity in the summer. During this season, opportunities for solitude are low in these locations.

Special Features

Special features are those unique geological, biological, ecological, cultural or scenic features that exist in roadless areas. The Teton Roadless Areas contains an abundance of special features. The following discussion includes special features identified by both the Forest Service and the public (see Blackleaf comment file).

There are several "special" scenic/geological features in the Teton Roadless Area. In the southwestern corner of the Roadless Area is Rocky Mountain, the highest peak on the front range between Glacier National Park and central Montana. Several miles north is Our Lake, a frequently visited alpine lake that is known for its scenery and opportunities for mountain goat viewing. The rugged limestone reefs that fringe the eastern border of the Blackleaf-Dupuyer area are frequently cited for their beauty. A waterfall framed by 1,000 foot high, sheer cliffs in the Muddy Creek Canyon has been recognized by both the public and Forest Service for its unique scenic values.

There are several unique plant communities in the Teton Roadless Area that qualify as special features. Our Lake has been nominated by the Montana Nature Conservancy as a Botanical Special Interest Area because of three globally endangered plant species. Clary Coulee, in the Blackleaf-Dupuyer Unit, supports populations of two rare orchid species. The Muddy Creek drainage in the Blackleaf-Dupuyer Unit supports one of the largest stands of old-growth spruce (250 acres) in the Rockies east of the Continental Divide.

There are numerous special features related to wildlife in the Teton Roadless Area. A large (approximately 80) mountain goat population occupies habitat throughout the roadless area and are frequently observed at Our Lake, Headquarters Pass and Volcano Reef. The entire roadless area supports grizzly bears (threatened). In 1989/90, gray wolves (endangered) were sighted in the Blackleaf-Dupuyer Unit and probably continue to use this area. The limestone reefs in the Blackleaf-Dupuyer Unit support a high density of nesting prairie falcons and golden eagles. One special biological feature mentioned in numerous public comments was the diversity of wildlife in the Blackleaf-Dupuyer Unit.

Manageability/Boundaries

The Manageability/Boundaries element relates to the ability of the Forest Service to manage an area to meet size criteria and the five elements discussed above. Changes in the shape of an area influence how it can be managed. If broken into narrow corridors or small islands, many of the six elements may be compromised.

The 63,133 acre Teton Roadless Area contains two "cherry stem" exclusions, the South Fork and North Fork Teton road corridors. The North Fork Teton corridor essentially divides the Teton Roadless Area into north (Blackleaf-Dupuyer) and south (Teton) geographic units. The Bob Marshall Wilderness is adjacent to the entire western boundary of the Teton Roadless Area. The Deep Creek/Reservoir North Roadless Area abuts the Teton Roadless Area's southern boundary. BLM, State and Boone and Crockett Foundation lands lie to the east of the roadless area. The large size of this roadless area and it proximity to wilderness and roadless lands facilitate manageability of the five previously discussed values.

Special Places - Special Values

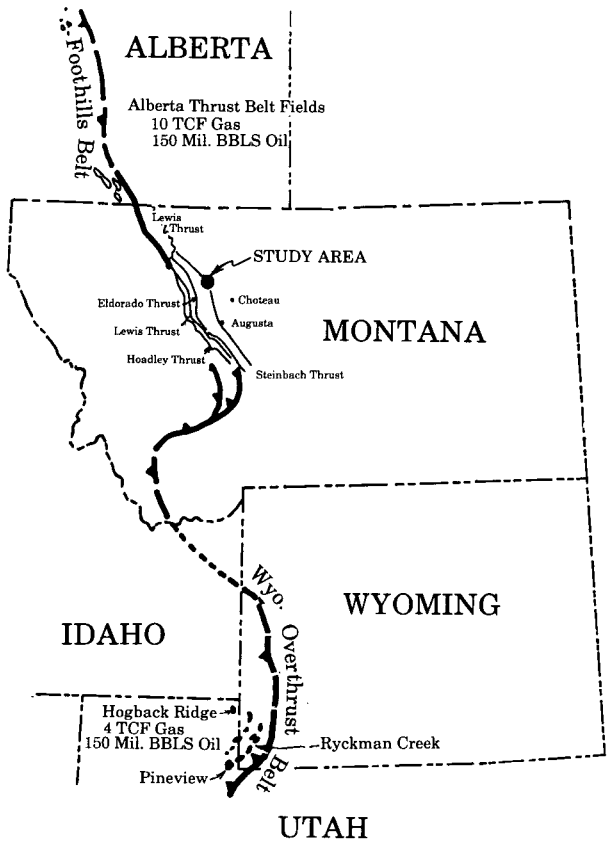
This section addresses those subjective concerns expressed by the public that are difficult to quantify.

Public comments reveal that the Blackleaf area is a special place for many people. According to these comments, the Blackleaf area is special because it is one of the few places left in lower 48 states that combines spectacular scenery, world class wildlife populations, and a "pristine" landscape in a unique geographic locale (the Rocky Mountains/High Plains transition zone). Individually, these attributes would not make the Blackleaf area special for many people. However, when they are combined at one location, a strong emotional attachment is evoked by a large segment of the public.

GEOLOGY (Issue: Oil and Gas Operations)

The Blackleaf EIS area is located on the eastern edge of the Northern Disturbed (Overthrust) Belt. It is a small segment of the Cordilleran thrust and fold belt which extends from western Canada southward through the Western U.S. (see Figure 3.13) (Mudge, 1982). The Overthrust Belt is a zone of north trending, closely spaced, westerly dipping thrust faults on which older sedimentary rock layers were thrust eastward over younger rocks. The movement took place in late Cretaceous through early Tertiary Period (55 million years ago).

Figure 3.13 Location of Overthrust Belt and Relationship to Major Oil and Gas Fields.



Modified from Warne, 1984

The Northern Disturbed Belt is divided into four subbelts based on stratagraphic and structural characteristics (see Figure 3.14) (Mudge 1982). The easternmost is Subbelt I and is equivalent to the eastern part of the Alberta Foothills. It contains westerly dipping thrust faults of small displacement, folds and some transverse faults that repeat Lower and Upper Cretaceous rocks. The nonresistant sandstone and shales form low hills with little relief.

Immediately west of Subbelt I is Subbelt II which includes the Sawtooth Range, Mount Warner and Old Man of the Hills (see Figure 3.14). It contains closely spaced thrust faults of large displacement that repeat Paleozoic and Lower Mesozoic rocks. The Paleozoic age limestones and dolomites form bold rugged northwest trending cliffs. The Mesozoic age sandstones, siltstones and shales form northwest trending valleys.

Further west and out of the EIS area is Subbelt III. It is mostly thrust-faulted and folded Cretaceous rocks that form a broad valley west of the Sawtooth Range, such as the North Fork of the Sun River. Subbelt IV consists of thrust-faulted and folded Proterozoic and Paleozoic sedimentary rocks that have been thrust eastward many miles. They have overridden Subbelts II and III in the northern and southern parts of the Disturbed Belt.

Surface Geology

Devonian through Cretaceous age sedimentary rocks are found on the surface in the Blackleaf EIS area (Mudge, Earhart 1983). They are shown in Figure 3.15 and briefly described in Appendix M.

Structural Geology

The EIS area is located along the leading edge of the Overthrust Belt. The eastern portion of the area is outside the thrust belt and consists of nearly horizontal sedimentary rocks of Cretaceous age. They dip gently to the west.

The east-central portion of the EIS area is within Mudge's Subbelt I, which, on the surface, consists of westerly dipping thrust faults of small displacement and folds that repeat Lower and Upper Cretaceous rocks (Clayton, Jerry, Mudge, Melville, et al. 1982). Surface anticlines are present between the North Fork of Dupuyer Creek and Muddy Creek and in the Antelope Butte area. To the south is the Teton River Anticline, (which is well exposed along the North Fork of the Teton River) and numerous smaller parallel anticlines and synclines. At depth the entire section

Figure 3.14 Northern Disturbed Belt

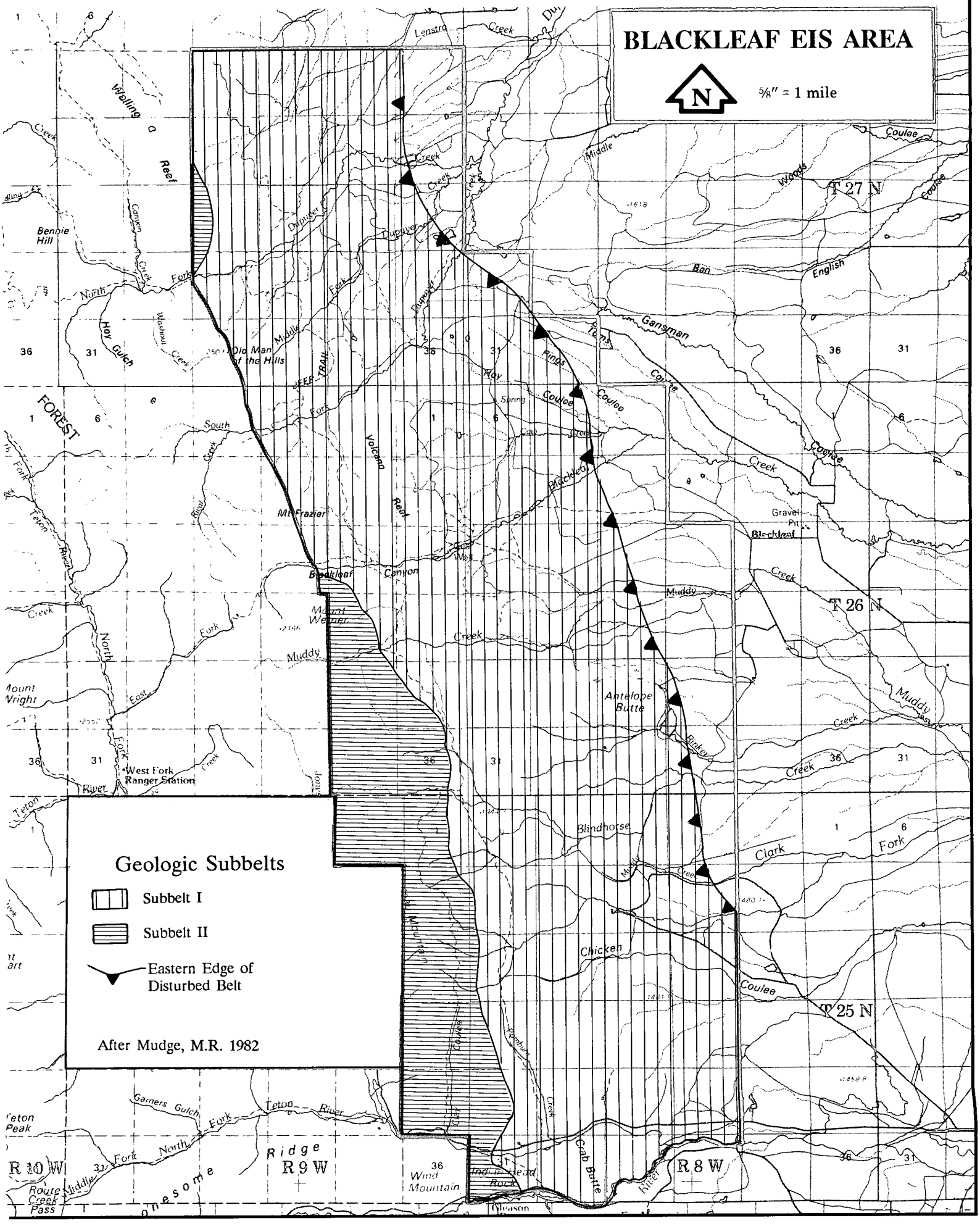
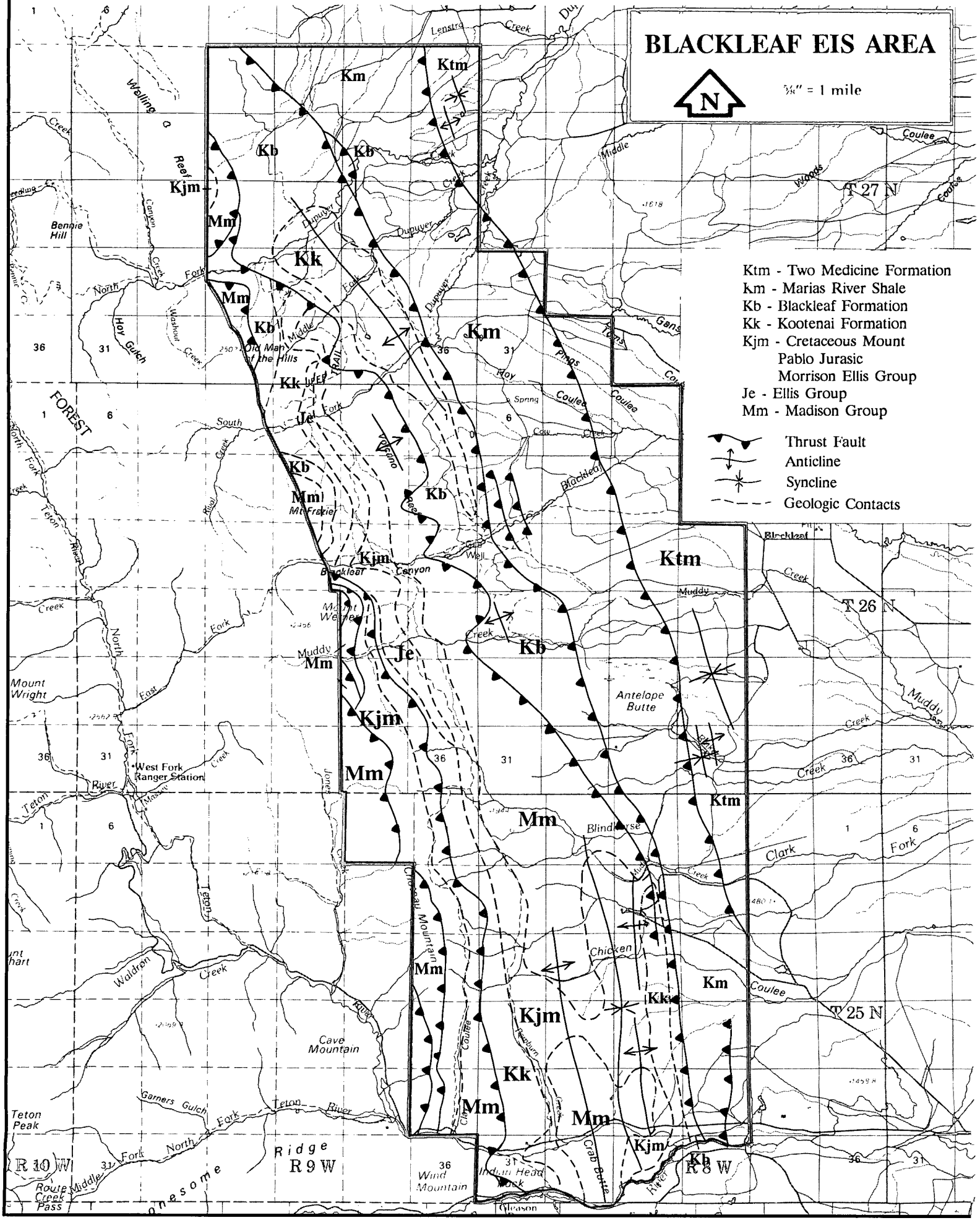


Figure 3.15 Geologic Formations.



from Devonian through Cretaceous is repeated many times by thrust faults.

The western portion of the unit consists of Mudge's Subbelt II. It contains closely spaced thrust faults of large displacement and repeat Paleozoic and Lower Mesozoic rocks. It can generally be described as overlapping Mississippian limestone (Mudge 1983).

OIL AND GAS RESOURCES (Issues: Wildlife, Visual Resources, Air Quality)

All of the federal minerals within the EIS area have been leased; there are currently 25 federal leases within the EIS area.

Present production from the Blackleaf gas field is from Subbelt I (see Figure 3.14). The western structural trap is where the Paleozoic terminates as a wedge edge against an underlying thrust fault. Paleozoic rocks are repeated by numerous thrust faults which formed drag folds resulting in a wedge edge. The gas has accumulated in the Sun River Dolomite Member of the Mississippian Madison Group (see Figure 3.16).

The Knowlton gas field (eastern Blackleaf) resulted from a backthrust or a reverse fault-bounded horst or "pop up" block in which gas and gas-condensate was trapped in the Mississippian Sun River Member (Napier, 1982).

General field characteristics include traps trending in a northwesterly direction which are generally thin in east-west cross section and associated with thrusting.

Future development in Subbelt I will focus on extending existing structures. The eastern Knowlton structure appears favorable to the south and the western Blackleaf has potential for northward extension. Future development may be associated with additional wedge edge structures to the west and possible drag folds associated with fault contacts between Subbelts I and II in the southwestern part of the area.

Subbelt II is very complex and development within this subbelt is expected to be low. Potential targets may be drag folds at the contacts between Subbelts I and II, and the repeated section at depth.

There are presently four producing gas wells in the EIS area. The formation containing these commercial quantities is a fractured dolomite called the Sun River member of the Madison formation of Mississippian age. A fifth well is temporarily abandoned and does not appear able to produce economic quantities of gas, but is proposed as an injection well for the disposal of produced water.

The wells were drilled to two separate thrust sheets and are producing from different reservoirs formed by thrusting and faulting (Johnson 1984). These reservoirs have different initial pressures and probably produce at different rates. The 1-8 and 1-5 wells are producing from a reservoir with an estimated reserve of 35 billion cubic feet (BCF) of gas. If half of those reserves could be produced from each well, it would indicate a producing life of 15 to 20 years for each well. Since the wells in the other reservoir (1-13, 1-19) have lower initial pressures, they would have a shorter life.

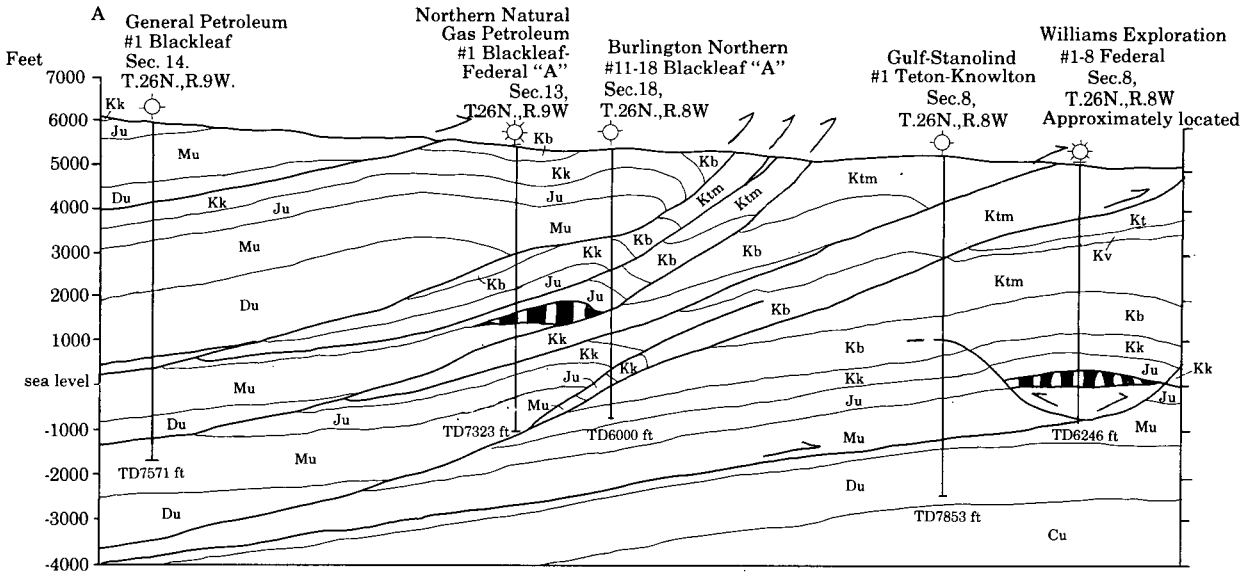
The product from this producing reservoir is a combination of gas, condensate and water. The gas also contains Hydrogen Sulfide (0.4%), a highly toxic, reactive gas (see Appendix H). It is necessary to process this product prior to sales. The initial step after the product comes out of the well is separation into the three components; gas, condensate and water. After these are separated the gas is run through a dehydration unit to remove any water vapor left in the gas stream.

There are four production facilities located in the Blackleaf Unit; one at each wellsite. These facilities separate the gas condensate and water. The condensate is piped to storage tanks at each well and the water goes to an evaporation pit on each location. The condensate is removed about every 10 days by truck; however, there is storage capacity for approximately 2 months of condensate (see Figure 3.17). The gas is then piped to the Gypsy Highview Sweetening Plant about 14 miles northeast of the 1-8 well.

SURFACE WATER (Issues: General, Water Quality)

Water quality is mostly very good, except during peak flows when a heavy load of sediment is transported, although water quality may be affected in some lower elevation areas by livestock use. The water has a relatively high amount of dissolved solids, reflecting the large amount of limestone and other relatively soluble rock in the watershed (specific conductance measured range of 190 to 340 micromhos/cm). The protozoa Giardia is known to be a human health problem for drinking water in the back country and should be suspect here also.

Figure 3.16 Cross Section of Blackleaf Gas Field.



CRETACEOUS

Kt	Two Medicine Formation
Kv	Virgelle Sandstone
Ktm	Telegraph Creek Formation and Marias River Shale
Kb	Blackleaf Formation
Kk	Kootenai Formation
Ju	JURASSIC ROCKS Not shown on map A
Mu	MISSISSIPPIAN ROCKS
Du	DEVONIAN ROCKS
Cu	CAMBRIAN ROCKS

CONTACT

FAULT—Dashed where inferred: arrow shows direction of movement

DRY HOLE

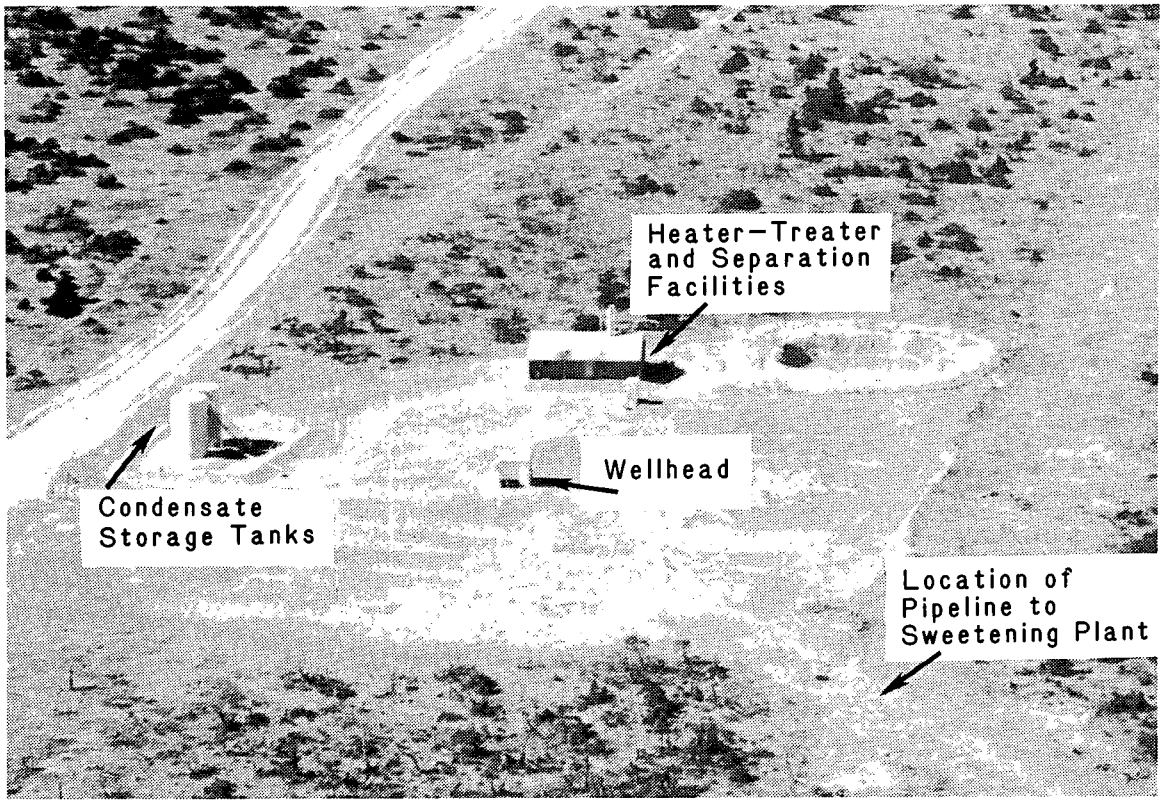
SHUT-IN GAS WELL

GAS RESERVOIR

TOTAL DEPTH OF DRILL HOLE

TD7571 ft

Source: Johnson, 1984



Surface water in the EIS area drains west to east. The northern one-third of the area drains through Dupuyer Creek into Birch Creek, then into the Two Medicine River (State Basin 41M - see Figure 3.18). Most of the remaining area drains through Muddy Creek (much of that through Blackleaf Creek) into the Teton River (State Basin 410). The remainder of the area drains directly to the Teton River.

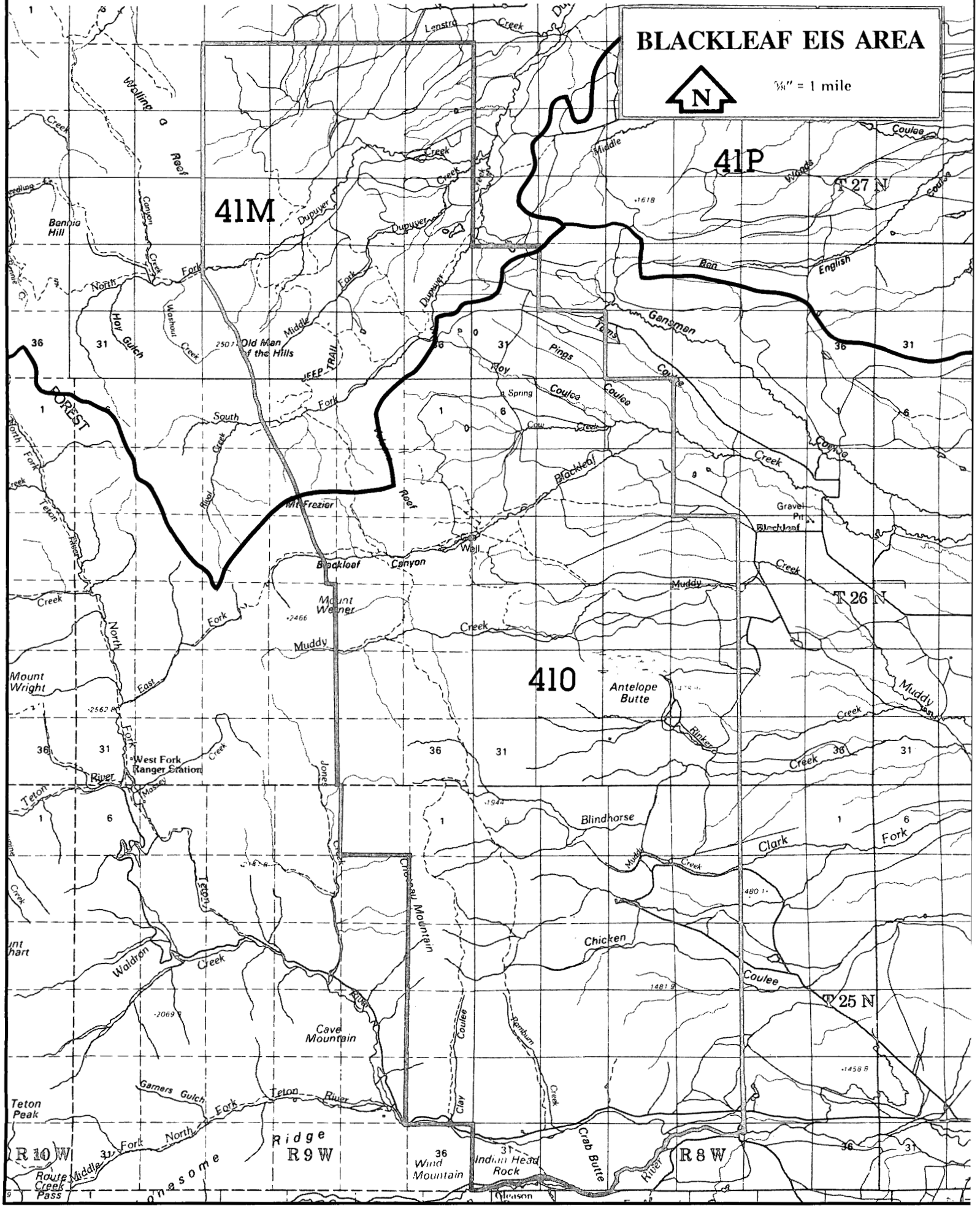
Surface water drains quickly from the western part of the EIS area because there is little surface soil on the steep slopes to absorb it. Most surface water on the eastern portion of the area sinks into the thick beds of exposed gravel left during an earlier era, though in some places the water table reaches the surface.

The major streams in the area are Muddy Creek, Blackleaf Creek and the forks of the Teton River and of Dupuyer Creek. All streams coming from the mountains across the area are extremely flashy, carrying huge amounts of suspended sediment and bedload during intense rains.

The North and South Forks of the Teton River and Dupuyer Creek are perennial. The Teton River and its two forks, on the south boundary of the area, drain a large watershed and were dramatically affected, or gutted during the 1964 and 1975 floods. Organic debris (uprooted trees) was burned or otherwise removed, and inorganic debris (gravel bedload) was bulldozed to the side after the floods, creating a very unnatural channel.

Blackleaf and Muddy Creeks flow during late spring and summer (about May through August), but this flow quickly disappears into the streambed gravels, except during peak flow times. Peak flow and any flooding usually result from snowmelt or spring rains in May or June, however flash flooding can occur through early autumn. Precipitation from mid-autumn through early to mid-spring is in the form of snow. Partial streamflow records from 1981 and 1982 (Forest Service) show the flashy character of the Blackleaf Creek. Muddy Creek is particularly notable for its scenic deeply incised gorge and waterfall.

FIGURE 3.18 STATE WATER BASINS



Other surface water resources in the EIS area include several glacial potholes with small ponds, a 40-acre reservoir on Rinker Creek east of Antelope Butte, a small reservoir on the Clark Fork of Muddy Creek and Antelope Butte Swamp, a large wetland of about 200 acres.

Neither of the two state basins (41M for the Two Medicine River drainage and 410 for the Teton River drainage as shown on Figure 3.18) have preliminary water rights adjudications. However, all surface water flow has been appropriated, or at least claimed, for irrigation. Much of the Teton River is diverted into Bynum and Eureka Reservoirs, for irrigation use. Chicken Coulee (Blacktail Creek) also drains into Bynum Reservoir. The Forest Service has claimed stockwater use on Scoffin Creek, the North and South Forks Dupuyer Creek, North Cow Creek, Cow Creek, and five spring developments in the area on the National Forest lands. The Bureau of Land Management has claimed stockwater use for three springs, one of which is developed, on public lands in the area. The MDFWP has acquired some water rights within the area, however the extent of these rights is not fully known.

Another important surface water use is providing fish and wildlife habitat (especially in the Antelope Butte Swamp). The MDFWP has rated most of the North and South Forks of Dupuyer Creek, and a short reach of Cow Creek upstream from Blackleaf Creek, as a Substantial Fishery Resource (Value Class III). The Teton River, its two forks, and a portion of the North Fork Dupuyer Creek have been rated as a Moderate Fishery Resource (Value Class V). The lower (Moderate) rating is largely a result of flood scour.

The Muddy Creek drainage maintains a Class B-2 state water quality standard while the rest of the EIS area has a Class B-1 standard. Both of these standards were established to maintain water quality for drinking, culinary and food processing purposes after conventional treatment. These standards also maintain water quality for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply without treatment. The difference in the two standards is that B-2 provides for only marginal propagation of salmonid fishes and associated aquatic life. Both classifications provide a very similar list of specific standards for various parameters, with only slightly lower requirements for the B-2 classification. Consideration for maintenance of the B-1 standard should also be given to the drainage area of Cow Creek, since its lower reach provides a substantial fishery resource.

GROUNDWATER (Issues: General, Water Quality)

All geologic formations in the area could contain groundwater, with yields and quality varying, depending on the lithology of the formation. Those rock units with a high degree of porosity and permeability (unconsolidated surface gravels, sandstones, and limestones) have the potential to contain large amounts of water. Those with low porosities and permeability contain little water.

There is a rapid surface water run-off in this area, as there is little soil on the steep slopes to absorb and store the water. Most recharge to groundwater appears to occur on the gravel filled valley bottom and the thick gravel beds on the flatter areas east of the forest. Blackleaf and Muddy Creeks and various smaller creeks flow during the early summer on the forest but quickly disappear into the stream bed gravels east of the forest. The water percolates down through the gravels and may accumulate on the tops of the less porous underlying bedrock, as shallow groundwater. Over time, the water would slowly enter the deeper, less porous bedrock. Shallow groundwater supplies most of the water wells in the general area. Upon entering deeper bedrock units the salinity and amount of dissolved solids generally increases.

The Mississippian Madison Limestone is a major, deep aquifer in central and eastern Montana (Downey 1984). The Little Belt Mountains and the Snowy Mountains are significant recharge areas. The Madison rocks within the EIS area are also capable of transmitting water. This area was not identified as a recharge area for the Madison (Downey 1984).

The large surface exposures of Cretaceous Age sandstones, siltstones and mudstones contain water as a function of porosities; the mudstones containing little water and the sandstones containing larger amounts. Water within these rocks is expected to contain dissolved salts.

There are large glacial deposits of tills and outwash throughout the EIS area overlain by recent accumulations of alluvial gravels, talus and colluviam. The glacial tills are generally impervious to water. Glacial tills are probably acting as a dam and allowing the formation of Antelope Butte Swamp.

An evaporite salt-bearing formation occurs at depth; (Potlatch Anhydrite, Mudge 1983), however the salt appears to have been removed in the geologic past and the evaporite

bed produces little dissolved salts (Marshall 1983). Past exploratory drilling along the Front has produced little fresh and/or salt water. Present production from the Knowlton structure produces very little groundwater. Williams Exploration indicates that very little water has been separated from the gas produced at Blackleaf Canyon from the Knowlton structure thus far. Wexpro, drilling just north of the Teton River, indicates that the Potlatch Anhydrite was the only evaporite facies they encountered and that they would not expect saltwater production in conjunction with petroleum production on their Pamburn Creek prospect (Marshall 1983).

RECREATION (Issues: Tourism and Recreation)

Deer and elk hunting are the major recreation activities in the EIS area. Approximately 95% of the recreation use occurs during the big game season or from October 20 to December 1 of each year.

There are fewer recreation opportunities on private land than on public lands, which is increasing the recreational use of these public lands.

The Blackleaf Wildlife Management Area has also increased the visitor use of the area and has contributed to a major increase in use during the fall hunting season.

The Blackleaf Road accesses the National Forest for less than 1/8 mile. This road starts at the Forest boundary and ends at the Blackleaf Trailhead No. 106, consisting of toilet and unloading facilities. No campground or picnic facilities exist, but this trail does provide access to the Bob Marshall Wilderness and the North Fork of the Teton River.

Cross county skiing is becoming more important in the area, but will not become a major activity due to the lack of access and inadequate snow depth caused by the severe winds. For this same reason, snowmobiling will remain a minor activity in the EIS area.

Some portions of the EIS area provide near wilderness characteristics for those seeking that type of recreational experience. These areas are somewhat remote; nearly roadless; provide rugged topography; present good opportunities for exploring; require a degree of self reliance; and are relatively free of human influence.

A portion of the EIS area, the Teton Roadless Area lies adjacent to the Bob Marshall Wilderness Area and was studied for possible inclusion in the National Wilderness Preservation System. However, none of this 17,603 acre area was recommended by the Forest Service as suitable for wilderness management.

VISUAL RESOURCES (Issue: Visual Quality)

The EIS area is located between two major geographic regions. The eastern half of the area is located within the Rocky Mountain Foreland character type, found at and near the eastern foot of the Rocky Mountains; extending from the Blackfeet Reservation south and eastward in southcentral Montana. This subregion includes a variety of land features including plateau surfaces, buttes and an expansive area of prairie and cultivated land. The western half of the EIS area is located within the Columbia Rockies character type. As the name implies, the area is mountainous terrain separated by valleys that vary from rocky gorges through narrow, crooked, stream-cut valleys to broad, straight structured valleys. The mountain range and valleys are generally aligned in a north-northwest to south-southeast direction.

There are two major processes involved in managing visual resources in this area. One is the scenic quality of the area. This is expressed in the following way:

Class A = Distinctive (FS) Outstanding (BLM)
Class B = Common (FS) Above Average (BLM)
Class C = Minimal (FS) Common (BLM)

The scenic quality of an area is influenced by the agencies' management objectives for that region. These objectives are called Visual Quality Objectives by the Forest Service and Visual Resource Management Objectives by the BLM. The objectives for each agency are:

Class I (BLM) = Preservation/Retention (FS)
Class II (BLM) = Unnoticed (FS)
Class III (BLM) = Minor Disturbance/Partial Retention (FS)
Class IV (BLM) = Disturbance/Modification (FS)

The majority of the scenery in the EIS area falls within Class B (Common) and Class C (Minimal) Scenic Qualities Ratings as defined by the National Forest Visual Management System. Those portions of the EIS area that are Class B and are in the background view from the highway would have a Visual Quality Objective of Minor Disturbance (Partial Retention). This means that management activities

should remain visually subordinate to the characteristic landscapes and that production facilities should be screened from view by vegetation or topography. The remaining portion of the EIS area would have a Visual Quality Objective of Modification. Under this objective, management activities may alter the original appearing landscape. Alterations should borrow from naturally established form, line, color and texture so visual characteristics are those of natural occurrences within the surrounding area.

About 1/3 of the western portion of the planning unit is in a Class A (Distinctive) scenic quality area. Portions of the EIS area are located in the background view from Highway 89 and the visual quality objective for variety Class A would be Preservation (retention). This means that management activities should not be visually evident.

The majority of the EIS area has an existing Visual Quality Objective Rating (FS system) of Minor Disturbance, reflecting the undeveloped nature of the area (see Figure 3.19). This means changes in the landscape are noticed by the average person, but do not attract attention. The natural appearance of the landscape still remains dominant.

The Visual Absorption Capability (VAC) of the area ranges from low to high. An opportunity exists to alleviate visual impacts in areas that have medium to high visual absorption capabilities.

NOISE: (Issues: Wildlife, Recreation)

The existing sound environment is characterized by natural sounds (e.g., water flow in streams, wind, etc.) and modified by intermittent sounds from vehicles passing on roads and human activities in recreational areas.

Existing sound levels in the EIS area were measured during July and August 1983, in the Chicken Coulee and Antelope Butte areas. These data were used to estimate average day/night sound levels using the A-weighted decibel scale. Estimated day/night ambient sound levels ranged from a low of 25 dBA in Chicken Coulee to a high of 55.5 dBA near Antelope Butte in a high wind situation. The overall ambient noise levels average 40 dBA. Comparing these ambient sound levels with other familiar sounds (see Figure 3.20) suggests a quiet environment throughout the EIS area. Figure 3.20 also shows how oil and gas related development sounds would compare.

TRANSPORTATION SYSTEM (Issue: Oil and Gas Operations)

The primary access routes to the EIS area include U.S. Highway 89, the Forest Service's Teton Road No. 144 and several state and county maintained routes.

The transportation system within the EIS area consists of developed roads (35.5 miles), primitive roads (37.8 miles) and single track trails (25.1 miles) . Table 3.3 shows which agency or level of government has jurisdiction over various sections of these roads and trails.

TABLE 3.3

TABLE OF ACCESS SYSTEMS AND JURISDICTION[1]

Type of System	Number of Miles	Jurisdiction
Developed Roads	5.8 miles	United States Forest Service
	29.7 miles	State or County
Total	35.5 miles	
Primitive Roads	3.3 miles	State of Montana
	31.7 miles	Private Ownership
	2.8 miles	Bureau of Land Management
Total	37.8 miles	
Trails	18.7 miles	United States Forest Service
	3.2 miles	Private Ownership
	3.2 miles	Bureau of Land Management
Total	25.1 miles	

[1]BLM/USFS. 1989

Special restrictions govern vehicle travel inside the EIS area. Vehicle traffic on the Lewis & Clark National Forest is managed under the Forest Travel Plan. This plan restricts off-road vehicle (ORV) travel to designated routes in the forest and prohibits off road travel by class of vehicle. Motorcycle and snowmobile use has not been restricted inside the forest boundary, unless site-specific conditions dictate restrictions.

Bureau of Land Management lands are closed under the Blind Horse ONA management guidelines which prohibit motorized vehicle use (Rocky Mountain Front ONA Activity Plan Environmental Assessment 1989).

State of Montana lands are generally contained in the Blackleaf Wildlife Management area and off road vehicle use is restricted during seasonal periods for wildlife purposes.

Figure 3.19 Visual Quality Objective and Transportation System in the Blackleaf EIS Area.

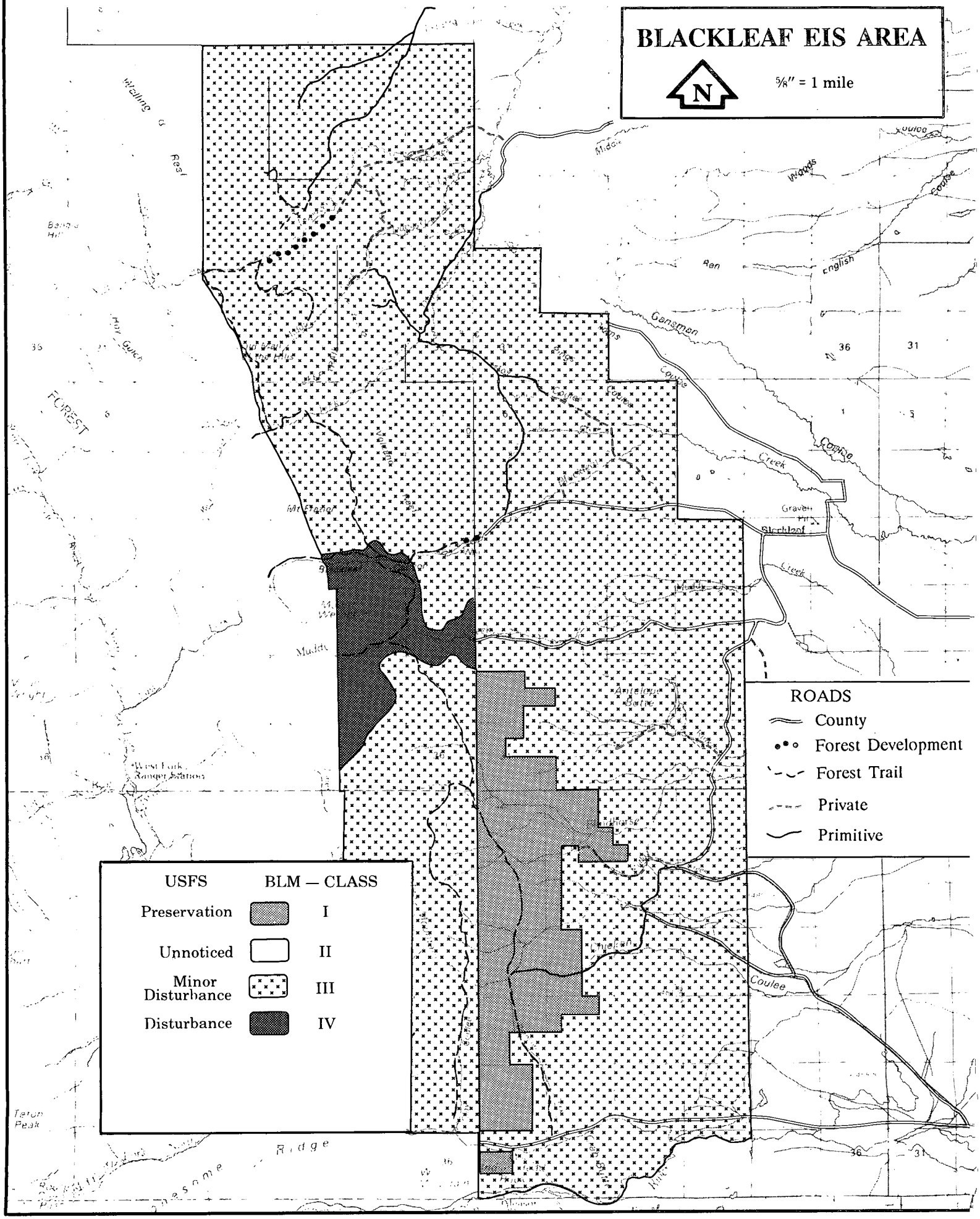
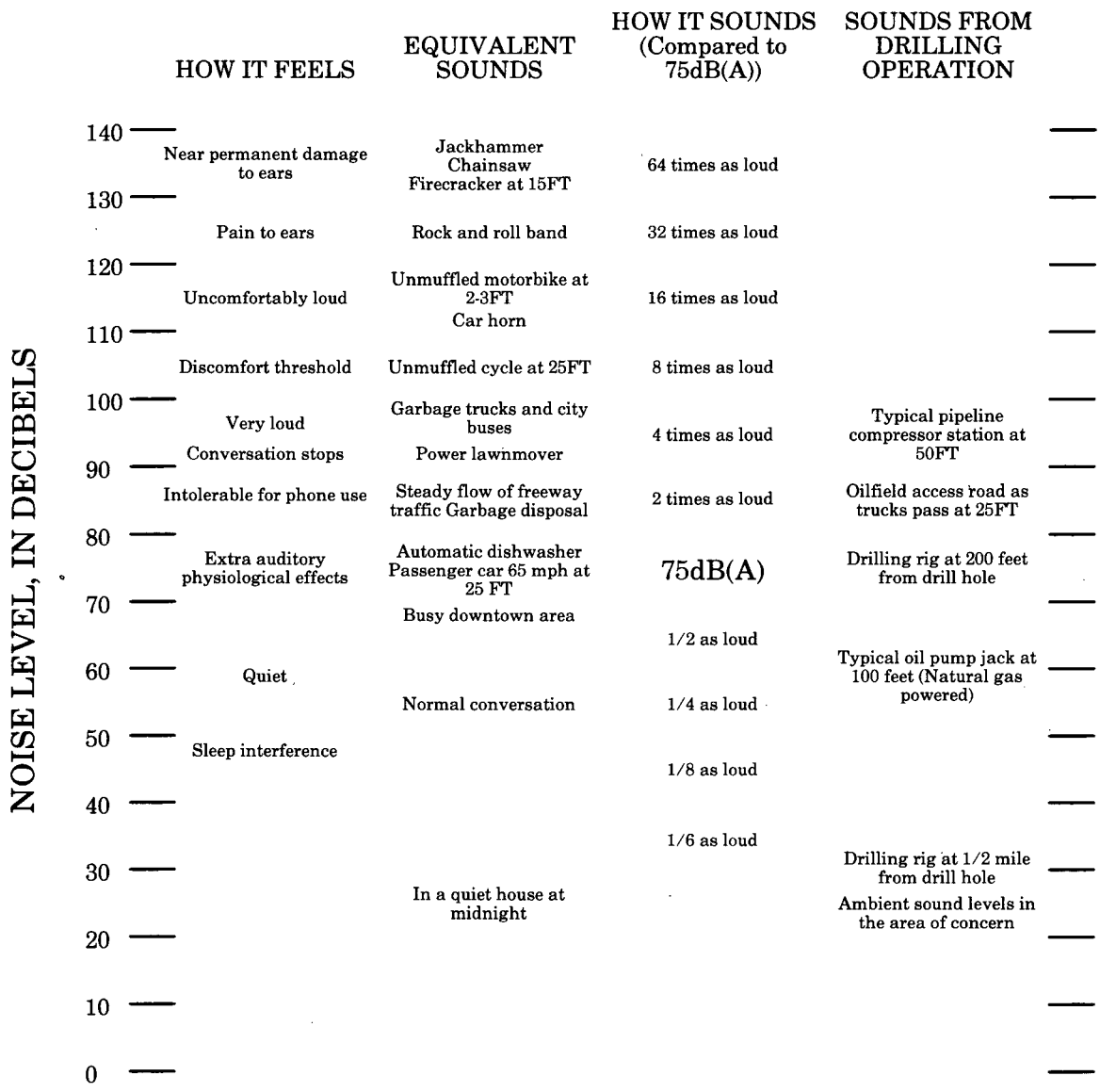


Figure 3.20 Noise Level Comparison Chart.



Source: Modified from the Federal Energy Regulatory Commission (FERC) Final EIS on Trailblazer Pipeline System FERC/EIS-0018 Docket No. OP79-80 et al.

HEALTH AND SAFETY (Issues: Health and Safety of Area Residents)

As required by BLM regulations, the Blackleaf Unit operator, plus operators outside the Unit, are required to have developed contingency plans to ensure the safety of all personnel and the general public in the event of equipment failures and/or disaster while drilling in formations which may contain hydrogen sulfide (H2S). While H2S may not be encountered, its potential occurrence requires planning to assure safe operations if the gas should be present. The BLM reviews and approves the contingency plans as a part of the APD.

There is no known incidence of sickness, disease, or health effects for the local area due to oil and gas activities. State permits would be required if it was determined that releases of hydrogen sulfide or carbon dioxide gases would exceed the State standards for air quality. State and federal regulations would also apply in protecting water sources from contamination by drilling and disposal of solid waste materials.

Other information pertinent to describing the health and safety environment for the Blackleaf EIS area is contained in Chapter 3 - Oil and Gas Resources.

ECONOMIC AND SOCIAL CONDITIONS (Issues: Oil and Gas, Tourism and Recreation)

Three zones (local, regional and Montana) were used in this description. The local area is defined as Teton County or the area where people's lifestyles are most likely to be affected. The regional zone includes Cascade, Glacier, Lewis and Clark, Pondera, and Teton Counties. This area is defined on the basis of the labor market of the area and includes communities within a 60 mile commuting distance to the Blackleaf EIS area. State of Montana is used for comparison purposes.

Population Characteristics

The population of the regional area was 150,100 in 1986 (18% of Montana's total population). This is an 8% increase from 1970 compared to an 18% increase for the State of Montana. Between 1970 and 1986, the regional area grew at a slower rate than the trend in Montana. Some counties and communities experienced significant changes in population from 1970 to 1988. Lewis and Clark County grew more rapidly than the state with an increase in population of 41% while the communities of Browning, Cut Bank and Fairfield had decreases in population between 1970 and 1986. Although the 1986 census estimate for Browning was 1,280, about 3,000 to 4,000 people are considered to comprise the surrounding community (see Tables 3.4 and 3.5).

Between 1986 and 1988, the regional area experienced a decline in population similar to the trend for Montana's total population. Only Lewis and Clark County had an increase in population (7.3 %), compared with an overall decline of 1.7% for the state. For the local area, Teton County's population grew by 4% between 1970 and 1986, but between 1986 and 1988, the county's population decreased by 4.6%, finally to a level below 1970 (see Tables 3.4 and 3.5).

The largest community within 60 miles of the Blackleaf EIS area is Cut Bank, with a 1986 population of 3,750. Other towns within 60 miles include Browning (1986 population 1,280), Conrad (2,880), Valier (670), Choteau (1,850), Dutton (410) and Fairfield (600). Another 19 unincorporated communities are within 60 miles of the Blackleaf EIS area. Two of the unincorporated communities, Dupuyer and Bynum, are within 20 miles of the Blackleaf EIS area. Tables 3.4 and 3.5 show a comparison of 1986 population characteristics with 1970 and 1980 for counties and selected communities in the regional area.

Within the area, Teton County is lacking some basic services; the number of physicians per person is lower, education levels are slightly lower, the proportion of housing lacking some or all plumbing is higher, mean family income is lower and the proportion of families below the national poverty level is high. Positive factors include the county's remoteness and sparse population which result in freedom from many urban problems, such as high crime rates and overcrowding.

These indicators are simply an inference and are not meant to be a direct measurement of social well-being or all encompassing. It should be pointed out that even if particular statistics show poor social well-being, the residents may not perceive their situation as such. Location and lifestyle may be more important to local residents than some other economic or social indicators of well-being.

TABLE 3.4

POPULATION CHARACTERISTICS FOR THE REGIONAL AREA AND MONTANA, 1970, 1980, 1986 AND 1988[1]

Community	1970	1980	% Change 1970-1980	1986	% Change 1980-1986	1988	% Change 1986-1988
Cascade County	81,804	80,696	-1.4	79,400	-1.6	78,200	-1.5
Glacier County	10,783	10,628	-1.4	11,200	5.4	11,100	-.8
Lewis and Clark County	33,281	43,039	29.3	46,400	7.8	47,000	1.3
Pondera County	6,116	6,731	1.8	6,700	- .5	6,700	No Change
Teton County	6,116	6,491	6.1	6,400	-1.4	6,100	-4.6
Regional Area	138,595	147,585	6.5	150,100	1.7	149,100	-.5
Montana	694,409	786,690	13.3	819,000	4.1	805,000	-1.7

[1]1970 Census of Population, Characteristics of the Population, part 28, Montana.
U.S. Bureau of Census, 1987.
Bureau of Business and Economic Research, University of Montana

TABLE 3.5

POPULATION FOR SELECTED COMMUNITIES WITHIN THE REGIONAL AREA 1970, 1980 AND 1986[1]

Community	1970	%Change 1980	1970-1980	%Change 1986	1980-86
Browning	1,700	1,226	-27.9	1,280	4.6
Cut Bank	4,004	3,688	- 7.9	3,750	1.6
Conrad	2,770	3,074	11.0	2,880	-6.2
Valier	651	640	-1.7	670	5.2
Choteau	1,586	1,798	13.4	1,850	2.8
Dutton	415	359	13.5	410	15.0
Fairfield	638	650	1.9	600	-7.4

[1]1980 Census of Population and Housing, Advance Reports Final Population and Housing Unit Counts PHC80-V-28, Montana. U.S. Bureau of the Census, 1987.

Projected population levels through the year 2005 are displayed in Tables 3.6 and 3.7 for counties and selected communities in the regional area.

TABLE 3.6

PROJECTED POPULATION AND EMPLOYMENT LEVELS THROUGH THE YEAR 2005 FOR COUNTIES IN THE REGIONAL AREA[1]

	Population			Employment		
Year	Total	Change	%	Total	Change	%
CASCADE COUNTY						
1990	89580			34972		
1995	93778	4197	4	36261	1288	3
2000	97254	3475	3	37606	1344	3
2005	100825	3571	3	38988	1382	3
GLACIER COUNTY						
1990	11948			4591		
1995	12388	440	3	4760	169	3
2000	12848	459	3	4936	176	3
2005	13319	471	3	5118	181	3
LEWIS & CLARK COUNTY						
1990	50166			24696		
1995	54272	4106	8	26734	2038	8
2000	58275	4002	7	28720	1985	7
2005	62181	3906	6	30658	1938	6
PONDERA COUNTY						
1990	7369			3071		3
1995	7710	341	4	3184	113	3
2000	8067	357	4	3302	118	3
2005	8394	326	4	3424	121	3
TETON COUNTY						
1990	6973			2781		
1995	7228	254	3	2883	102	3
2000	7492	263	3	2990	106	3
2005	7766	273	3	3100	109	3

[1]Population and employment were estimated using coefficients from the Montana BLM Economic/Demographic Model.

TABLE 3.7

CURRENT AND PROJECTED POPULATION AND EMPLOYMENT LEVELS THROUGH THE YEAR 2005 FOR SELECTED COMMUNITIES IN THE REGIONAL AREA[1]

	Population			Employment		
Year	Total	Change	%	Total	Change	%
CUT BANK						
1990	4138			1813		
1995	4288	149	3	1880	66	3
2000	4447	159	3	1950	69	3
2005	4611	163	3	2022	71	3
BROWNING						
1990	1380			587		
1995	1432	52	3	609	21	3
2000	1485	52	3	632	22	3
2005	1540	54	3	655	23	3
CONRAD						
1990	3365			1411		
1995	3521	155	4	1463	52	3
2000	3684	163	4	1518	54	3
2005	3838	154	4	1574	55	3
VALIER						
1990	700			328		
1995	733	32	4	340	12	3
2000	767	33	4	352	12	3
2005	796	29	3	365	12	3
CHOTEAU						
1990	1931			725		
1995	2002	70	3	752	26	3
2000	2075	73	3	780	27	3
2005	2151	75	3	809	28	3
DUTTON						
1990	385			156		
1995	399	14	3	161	5	3
2000	414	14	3	167	6	3
2005	429	15	3	173	6	3
FAIRFIELD						
1990	698			254		
1995	723	25	3	263	9	3
2000	750	26	3	273	9	3
2005	777	27	3	283	10	3

[1]Population and employment were estimated using coefficients from the Montana BLM Economic/Demographic Model.

Regional Economy

Like Montana, the regional area derives its economic strength from natural resources. These resources include the land which is used for crop and livestock production, oil and gas production, and water and wildlife that offer outdoor recreation opportunities. Most of the area's employment, personal income and business activity is derived from the utilization of natural resources.

A description of the oil and gas extraction and tourism industries is given below. Whenever possible, production data is given for each industry to indicate historic output levels and the relative contribution of each industry to the economic base of the region.

The oil and gas industry has been present in Montana since the early 1900s and is an important basic industry providing 4,200 jobs (1% of the total employment) and $122 million in earnings (2% of the total earnings) for Montana workers in 1984.

Employment in the oil and gas industry is down substantially from its peak of 6,825 workers in 1981. In 1987, 9% of Montana's total gas production and 7% of the total oil production was from the regional area. Natural gas production in Teton County increased significantly from 1982 to 1984. Production increased 178% from 1982 to 1983 and another 97% in 1984. However, production declined 23% in 1985, 25% in 1986, and another 75% in 1987. Tables 3.8 and 3.9 show oil and gas production by county for the regional area during the years 1978 through 1987.

TABLE 3.8

GAS PRODUCTION FOR THE REGIONAL ZONE OF INFLUENCE 1978-1985 (MCF)[1]

Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area	Montana
1987	0	3,146,248	0	610,883	290,441	4,047,572	44,537,103
1986	0	3,797,212	0	631,242	1,149,336	5,577,790	43,657,231
1985	0	3,886,084	0	725,002	1,525,644	6,136,730	45,871,819
1984	0	3,062,034	0	832,440	1,970,821	5,865,295	48,499,939
1983	0	3,574,831	0	1,142,945	1,002,135	5,719,911	46,422,761
1982	0	3,101,586	0	1,056,651	360,779	4,519,016	48,337,829
1981	0	2,070,592	0	1,676,078	452,373	4,199,043	48,654,456
1980	0	2,491,281	0	2,187,099	473,273	5,151,653	53,520,370
1979	0	2,069,082	0	1,386,927	111,644	3,567,653	54,969,129
1978	0	3,574,291	0	447,891	96,730	4,118,912	46,758,635

[1]Reports of the State Department of Revenue July 1, 1978 to June 30, 1988, and unpublished data.

TABLE 3.9

OIL PRODUCTION FOR THE REGIONAL ZONE OF INFLUENCE 1978-1987 (Bbl)[1]

Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area	Montana
1987	0	1,310,376	0	332,604	129,361	1,772,341	24,225,665
1986	0	1,339,391	0	361,336	142,730	1,843,457	26,326,916
1985	0	1,389,902	0	379,992	138,013	1,907,907	30,284,836
1984	0	1,395,188	0	403,083	158,637	1,956,908	30,668,305
1983	0	1,392,774	0	433,888	142,861	1,969,523	29,320,419
1982	0	1,463,621	0	460,894	136,850	2,061,365	30,937,514
1981	0	1,585,969	0	363,732	125,014	2,074,715	30,517,947
1980	0	1,513,865	0	306,137	467,399	2,287,401	29,927,468
1979	0	1,524,016	0	288,301	129,293	1,941,610	30,285,631
1978	0	1,612,372	0	377,743	391,763	2,381,878	30,934,923

[1]Reports of the State Department of Revenue July 1, 1978 to June 30, 1988.

It is estimated that the oil and gas extraction sector provides most of the 656 mining jobs and $10 million in earnings in the regional area or 1% of the total employment and earnings for 1986 (see Tables 3.10 and 3.11).

Evaluating the tourism industry is difficult because data are often unavailable and this industry's employment and income earnings cut across many other industry sectors. The major factor when evaluating this industry is the expenditures of the nonresident travelers and tourists.

Nonresident travel in Montana was estimated at 2.2 million visitors in 1983 with expenditures at $423 million (Montana Department of Commerce, 1985). This spending supported about 10,500 jobs and created $106 million in earnings for Montana workers. This is about 3 and 2 % of the state employment and income earnings respectively. The majority of travel and tourism expenditures occurs in relatively few Montana counties (see Table 3.12).

TABLE 3.10

MINING EMPLOYMENT IN THE REGIONAL AREA
1982-1986[1]

Year	Cascade	Glacier	Lewis & Clark	Pondera	Teton	Regional Area
1986	102	353	103	61	37	656
1985	98	432	87	56	32	705
1984	89	452	127	54	(D)	722
1983	96	422	126	45	74	763
1982	82	498	102	44	186	912

(D) Not shown to avoid disclosure of confidential information. Not included in total.

[1]Bureau of Economic Analysis, U.S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.11

MINING EARNINGS IN THE REGIONAL AREA
1982-1986
(Thousands of 1986 Dollars)[1]

Year	Cascade	Glacier	Lewis & Clark	Pondera	Teton	Regional Area
1986	1,995	5,136	1,315	944	626	10,016
1985	2,658	8,620	1,803	837	673	14,591
1984	2,261	9,564	2,243	782	(D)	14,850
1983	2,405	8,900	2,617	658	2,158	16,738
1982	2,806	11,377	2,296	717	4,231	21,427

(D) Not shown to avoid disclosure of confidential information. Not included in total.

[1]Bureau of Economic Analysis, U.S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.12

CONCENTRATION OF TRAVEL-RELATED EMPLOYMENT AND EARNINGS IN MONTANA COUNTIES, 1983[1]

County	Employment Number of Workers	Earnings ($1,000)
Yellowstone	1,575	15,900
Gallatin	1,155	11,660
Flathead	1,155	11,660
Cascade	945	9,540
Silver Bow	735	7,420
Missoula	735	7,420
Glacier	735	7,420
Lewis & Clark	525	5,300
Park	315	3,180
Dawson	315	3,180

[1]Montana Department of Commerce, 1985.

Three of the top 10 counties are located in the regional zone of influence and Cascade, Glacier, and Lewis & Clark Counties account for 21% of the employment from travel and tourism in Montana.

Recreation use in the Blackleaf EIS area is estimated at 450 recreation visitor days annually. Recreationists using these public lands spend an estimated $20,000 each year. These expenditures represent direct payments to sporting goods stores, motels, service stations, and other services. As recreation expenditures circulate through the economy, an estimated $37,000 will occur in business activity with $11,000 in earnings, and the equivalent of one job in the retail trade and service sector.

Employment

Figures for 1982 and 1986 show services, government and retail trade to be the main sources of employment in the regional area. Those three sectors of the economy account for 68% of the 1986 total employment. During 1986, 17% of the work force was employed in the retail trade sector, 27% in services and 24% in government. Total employment increased 5% from 1982 to 1986. During this same period employment in Montana increased by 1%. While total employment increased some sectors of the economy experienced significant changes. Mining employment decreased 28% and wholesale trade decreased 17% (see Table 3.13).

TABLE 3.13

EMPLOYMENT BY TYPE AND BROAD INDUSTRIAL SOURCE FOR THE REGIONAL AREA 1982-1986[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-86
Farm	3,839	5	3,793	5	-1
Agr. Ser., For., Fish	443	1	575	1	30
Mining	912	1	656	1	-28
Construction	3,434	4	3,750	5	9
Manufacturing	2,858	4	2,622	3	-8
Trans. & Pub. Utilities	4,523	6	4,215	5	-7
Wholesale Trade	4,249	5	3,542	4	-17
Retail Trade	13,576	17	14,239	17	5
Fin., Ins. & Real Est.	6,078	8	6,610	8	9
Services	19,309	25	22,287	27	15
Government	18,645	24	19,253	24	3
Total	77,866		81,542		5

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

Employment in Teton County was relatively stable from 1982 to 1986, increasing by only 2%. Although employment remained relatively stable there were significant shifts in employment between sectors of the economy. Employment in mining decreased 80% and wholesale trade decreased 14% while employment in agricultural services, finance and other services increased (see Table 3.14).

Projected employment levels through the year 2005 are displayed in Tables 3.6 and 3.7 for counties and selected communities in the regional area.

Earnings

Table 3.15 shows the regional area's earnings by source for 1982 and 1986. In 1986, government contributed 28% of the regional area's total earnings while services contributed another 24%. Government is the major source of earnings with services and retail trade contributing the next largest portions. Total earnings were 1% higher in 1986 than in 1982. During this same period, total earnings in Montana decreased by 9%.

TABLE 3.14
EMPLOYMENT BY TYPE AND BROAD INDUSTRIAL SOURCE FOR TETON COUNTY, 1982-1986[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-86
Farm	869	28	863	29	-1
Agr. Ser., For., Fish	55	2	76	3	38
Mining	186	6	37	1	-80
Construction	142	5	133	4	-6
Manufacturing	60	2	59	2	-2
Trans. & Pub. Utilities	192	6	177	6	-8
Wholesale Trade	150	5	129	4	-14
Retail Trade	344	11	342	11	-1
Fin., Ins. & Real Est.	168	5	195	6	16
Services	451	15	549	18	22
Government	459	15	4643	15	1
Total	3,076		3,024		-2

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.15
EARNINGS BY BROAD INDUSTRIAL SOURCE FOR 1982-1986
THE REGIONAL AREA (Thousands of 1986 Dollars)[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-86
Farm	38,350	3	54,708	4	43
Agr. Ser., For., Fish	4,585	0	5,128	0	12
Mining	21,427	2	10,016	1	-53
Construction	80,841	6	81,956	6	1
Manufacturing	67,164	5	58,032	4	-14
Trans. & Pub. Utilities	130,837	10	109,901	8	-16
Wholesale Trade	100,200	8	80,416	6	-20
Retail Trade	155,201	12	155,034	12	0
Fin., Ins. & Real Est.	78,568	6	85,319	6	9
Services	280,059	21	315,307	24	13
Government	367,258	28	379,699	28	3
Total	1,324,490		1,335,516		1

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

Table 3.16 shows Teton County's earnings by source for 1982 and 1986. In Teton County farming and government were the major source of earnings in 1986, with transportation/public utilities and services contributing the next largest portions. Total earnings were 9% higher in 1986 than in 1982.

Public Finance

Table 3.17 shows the 1988 total taxable valuation and taxes levied by county for the regional area. Cascade County, with Great Falls serving as a major trade and service center, has the highest taxable valuation and one of the highest average mill levies. Teton County has the lowest taxable valuation and also maintains a low average mill levy due to the small population and rural setting.

Net proceeds from oil and gas production accounted for 9% of the total taxable valuation for the five counties and varied from zero for Cascade and Lewis & Clark Counties to 45% for Glacier County (see Table 3.18). Property tax assessment on agricultural land and equipment accounted for 13% of the total taxable valuation and varied from 4% for Lewis and Clark County to 47% for Teton County (see Table 3.18).

Montana imposes four taxes on natural gas production; the resource indemnity trust tax, gas producers privilege and license tax, natural gas severance tax and net proceeds tax.

TABLE 3.16
EARNINGS BY BROAD INDUSTRIAL SOURCE FOR TETON COUNTY
1982-1986 (Thousands of 1986 Dollars)[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-86
Farm	8,065	20	15,063	35	87
Agr. Ser., For., Fish	467	1	635	1	36
Mining	4,231	11	626	1	-85
Construction	2,382	6	2,374	5	0
Manufacturing	742	2	640	1	-14
Trans. & Pub. Utilities	5,229	13	4,936	11	-6
Wholesale Trade	3,038	8	2,754	6	-9
Retail Trade	3,136	8	2,687	6	-14
Fin., Ins. & Real Est.	1,691	4	1,671	4	-1
Services	4,141	10	4,846	11	17
Government	6,535	16	7,099	16	9
Total	39,657		43,331		9

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.17
TOTAL TAXABLE VALUATION AND TAXES LEVIED FOR 1988 BY COUNTY[1]

County	Total Taxable Valuation	Taxes Levied State	County	Schools	Other	Total	Mills*
Cascade	90,299,276	541,983	7,158,033	21,718,786	7,574,180	36,992,982	409.67
Glacier	33,222,585	199,429	2,067,988	5,188,315	651,794	8,107,526	244.04
Lewis and Clark	66,449,765	398,545	5,073,061	10,856,839	8,238,714	24,567,159	369.71
Pondera	17,984,009	107,907	1,555,949	2,779,767	777,678	5,221,301	290.33
Teton	16,032,023	95,714	1,236,719	2,595,464	1,469,738	5,397,635	336.68

*Average mill levy based on total taxes levied and total taxable valuation.
[1]Report of the State Department of Revenue for the Period July 1, 1986 to June 30, 1988.

TABLE 3.18

TOTAL, OIL, GAS, AND AGRICULTURAL TAXABLE VALUATION FOR COUNTIES IN THE REGIONAL AREA, 1988[1]

County	Total	Oil & Gas	% of Total	Agricultural	% of Total
Cascade	90,299,276	0	—	6,605,688	7
Glacier	33,222,585	15,048,034	45	4,442,052	13
Lewis & Clark	66,449,765	0	—	2,340,983	4
Pondera	17,984,009	3,231,977	18	7,127,068	40
Teton	16,032,023	1,126,044	7	7,549,524	47

[1]Report of the State Department of Revenue for the Period July 1, 1986 to June 30, 1988.

The resource indemnity trust tax is an annual tax for all firms engaged in extracting minerals. The tax collections are deposited in a trust fund to protect the state against loss or damage to the environment. The interest from the trust is used to develop Montana's water resources and to fund other projects to improve the environment.

The oil and gas producers privilege and license tax is a quarterly tax on all oil or natural gas produced, stored or marketed within the state. The tax collections fund the operations of the Board of Oil and Gas Conservation.

Natural gas produced from within Montana is subject to a severance tax of 2.65% of the total gross value. Gross value of natural gas is determined by taking the total cubic feet produced each month of the year at the average value at the wellhead. However, government royalties are exempt from the tax. Natural gas severance taxes are allocated to local governments and the state general fund. All natural gas produced from a well 5,000 feet deep or deeper, which is drilled between December 31, 1976 and December 31, 1992, is exempt from all severance tax for 3 years, providing the gas is placed in a distribution system serving chiefly Montana consumers.

The largest tax on natural gas is the net proceeds tax imposed for local governments. The tax is calculated on the gross value of natural gas, minus all allowable deductions, multiplied by the local mill levy. Half the net proceeds from a gas well are exempt from the net proceeds tax for 3 years, if produced from a well 5,000 feet deep or deeper and drilling was commenced after December 31, 1976 and before December 31, 1992, providing the gas is placed in a distribution system serving chiefly Montana consumers.

Table 3.19 shows the taxes generated from natural gas production within Montana in recent years:

TABLE 3.19

NATURAL GAS PRODUCTION TAXES[1]

	Fiscal Year		Calendar Year
Fiscal or Calendar Year	Resource Indemnity Trust Tax	Severance Tax	Net Proceeds
1987	538,251	2,492,465	
1986	583,961	2,890,666	14,253,000
1985	627,504	2,945,778	14,772,000
1984	589,348	2,797,996	14,775,765
1983	537,871	2,649,726	14,202,097
1982	491,092	2,659,811	11,976,791
1981	446,778	2,116,291	10,830,283
1980	371,386	1,264,025	9,554,124
1979	319,377	1,151,103	7,793,175
1978	189,214	923,600	4,856,033

[1]Reports of the State Department of Revenue July 1, 1978 to June 30, 1988 and unpublished data.

Social Conditions

Social conditions, while difficult to measure directly, can be inferred from a variety of secondary indicators. It has been found that changes in such economic indicators as rate of population growth, per capita income, and general level of unemployment, as well as such social indicators as rates of crime, divorce, and infant mortality can be used to describe generally changes in area social conditions.

Table 3.20 presents indicators of social well-being for counties in the regional area. These indicators present a mixed picture, suggesting that portions of the area have both the positive and negative factors associated with remote rural areas. When comparing the area to Montana; the area rates higher in the positive factors and lower in the negative factors. The area education levels are higher, unemployment rate is lower, mean family income is higher and the proportion of families below the national poverty level is lower.

TABLE 3.20
INDICATORS OF SOCIAL WELL-BEING[1]

	Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area	Montana
Physicians Per 100,000 Population	1984	193.1	53.0	220.5	70.4	46.8	178.9	153.6
	1980	163.6	65.9	174.3	74.3	77.0	151.8	133.5
Crime Rate Per 1,000 Population	1983	68.7	N/A	60.7	9.9	9.4	60.5	42.8
	1979	72.2	19.1	64.9	10.1	9.7	63.4	45.3
Per Capita Income	1980	6,959	5,362	7,264	6,661	6,070	6,880	6,596
	1970	2,864	2,119	3,261	2,463	2,819	2,880	2,712
Families With Income Below the Poverty Level %	1979	8.1	16.7	6.2	10.8	11.4	8.4	9.2
	1969	8.3	23.4	6.5	14.2	10.9	9.4	10.4
High School Graduates, Percent of Population Over 24								
Total	1980	75.2	67.9	82.3	68.7	67.4	76.1	74.4
Total	1970	65.3	50.1	69.6	55.4	53.0	64.1	59.2
Native American	1980	46.1	59.4	54.3	N/A	31.8	54.2	56.0
Unemployment Rate, Percent of Civilian Labor Force								
Total	1980	7.8	8.6	5.1	6.2	4.7	6.8	8.3
Total	1970	6.5	12.6	4.9	3.2	4.2	6.2	6.3
Native American	1980	21.4	14.2	6.8	N/A	15.2	15.7	20.1
Mean Family Income								
Total	1979	21,373	18,430	22,301	21,890	18,971	21,347	20,679
Total	1969	10,137	8,353	11,378	8,800	9,985	10,227	7,846
Native American	1979	12,538	14,118	14,081	N/A	N/A	13,596	14,101
Year-Round Housing Units With No Bath or Only Half Bath, %	1980	3.3	5.6	2.5	4.9	6.8	3.4	4.0
Year-Round Housing Units With No Complete Kitchen Facilities, %	1980	1.7	4.6	1.7	6.0	6.0	2.3	3.0

N/A = Data Not Available

[1]County Profiles, Census of Economic and Information Center, Helena, Montana.

1980 Census of Population and Housing, Advance Estimates of Social, Economic, and Housing Characteristics, Montana

1970 Census of Population, Characteristics of the Population, Montana

These indicators have changed from 1970 to 1980 and show that overall the area's standard of living has improved. The number of physicians per person increased slightly from 1970 to 1980, the percentage of families with income below the poverty level has decreased and education levels are higher. At the same time per capita income increased 23% and mean family income increased 9% (adjusted for inflation). This compares with a 20% increase in per capita income and a 28% increase in mean family income for Montana during the same time period.