

3.19 WILDLIFE AND FISHERIES RESOURCES

The terrestrial wildlife species found in the Vernal Planning Area (VPA) are typical of the intermountain region of the United States. These species include big game species such as mule deer, Rocky Mountain elk, pronghorn antelope, bighorn sheep, moose, black bear, and mountain lion. Additional species of concern in the VPA fall within the general categories of upland game species, raptors, waterfowl and shorebirds, fish and aquatic species, neotropical migrants, and small mammals and reptiles. Wildlife resources in the VPA are currently managed as directed by the Diamond Mountain RMP and Book Cliff RMP. These RMPs focus on managing habitat conditions instead of wildlife populations. Management goals for most wildlife populations in the VPA are determined primarily by UDWR, with the exception of federally protected wildlife populations, which are determined by USFWS. The current VPA RMPs allocate forage for elk, deer, and antelope. Additionally the Diamond Mountain RMP allocates forage for moose and bighorn at the level identified by the UDWR's prior stable numbers and long-term wildlife population management goals. Resource allocations for raptors, reptiles, amphibians, and other non-game species in the VPA are limited to protecting individuals and the habitat of state and federally listed species, and designating spatial and temporal barriers for nesting raptors.

BLM's management of wildlife habitat in the VPA has had, and will continue to have, an impact on both local communities and those that exist outside of the Uintah Basin. There is considerable regional interest in the overall condition and management of the VPA. In the past, a majority of the local interest has been focused on big-game management and associated recreational activities. In recent years, however, non-consumptive uses in the VPA, such as tourism and wildlife viewing, have been increasing with the continued expansion of Utah's tourism industry. Because many of the wildlife species found in the VPA regularly cross public, private, and tribal lands, a collaborative effort between all land managers and owners has been essential for effective wildlife management in the VPA.

The UDWR has designated five wildlife management units within the VPA to aid in the management of these wildlife species. Seventy-six percent of Unit 17 (Wasatch Mountains) is located outside of the VPA. Of the remaining lands within the VPA designated part of this unit, BLM administers only 1,245 acres, therefore, the wildlife management goals and objectives relative to this unit were not included in this analysis. The remaining four wildlife management units, and their sub-units, are outlined in Table 3.19.1. UDWR has developed, or is presently developing, wildlife management plans for the aforementioned big game wildlife species as well as fisheries and upland game populations.

TABLE 3.19.1. WILDLIFE MANAGEMENT UNITS WITHIN THE VERNAL PLANNING AREA (VPA)			
Unit/Sub-unit number	Unit/Sub-unit name	Acres of Unit in the Vernal Planning Area	Acres of Unit in VPA Managed by BLM
8, 8b 8c	North Slope Uintah Mountains West Daggett Three Corners	365,651	62,528 (17% of Unit)
9 9a 9b 9c 9d	South Slope Uintah Mountains Yellowstone Vernal Bonanza Diamond Mountain	2,775,395	711,092 (26% of Unit)
10 10a	Book Cliffs Bitter Creek and Little Creek	1,225,726	652,440 (53% of Unit)
11 11a	Nine Mile Anthro	706,163	296,756 (42% of Unit)

3.19.1 Wildlife Associated with the Vernal Planning Area (VPA)

3.19.1.1 Mule Deer

Mule deer occupy most ecosystems in Utah but generally attain their greatest densities in shrublands in areas characterized by rough, broken terrain and abundant browse and cover. Many mule deer populations migrate between summer and winter ranges. Mule deer summer range habitat types on BLM-administered lands in the VPA consist primarily of oak, sagebrush, Douglas fir, and Utah juniper vegetation types. Winter range habitat primarily consists of Utah juniper, prickly pear, sagebrush, galleta, greasewood, and Fremont cottonwood vegetation types. Areas of high winter use in the Book Cliffs included areas of open pinyon/juniper woodland interspersed with four-wing saltbush and sagebrush in Lower McCook Ridge, Indian Ridge, and Big Park (Karpowitz 1984).

The amount of overall crucial winter range and the migration corridor for mule deer that BLM manages is outlined in Table 3.19.2 The target wintering mule deer herd size and annual harvest for these three wildlife management units are described in Table 3.19.3.

TABLE 3.19.2. MULE DEER HABITAT IN THE VERNAL PLANNING AREA (VPA)						
Unit	Overall range		Crucial winter range		Migration corridor	
	Total Area (acres)	Acres managed by BLM	Total Area (acres)	Acres managed by BLM	Total Area (acres)	Acres managed by BLM
North Slope Uintah Mountains	349,738	61,526	105,949	0	0	0
South Slope Uintah Mountains	2774,731	0	479,253	0	0	0
Book Cliffs	1,203,853	651,819	355,992	58,361	58,361	47,091
Nine Mile	667,440	262,357	39,959	0	0	0
Total	4,995,762	975,702	981,153	58,361	58,361	47,091

TABLE 3.19.3. WILDLIFE MANAGEMENT GOALS FOR MULE DEER						
Unit number	Unit name (subunit)	Estimated population size*	Population objective	Buck to doe ratio	Buck size	Annual harvest
8b, 8c	North Slope (West Daggett and Three Corners)	4,500	5,300	15:100	30% being 3 point or better	600
9a	South Slope (Yellowstone)	Not available	12,000	15:100	30% being 3 point or better	1,500
9b, 9c	South Slope (Vernal and Bonanza)	11,600	13,000	15:100	30% being 3 point or better	1,000
9d	South Slope (Diamond Mountain)		13,000	25:100	30% being 3 point or better	Limited Entry
10a	Book Cliffs (Bitter Creek and Little Creek)	5,200	15,000	25:100	30% being 3 point or better	Limited Entry
11a	Nine Mile (Anthro)	1,200	2,500	15:100	30% being 3 point or better	250

*Some of these units are estimated at about ½ of population objectives due to drought impacts and low productivity.

3.19.1.2 Rocky Mountain Elk

The season and function of use of elk habitats help distinguish various types of winter ranges, production areas (calving grounds), and/or summer range. Production or calving areas are used from mid-May through June and typically occupy higher elevation sites than winter range. Calving grounds are usually characterized by aspen, montane coniferous forest, grassland/

meadow, and mountain brush habitats, and are generally in locations where cover, forage, and water are in close proximity (Fitzgerald et al. 1994). In western Colorado, for instance, most females calve within 660 feet of water (Seidel 1977). Crucial winter range is considered to be the part of the local deer and elk range where approximately 90% of the local population is located during an average of five winters out of ten from the first heavy snowfall to spring green-up.

The amount of crucial winter range for elk that BLM manages is outlined in Table 3.19.4. The management goals for these four wildlife management subunits are described in Table 3.19.5.

Unit	<i>Overall range</i>		<i>Crucial winter range</i>	
	Total Area (acres)	Acres managed by BLM	Total Area (acres)	Acres managed by BLM
North Slope Uintah Mountains	303,644	54,041	51,836	2,975
South Slope Uintah Mountains	1,694,137	251,978	328,916	73,469
Book Cliffs	1,006,347	524,893	418,140	207,418
Nine Mile	450,518	171,070	76,996	2,489
Total	3,454,646	1,001,982	875,888	286,351

Subunit number	Subunit Name	Estimated population size	Population objective	Bull/cow ratio	Bull age
8a, 8b	North Slope (Summit and West Daggett)	1,400	1,600	8:100	50% of bulls 3½ years or older
8c	North Slope (Three Corners)	420	500	8:100	50% of bulls 3½ years or older
9a	South Slope (Yellowstone)	Not available	5,500	8:100	50% of bulls 2½ years or older
9b, 9c, 9d	South Slope (Vernal, Bonanza, and Diamond Mountain)	2,600	2,500	8:100	50% of bulls 2½ years or older
10a	Book Cliffs (Bitter Creek and Little Creek)	2,200	6,500	8:100	50% of bulls 2½ years or older
11a	Nine Mile (Anthro)	650	700	8:100	50% of bulls 2½ years or older

3.19.1.3 Pronghorn

Pronghorn are common in Utah, where it primarily occurs in desert, grassland, and sagebrush habitats where they feed mainly on browse. Pronghorn are often found in small groups, and are usually most active during the day.

The lower elevations of the VPA sustain several pronghorn herds, which are highly valued by local sportsmen and wildlife enthusiasts. Population estimates for these herds are 279 individuals in the West Daggett (8b) and Three Corners (8c) subunits of the North Slope wildlife management unit, 183 individuals in the Vernal (9b) subunit of the South Slope wildlife management unit, and 863 individuals in the Bonanza (9c) and Diamond Mountain (9d) subunits of the South Slope wildlife management unit. BLM and UDWR maintain several guzzler systems in these areas to provide a water source for pronghorn during summer months. The pronghorn populations in the VPA have been adversely affected by historic range degradation and habitat loss in the sagebrush steppe habitat type as well as periodic drought conditions. The management goals for the pronghorn herds in these wildlife management units have not been finalized (UDWR 2001). Locations and total acreage of pronghorn habitat managed by BLM in the VPA are shown in Table 3.19.6.

TABLE 3.19.6. PRONGHORN HABITAT IN THE VERNAL PLANNING AREA (VPA)		
Unit	Total Area (acres)	Acres managed by BLM
North Slope Uintah Mountains	108,612	57,799
South Slope Uintah Mountains	592,313	410,235
Book Cliffs	122,968	85,973
Nine Mile	317,512	179,321
Total	1,141,405	733,328

3.19.1.4 Bighorn Sheep

Rocky Mountain bighorn sheep can be found in small herds in northern-eastern Utah. Bighorn sheep have experienced significant declines in numbers in the early 1900s due to disease, habitat degradation, and hunting. Bighorn sheep require separation from domestic sheep to prevent the transmission of diseases, against which they have no natural defenses. Utah has been involved in an aggressive program for the past 30 years to restore bighorn sheep to their native habitat. Bighorn sheep currently exist in three areas in northern-eastern Utah, including areas adjacent to BLM-administered lands along the upper Green River, and in the Book Cliffs and Nine-Mile Canyon area. The population estimates for the bighorn sheep along the upper Green River (the West Daggett (8b) and Three Corners (8c) subunits of the North Slope wildlife management unit) is approximately 175 individuals. Estimated population in Nine-Mile Canyon is approximately 225 individuals. Occasional sightings have also been documented in the Book Cliffs. These herds are all the result of reintroduction efforts and will likely continue to be augmented with additional reintroductions. Additional bighorn sheep reintroductions are proposed in the Browns Park/Diamond Mountain area. Water and vegetation improvements have also benefited these bighorn sheep populations. A management plan for bighorn sheep in the

state of Utah has been developed. Locations and acreage of bighorn sheep habitat in the VPA is shown in Table 3.19.7.

TABLE 3.19.7. ROCKY MOUNTAIN BIGHORN SHEEP HABITAT IN THE VERNAL PLANNING AREA (VPA)		
Unit	Total Area (acres)	Acres managed by BLM
North Slope Uintah Mountains	95,751	14,740
South Slope Uintah Mountains	405,481	38,805
Book Cliffs	633,271	228,002
Nine Mile	26,344	6,412
Total	1,160,847	287,959

3.19.1.5 Moose

Moose occur in the Rocky Mountains and the northeastern portion of the Intermountain West (Zeveloff and Collett 1988). Prior to 1918, moose were not known to occur in Utah. Since that time, they have been recorded on the north slope of the Uintah Mountains where their numbers have slowly increased. This increase has been attributed to an increase in beaver populations and the subsequent proliferation of marsh areas with which moose are typically associated (Zeveloff and Collett 1988). From the Uintah population, moose have dispersed and/or been transplanted to a variety of locations throughout the state. Although they may range widely across habitat types, moose are primarily associated with boreal forests and riparian areas. Moose are predominantly browsers and rely on the stems, bark, and leaves of a variety of trees and shrubs for forage. Year-round forage includes willow, fir, and quaking aspen. During the summer, grasses, forbs, and aquatic vegetation typically compose a large portion of the moose diet (Zeveloff and Collett 1988).

There are resident populations of moose in the South Slope Uintah Mountains, Book Cliffs, and Nine Mile wildlife management units. The 2000 population estimates for these management units were 175 individuals in the South Slope Uintah Mountains wildlife management unit, 10 individuals in the Book Cliffs wildlife management unit, and 10 individuals in the Nine Mile wildlife management unit. Acreage of habitat in these units is shown in Table 3.19.8. Moose habitat is generally associated with early stages of seral development and shrub growth. Annual flooding and habitat management techniques, such as prescribed burnings, are thought to improve habitat for moose.

TABLE 3.19.8. MOOSE HABITAT IN THE VERNAL PLANNING AREA (VPA)		
Unit	Total Area (acres)	Acres managed by BLM
North Slope Uintah Mountains	217,029	21,381
South Slope Uintah Mountains	1,095,295	71,342
Book Cliffs	0	0
Nine Mile	98,090	19,893
Total	1,410,414	112,616

3.19.1.6 Bison

The Ute Tribe maintains an introduced bison population on tribal lands in the Hill Creek portion of the Book Cliffs. These bison can be frequently found on BLM lands adjacent to Ute Tribal lands in the southern Book Cliffs where suitable bison habitat has been identified.

3.19.1.7 Black Bear

In the VPA, black bears are typically associated with forested or brushy mountain environments and wooded riparian corridors and seldom use open habitats (Zaveloff and Collett 1988). Should discuss impacts in Chapter 4... nocturnal, etc. Black bears tend to be nocturnal and tend to shy away from human contact. They are generally omnivorous with preferred foods including berries, honey, fish, rodents, birds and bird eggs, insects, and nuts. Black bears obtain most of their meat from carrion. From November to April, bears enter a period of winter dormancy. Winter dens are located in caves, under rocks, or beneath the roots of large trees where they are kept nourished and insulated by a thick layer of fat (Zaveloff and Collett 1988).

The VPA sustains several large populations of black bear, some of which are traditionally thought to be the highest density black bear population in the state of Utah. A long-term study being conducted by BYU has shown that the black bear population in the Book Cliffs area has local concentrations of individuals in the Horse Canyon, Main Canyon, and Trail Canyon areas. The factors that make these areas support such high bear populations are still being investigated, but initial studies have shown that good habitat conditions with respect to elevation, permanent water sources, cover, and diversity of food, as well as isolation from human disturbance has raised concerns about potential impact on resource development in these areas on these populations (Pers. Comm. Hal Black, 1/13/04). The amount of black bear habitat that BLM manages in the VPA is outlined in Table 3.19.9.

TABLE 3.19.9. BLACK BEAR HABITAT IN THE VERNAL PLANNING AREA (VPA)		
Unit	Total Area (acres)	Acres managed by BLM
North Slope Uintah Mountains	155,511	0
South Slope Uintah Mountains	1,044,332	56,304
Book Cliffs	232,792	108,291
Nine Mile	156,051	32,144
Total	1,588,686	196,739

3.19.1.8 Mountain Lion

The mountain lion inhabits most ecosystems in Utah. However, it is most common in the rough, broken terrain of foothills and canyons, often in association with montane forests, shrublands, and juniper-juniper woodlands (Fitzgerald et al. 1994). Mule deer is the mountain lion’s preferred prey species. Consequently, mountain lion seasonal use ranges generally parallel those of mule deer.

Mountain lions are widespread and occur frequently throughout middle and upper elevations of the VPA where populations are considered stable. The amount of winter range for mountain lions that the BLM manages is the same as the mule deer habitat outlined in Table 3.19.2.

3.19.1.9 Upland Species

Upland game in the VPA include populations of blue grouse, California quail, chukar partridge, greater sage-grouse, ruffed grouse, mourning dove, ring-necked pheasant, Rio Grand turkey, Merriam’s wild turkey, and cottontail rabbit. Annual fluctuations for most upland game bird and small mammal populations closely correlate with annual climatic patterns. Mild winters and early spring precipitation during the months of March, April, and May are associated with increases in upland game populations. Warm, dry weather during the early summer, especially in June, is generally considered vital for the survival of newly born young of many upland game species. Ring-necked pheasant and greater sage-grouse are two upland game species that have experienced a long-term decline as a result of the degradation and loss of important sagebrush steppe and grassland habitat (UDWR 2000). The greater sage-grouse is discussed further in the sensitive species section (Section 3.14).

3.19.1.10 Waterfowl, Shorebirds, and Wading Birds

The VPA is associated with the western portion of the Central Flyway, which guides migrating birds along the Rocky Mountains and the Great Plains. Because of the arid climate of the VPA, migration routes are often associated with riparian corridors and wetland or lake stopover areas. There are several important waterfowl habitats in the VPA including the Pariette wetlands, Pelican Lake, and the Green and White rivers. Waterfowl, shorebirds, and wading bird populations are primarily associated with the Pariette wetlands, Ouray National Wildlife Refuge, and other wetland areas such as Stewart Lake Waterfowl Management Area and Pelican Lake. These wetlands are an oasis in the Uintah Basin, surrounded by the harsh, arid desert landscape

of northeast Utah. Mallard, gadwall, cinnamon teal, pintail, and Canada geese are the most common waterfowl species observed in these areas. Herons, egrets, black-necked stilts, and various sandpipers are the more common wading birds seen. Other kinds of birds less frequently seen are American white pelican, sandhill crane, American bittern, and white-faced ibis.

The Pariette Wetlands Refuge managed by BLM includes over 9,000 acres (6,504 acres of desert uplands and 2,529 acres of open water, wetland, and riparian habitat) in Pariette Draw. The wetlands feature a perennial flowing stream, 23 man-made freshwater ponds with alkali bulrush, and other emergent vegetation. The marshes, wet meadows, grain fields, and irrigation structures in Pariette have been constructed to improve available habitat for waterfowl and other wildlife species in the area.

The Ouray National Wildlife Refuge consists of approximately 19 square miles of bottomland and river surface along 12 linear miles of the Green River. The Ouray refuge was originally established to provide habitat for breeding and migrating waterfowl. More specifically, the primary objective was to provide food and cover for 14 species of nesting ducks. While the purpose for which the Refuge was established has not changed, the methods of achieving the purpose have changed. Management strategies today are focused on managing water to mimic the natural flood plains that existed before dams were erected along the Green River. Portions of protective levees throughout the Refuge have been removed to allow more frequent flooding. The river feeds five bottomlands within the river flood plain, including Johnson Bottom, Leota Bottom, Wyasket Lake, Sheppard Bottom, and Woods Bottom, as it winds through the Wildlife Refuge. In late May, as natural flooding occurs, ponds are formed, spurring the growth of semi-aquatic plants which provide food and cover for ducks and other wildlife. In addition, these ponds serve as nurseries for the endangered fish species of the Colorado River system.

3.19.1.11 Raptors

There are 20 species of raptors found in the VPA, several of which are offered special protection by the state and/or federal government. These raptor species are discussed further in the Special Status Species section (Section 3.14). Special habitat needs for all of these raptor species include the protection of nest sites, foraging areas, and roosting or resting sites. Buffer zones are usually recommended around raptor nest sites during the early spring and summer when raptors are raising their young. The most utilized raptor nesting habitats in the VPA are generally found along riparian areas, juniper-desert shrub transition areas, and cliff faces.

An inventory of raptors within the Vernal Field Office boundary was completed in August 2003 by Utah State University – Uintah Basin. This study focused on determining the nesting requirements and the seasonally important raptor habitats located on public lands within the VPA boundary. GIS locations and the demographics of each raptor nest site identified during the inventory were recorded. This information was added to an expandable GIS database that will track nest site and other important raptor habitat locations. Oil and gas development maps will be used to develop predictive models for raptor/energy development conflicts, and to develop mitigation measures for unleased parcels. This will provide resource managers with information concerning raptor activity and productivity in the VPA.

Special habitat needs relative to raptors are generally associated with limiting disturbance during the nesting season and maintaining small mammal populations as a prey base. Electrocution from

power lines and environmental contaminants continue to be a threat to some raptor species in the VPA.

3.19.1.12 Other Non-Game Species

Because of the variety of habitats found within the VPA, the VPA contains a high diversity of non-game species such as neotropical migrants and other birds, small mammals, amphibians, and reptiles. The VPA contains various riparian, marsh, talus slope, aspen-conifer, pinyon-juniper, and ridge top habitats used by these wildlife species. A list developed by the USFWS, UDWR, Partners in Flight of neotropical migrants, and other sensitive bird species found in the VPA is provided in Appendix I, Table 40. Other common neotropical migrants and other bird, small mammal, amphibian, and reptile species to the VPA include the American crow, American kestrel, black-capped chickadee, common raven, green-tailed towhee, horned lark, house finch, song sparrow, vesper sparrow, western kingbird, western meadowlark, black-tailed and white-tailed jackrabbits, desert and mountain cottontails, golden-mantled ground squirrel, raccoon, red fox, coyote, common sagebrush lizard, common sideblotched lizard, gopher snake, and greater short-horned lizard. Several small mammal, amphibian, and reptile surveys have been conducted in the VPA. Many of these non-game species are also harder to study and monitor because of low population sizes and/or secretive behavior. However, BLM is acquiring basic habitat and population information on non-game species listed by state and federal agencies as special status species.

Neotropical migrants, small mammals, amphibians, and reptiles often have special habitat needs. Areas in the VPA with the highest concentrations and diversity of these species are generally associated with riparian areas. Amphibian populations have been shown to be particularly susceptible to disturbance activities and increases in chemical pollutants in their habitats. A study of the reptile, amphibian, and small mammal species found in the Book Cliffs area was conducted by Brigham Young University in 1995 and 1996. These studies concluded that a large proportion of small mammals and all amphibian species in the study area had the potential to be significantly impacted by grazing in riparian and wetland areas. Most of the reptile species were associated with talus slopes and rock faces and appeared to be at little risk from all conceivable management options. Additionally, the UDWR has identified that many neotropical migrants rely on riparian areas and corridors for nesting and migration purposes.

3.19.1.13 Fisheries and Aquatic Species

The riparian and aquatic habitat in the VPA is generally associated with the Green and White river drainages. Aquatic species in the VPA include several special status fish species such as bonytail, Colorado pikeminnow, humpback chub, razorback sucker, roundtail chub, bluehead sucker, Colorado River cutthroat trout, and flannelmouth sucker, which are discussed further in the special status species section. The Green and White rivers provide critical habitat for several of these fish species. A primary concern with the riparian areas in the VPA is the effect of decreased regeneration of cottonwood and willow stands and the invasion of non-native plant species such as salt cedar (*Tamarix* sp.) and Russian olive (*Elaeagnus angustifolia*) on riparian and aquatic wildlife species.

There are several important cold- and warm-water fisheries within the VPA, including Matt Warner, Calder, Crouse, Steinaker, Red Fleet, Cottonwood, and Brough reservoirs; Pelican Lake; and the White and Green rivers and their tributaries. Most of the reservoirs in the resource area

are managed as cold-water fisheries and are stocked with salmonids by the UDWR. The Green River below Flaming Gorge Dam and Pelican Lake have been designated by the state of Utah as waters to be managed under the Blue Ribbon Fisheries Initiative because of the quality angling they provide. The Pariette wetlands have also been identified as an important aquatic area in the VPA. However, maintenance of the nonnative fisheries associated with the VPA have adversely impacted the recovery of several special status fish species found in the VPA, including the Colorado River cutthroat trout, bonytail, Colorado pikeminnow, humpback chub, and razorback sucker (Hawkins and Nesler 1991).

Aquatic species are often used as indicator species of ecosystem health. These species often need protection from resource utilization such as recreation, grazing, mineral extraction, and invasive non-native species. These species may be impacted by resource management decisions made outside the VPA (e.g., the operation of Flaming Gorge Dam on the Green River).

3.19.2 Habitat Fragmentation

Wildlife habitats in the VPA include aquatic, riparian, grassland, desert shrub, badlands, sagebrush steppe, pinyon/juniper woodland, mountain shrub, and conifer forest. These vegetation types are also discussed further in the Vegetation Section. Fragmentation of these habitat types due to activities such as oil and gas development, road and pipeline construction, fence construction on rangelands and dam construction on waterways, or other resource development and land conversion can have a number of detrimental impacts on wildlife species. Habitat fragmentation generally results in some direct impact on wildlife from the initial loss of habitat associated with the alteration. Additional indirect impacts of this habitat loss may also affect the surrounding habitats by increasing the amount of transitional and avoidance space associated with the surrounding habitats. Increasing the edge habitats has been shown to accelerate ecological processes, increase the ability of invading plant or animal species to becoming established in the interior of the patch, and decrease functional habitat use for a variety of wildlife species. Interior species also become more vulnerable to decreasing chances of successful dispersal from occupied patches and colonization to unoccupied patches because of the decreased size and connectivity of the patches.

The VPA presently contains large areas of disturbed wildlife habitat. Fragmentation has become an issue in areas where mineral, agriculture, and other types of land development is currently occurring. Reducing the effects of habitat fragmentation on wildlife species include determining thresholds for disturbance, conserving existing habitats on an ecosystem level, providing usable corridors between neighboring patches, and controlling the invasion of undesirable species into these refuges. UDWR maintains a database that identifies important areas for many of the game and sensitive species in the VPA including intact riparian areas, important habitats for mule deer, Rocky Mountain elk, greater sage-grouse, ferruginous hawk, black-footed ferret, etc. The impacts on wintering mule deer and other big game animals from an increasing density of natural gas wells, roads, and associated human activities in the northern Book Cliffs area was analyzed in a two-year baseline study (1999-2000) by UDWR. UDWR identified that accelerated oil and gas development in the Book Cliffs area has the potential to further displace big game animals and increase habitat fragmentation during the winter period, thereby lowering the relative carrying capacity of the range. UDWR recommended that this baseline study be continued for an additional three years to establish long-term distributional trends of wintering big game populations and to determine the potential impact that oil and gas development may have on

these populations in the north Book Cliffs area. Efforts will continue to be made to identify and maintain existing important habitats and their interconnecting corridors. A description of the existing habitat fragmentation can be found in Tables 20 to 32 in Appendix I.