



Wild Horses

OVERVIEW

Equus, the only surviving genus of the once diverse Equidae family, evolved in North America about five million years ago and eventually spread throughout the world. Though much of the evolution of *Equus* took place in North America, horses mysteriously became extinct on the continent towards the end of the Pleistocene ice age about 10,000 years ago (McFadden 1992). The ancestor of the modern horse (*Equus caballus*) was domesticated approximately 2,500 to 6,000 years ago and the only remaining wild native horse species is the Mongolian or Przewalski's horse (*Equus przewalskii*), which survived in captivity and was released to Mongolian reserves (Berger 1986).

Spaniards reintroduced horses to North America in the 1500s. Trade with Native Americans, ranchers, and missions helped spread the species throughout the continent and occasionally horses escaped or were abandoned and became feral. These feral horses are more popularly known as mustangs and wild horses. Wild horse populations with strong Spanish ancestries have the longest history of escape from domestication. These populations are the Pryor Mountain herd (Montana and Wyoming), Kiger (Oregon), and Sulfur (Utah). However, other domestic horses that escaped or were intentionally released have since been mixed with the Spanish bloodlines. Some wild horse herds, such as those in Nevada and California, are dominated by these breeds.

The wild horses of Bighorn Canyon National Recreation Area (NRA) are descendents of domestic horses introduced by Spaniards and more recently escaped or abandoned domestic horses. It is unknown when horses first appeared in the Pryor Mountains or where they came from, but the population almost certainly has a Spanish origin (Cothran 1992). Wild horses in Bighorn Canyon NRA are restricted to the Pryor Mountain Wild Horse Range (PMWHR), which was created in 1968. Since the horses have a limited range and a high growth rate, the population must be controlled to prevent overgrazing and promote a healthy rangeland. Population controls include fertility control and removals. Since horses of this type are no longer present in Spain or Portugal, the Pryor Mountain population is considered a unique genetic resource (Sponenberg 2000).

Wild horses are protected as "living symbols of the historic and pioneer spirit of the West" by the Wild and Free-Roaming Horses and Burros Act of 1971 (Public Law 92-195). The Pryor Mountain horses are the subject of great public interest and are a draw for tourism. The Pryor Mountain Wild Mustang Center, located in Lovell, Wyoming, is dedicated to preserving and interpreting the

Pryor Mountain population and a registry for adopted Pryor Mountain horses has been established. The population has also been featured on the PBS television series *Nature* and in several books.

Distribution and Population Size

In North America

Horses were reintroduced to North America in the 1500s by Spaniards as domestic livestock and the species quickly spread across the American West and plains through trade. By 1912, western Indian reservations had approximately 300,000 horses, though the Bureau of Indian Affairs soon developed a policy to replace horses with cattle on the range, which caused the release of some horses to the open range (Brownell 1999). Throughout the spread of the species across the continent, horses occasionally escaped or were abandoned and became feral. These feral horses included Thoroughbred, Morgan, Quarter Horse, and draft breeds. Horses were also intentionally released onto public lands by the US Cavalry, farmers, ranchers, and miners. When the Taylor Grazing Act of 1934 was enacted to prevent overgrazing and damage of public lands, these unbranded and unclaimed horses became trespass livestock and an immediate problem.

Trespass horses were removed from the range by "mustangers" who usually sold the horses for slaughter. As a result of public outcry towards the inhumane removal methods, Public Law 86-234 was enacted in 1959 and prohibited the use of motorized vehicles to hunt wild horses and burros on all public lands. In 1962, the Nevada Wild Horse Range was established in Nellis Air Force Range, the first designation of its kind. In 1968, PMWHR was established in Montana and Wyoming, including areas of Bighorn Canyon NRA. Soon after, the Wild Free-Roaming Horses and Burros Act of 1971, was enacted and gave wild horses and burros legal status. This act provided for the necessary management, protection, and control of the wild horses on public rangelands. In September 2007, the Bureau of Land Management (BLM) estimated there were 25,700 wild horses on ranges in 10 western states.

In the Greater Yellowstone Area

The earliest references to horses in the region are from the Lewis and Clark Expedition in 1806, when the party's horses were stolen north of the Pryor Mountains



presumably by the Crow. There are no references of wild horses in the expedition journals. Travel through the area increased during the mid to late 1800s, though no references of wild horses were recorded (Brownell 1999).

The Crow, who occupied a large area of Montana and Wyoming including the Missouri, Yellowstone, and Bighorn river valleys west of the Powder River, obtained horses by trading with other tribes and were the wealthiest Indian nation in horses by the early 1800s (Nabokov and Loendorf 1994; Brownell 1999). Horses became an integral part of Crow tribal culture and held religious, social, and economic importance. The Crow Indian Reservation included the Pryor Mountains until 1891 when the land was ceded to the United States by treaty. By the end of World War I, the Crow had approximately 40,000 horses “which were becoming unmanageable and quite wild” (Medicine Crow 1992). In response to complaints by cattlemen who leased the reservation lands, the US government allowed lessees to gather and eventually shoot the horses beginning in the early 1920s. In 1933 and 1934, one buyer shipped 22,000 horses from the area (Wyman 1945). The efforts were intensified and by 1940, the Crow were “bereft of horses” and their “culture was severely damaged” (Medicine Crow 1992). By this time, the Crow also had to buy horses for farming and ranching (Wyman 1945). It is possible some of the reservation horses could have moved south to Pryor Mountains during this time (Brownell 1999). The PMWHR also lies along a major historical Crow and Shoshone migration route, which may have contributed to the origin of the population.

As of 2006, there were five BLM Herd Areas in Idaho west and north of Yellowstone National Park and seven herd areas and two BLM Herd Management Areas east of the park in the Greater Yellowstone Area. The McCullough Peaks and Fifteenmile herd management areas are located southwest of Bighorn Canyon NRA and approximately 70 miles east of Yellowstone National Park.

In the Pryor Mountain Wild Horse Range and Bighorn Canyon National Recreation Area

Horses in the Pryor Mountains are legally restricted to the PMWHR, created in 1968 and located in Montana and Wyoming, west of the Bighorn Mountains. The range covers approximately 39,000 acres, including land managed by the BLM, National Park Service (NPS), US Forest Service (USFS), State of Wyoming, and private owners. Natural and man-made barriers keep most of the horses on the designated range: Crooked Creek drainage to the west and Bighorn Canyon to the east are natural barriers, while fences to the north and south also restrict movement. About 8,300 acres or 21% of the range lies within Bighorn Canyon NRA, between Layout Creek and Crooked Creek from the north and south, and from Bighorn Canyon on the east to the western park boundary. The

population has varied between 86 and 270 horses since the creation of the PMWHR (Garrott and Taylor 1990). In the winter of 1977-1978, 51% of the population died when heavy snow and periods of warm temperatures created several layers of ice in deep snow and made foraging difficult. During the winter of 1983-1984, 13% of the population died when snowfall was above normal (Garrott and Taylor 1990). Between 1996 and 2006, the population was controlled and managed at around 160 horses (BLM 2006).

Horses occur in three possible, but not genetically distinct, subpopulations: Burnt Timber Ridge, Dry Head, and Sykes Ridge that are separated by Big Coulee, an impassable canyon, and a long, vertical cliff face. The horses may move between ridges at the top of the mountain and below Big Coulee Canyon. At least three trails allow horses to occasionally cross the vertical cliff face (Singer et al. 2000). The horses do not establish or maintain territories, but do establish a specific, regular “home range” which may change due to availability of water and forage, weather conditions, and harassment (Hall 1972). Horses typically move seasonally, traveling from the upper elevations in the summer to the lower and middle elevations in the winter where typical snow depths are 0-10 inches (0-25 cm). Horses are more restricted by free water sources in the summer than in the winter when they eat snow for water which can require travel of 1.2-3 miles (2-5 km) a day to snow banks (Singer et al. 2000). In the past ten years, several harems and bachelors have been using upper elevation, undesignated USFS land from the mid-summer through early fall (BLM 2006).

Physical Description and Genetics

The Pryor Mountain horses are generally small, reaching approximately 56 inches at the withers (14 hands, 142 cm); females (mares) average 600-750 lbs (270-340 kg), males (stallions) average 800-850 lbs (360-380 kg). Hooves are small with thick, tough walls. Horses of this phenotype have a straight to concave forehead, convex nose which tapers to a narrow muzzle in a frontal view, narrow but deep chest, long and angulated shoulders, short backs, and a sloping croup with relatively low set tail (Hall 1972; BLM 2001). The majority of Pryor Mountain horses uniformly demonstrate the Spanish Colonial Horse phenotypic features (BLM 2001).

The Pryor Mountain horses display a wide range of coat colors and markings, consistent with horses of Spanish origin (BLM 2001). Primitive markings include black dorsal and wither stripes, black rimmed ears, and black striped legs in some cases. Primitive markings are usually associated with duns (shades of tan or yellow) that have dorsal stripes. Grullos, generally darker and rarer than duns, consistently have black primitive marks



and dark or black heads. Both coat colors and markings are variable. Other coat colors include black, bay, brown, palomino, roan, chestnut, buckskin, and various colors in between. Typical markings are white fetlocks, legs, stars, strips, snips, and blazes. The Pryor Mountain horses display three distinct lumbar vertebrae structures which are representative of several types of horses including Arabians, the Quarter Horse, and Andalusian (Hall 1972).

The extent that introduced horses have changed the genetic character of the Pryor Mountain horses is unknown, though it is certain that the population has not been completely isolated. The breeds that the original Pryor Mountain horses are derived from are also likely to have changed genetic characteristics since the founding of the herd through changes in selection, crossbreeding, or genetic drift (Cothran 1992). As a small population, the genetic change of the Pryor Mountain population has likely been higher than that of a larger population or breed. Cothran (1992) analyzed the genetics of the population and concluded that the Pryor Mountain horses almost certainly have Spanish origin. Since horses of this type are no longer present in Spain or Portugal, this population is considered a unique genetic resource (Sponenberg 2000).

The average genetic similarity was highest for breeds of Spanish origin, though the highest breed comparison was with the Quarter Horse, a genetically diverse breed which is highly similar to a variety of breeds but has a strong Spanish component in its ancestry. The Pryor Mountain horses are more similar to American Spanish breeds such as the Paso, than Old World breeds from Spain and Portugal such as the Andalusian (Cothran 1992).

The Pryor Mountain population has three alleles that are considered strong markers of Spanish ancestry and several variants that are common in Spanish horses as well as in a variety of other breeds (Cothran 1992). The large number of rare alleles may be partially due to the introduction of other breeds and horses from other herds and geographic regions in the past. Also of importance is the lack of clearly non-Spanish markers in the population (BLM 2001).

Ecology

Habitat

The PMWHR varies in elevation from 3,600 feet (1100 m) to 8,750 feet (2670 m) and includes steep-walled canyons, grassy meadows, and rocky slopes ($>45^\circ$) along Bighorn Canyon and Crooked Creek Canyon (Kissell et al. 1996). Most water sources in the area are ephemeral. There are four permanent springs in the horse range, including one which is located in a narrow canyon and inaccessible. A year-round trough is present on Trail Creek. Two artificial water catchments were developed in mid-slope areas of the range in the early 1970s. Crooked

Creek, a perennial stream on the western edge of the range, is accessible at four locations (Hall 1972). Soils in the range are loamy, mostly shallow (<10 inches, 25 cm) to moderately deep (20–40 inches, 51–102 cm) and include sandstone, limestone, shale, dolomite, and alluvial deposits near some of the major drainages (Ricketts 2004; Kissell et al. 1996). Annual precipitation varies between 6 inches (15 cm) in lower elevations to nearly 27 inches (68 cm) in the higher elevations. Snowfall ranges from 5–6 inches (12–15 cm) at lower elevations to 20 inches (50 cm) in higher elevations (Singer et al. 2000).

Vegetation types in the PMWHR are juniper woodland, dominated by Utah juniper (*Juniperus osteosperma*) at its northern most extent; mountain mahogany woodland, dominated by curl-leaf mountain mahogany (*Cercocarpus ledifolius*); juniper/mountain mahogany woodland, dominated by a mixture of Utah juniper and by curl-leaf mountain mahogany; riparian dominated by cottonwoods (*Populus* spp.) and fragrant sumac (*Rhus aromatica*); desert shrubland dominated by saltbrush (*Atriplex canescens*, *A. confertifolia*), black greasewood (*Sarcobatus vermiculatus*), rubber rabbitbrush (*Ericameria nauseosus*), and big sagebrush (*Artemisia tridentata*); sagebrush steppe including the big sagebrush community and black sagebrush (*A. nova*) community on limestone soils; grassland dominated by bluebunch wheatgrass (*Pseudoroegneria spicata*), blue grama (*Bouteloua gracilis*), needle-and-thread (*Hesperostipa* spp.), broom snakeweed (*Gutierrezia sarothrae*); coniferous woodland dominated by limber pine (*Pinus flexilis*), ponderosa pine (*P. ponderosa*), Douglas fir (*Pseudotsuga menziesii*), and a spruce (*Picea engelmanni*)-fir (*Abies lasocarpa*) mix; and agricultural areas dominated by alfalfa (*Medicago* spp.). The area of PMWHR inside Bighorn Canyon NRA is dominated by a Utah juniper, curl-leaf mountain mahogany, low forb, and needle-and-thread community (Knight et al. 1987; Ricketts 2004).

Kissell et al. (1996) found that horses primarily use lower elevations throughout the year, though some use upper elevations in the summer in response to the availability of forage. Horses were observed on all aspects, though eastern, southern, and northeastern aspects were used most often. During most of the winter, southern and southeastern exposures are warmer, have less wind, and are free from snow or have <4 inches (10 cm) of snow accumulation (Hall 1972; Singer et al. 2000). Except in rare instances, horses do not spend winters in high elevations where snow depths typically exceed 3 feet (1 m) most of the winter (Singer et al. 2000). Most horses were observed on slopes $\leq 15^\circ$, though completely flat areas were rarely used; no use of slopes $>45^\circ$ was documented. Berger (1986) found use of slopes, ravines, and clumps of juniper as refuge increased as wind chill decreased temperatures. Over 50% of horse observations over the course of the Kissell et al. (1996) study were at distances >1600 feet



(500 m) from permanent water sources. Juniper woodland was used most throughout the year. Grassland and desert shrubland were also used a majority of the time, though use varied by season. Riparian and agricultural areas were used least throughout the year (Kissell et al. 1996).

In 1984, 17,555 acres of the range were considered unsuitable for grazing because of lack of vegetation, rock outcrops, and bare soil (BLM 1984). The Natural Resources Conservation Service (NRCS) conducted a comprehensive inventory and assessment of the health of the PMWHR in 2004. A downward trend for the PMWHR occurred on 76% of transects, severe erosion occurred on approximately 57% of the range, and the range health functioned at a moderate to a moderate-extreme divergence from the historic climax plant community. There are three Wilderness Study Areas within PMWHR.

Food Sources

The diet of the Pryor Mountain population is dominated by grass, consistent with diets of other wild horses (Kissell et al. 1996; Berger 1986). Grasses comprise 82.7% of diet in winter, 96% in spring, 79.3% in summer, and 72.8% in fall on average. The most common grasses consumed are wheatgrass (*Pseudoroegneria* spp.) and needle-and-thread. Pryor Mountain horses also consume Indian ricegrass (*Achnatherum hymenoides*), fescues (*Festuca* spp.), and sedges (*Carex* spp.). Grasses are most abundant in the juniper woodlands and grasslands of PMWHR. The horses follow a similar use pattern to feral horses in Nevada, heavily using shrubland and grassland (Berger 1986). Juniper is more heavily used in the lower elevations while grasslands or meadows account for >99% of use in high elevations (Kissell et al. 1996).

Browse use comprised an average of 7.4% of winter diet, 1.6% spring diet, 12.7% of summer diet, 22.4% of fall diet during the Kissell et al. (1996) study. Winterfat (*Krascheninnikovia lanata*) and fringed sagebrush (*Artemisia frigida*) were the most common browse species. However, major browse species to vary year to year, though the reason for the change is unknown (Kissell et al. 1996). During the Coates and Schemnitz (1989) study, browse comprised 17% of summer diet and 16% of fall diet. Shadscale sagebrush and curl-leaf mountain mahogany were the heaviest used browse, though they did not exceed 2% of the diet in the Kissell et al. (1996) study. Browse more commonly constitutes <11% of any seasonal diet of feral horses (Hanley and Hanley 1982; Kissell et al. 1996). Forb use was greatest in the winter and summer, comprising 8.7% and 8.1% of the seasonal diet. Hood phlox (*Phlox hoodii*) was the most commonly used species (Kissell et al. 1996).

Competition

In 2003, approximately 160 horses and 100 bighorn sheep occupied PMWHR year-round, and additionally 350 mule deer during the winter. Since 2003, approximately 150-160 horses have been managed on the range. Horses and bighorn sheep overlap in the entire range. During the winter, horses use juniper woodland while sheep use mountain mahogany and or juniper woodland. Horses and bighorn sheep have the greatest potential for forage competition (wheatgrass and needle-and-thread) during the spring and summer; during the summer horses use more grassland and less grazed slopes than sheep, but there is a slight spatial overlap (Kissell et al. 1996). Coates and Schemnitz (1989, 1994) reported horse and sheep dietary overlaps as 70% for summer, 75% for fall, and 58% for winter and observed male sheep feeding with horses. Horses have been observed with sheep on the range (K. Grams, pers. comm.). Coates and Schemnitz (1989) also reported an overlap of forbs (scarlet globemallow, *Sphaeralcea coccinea*) in female sheep and horse diets and an overlap of grasses in ram and horse diets. However, Kissell et al. (1996) found no significant overlap in fall and winter diets between sheep and horses, but had results that support significant overlap in summer diet.

Horses and mule deer have limited special overlap due to different habitat preferences. Kissell et al. (1996) observed little spatial overlap between horses and mule deer due to seasonal migration to summer ranges by both horses and deer. There is no significant overlap in the food sources of horses and mule deer as deer primarily feed on browse and horses feed on grass (Kissell et al. 1996).

Social Structure

Horses on the PMWHR follow a harem band social structure with associated bachelor groups. In 2004, the herd consisted of 33 bands, each with a single dominant harem stallion, and 30 bachelors (Ransom et al. 2005). Harems vary in size from year to year and may range from 2 to 15 horses (BLM 1984). The average harem includes one stallion, a lead mare, subordinate mares, foals and yearling offspring, and immature males and females (2-3 years old). Larger harems may have two stallions; one is dominant though both breed (Feist 1971; Hall 1972). Stallions appear to be the dominant decision-makers on the PMWHR which is related to the high rate of interchange between mares and stallions in the Pryor Mountain population (BLM 2001). During 1992-1994, the rate that mares interchanged between harems annually was 15%, but increased about three-fold during 1994-1997, possibly due to the greater ratio of adult males (Singer et al. 2000). Lead mares typically direct and facilitate normal daily activity in wild horse populations. However, alpha mares are rare in the Pryor Mountain population which may be related to the very few associations developed between stallions and



specific mares for multi-year periods (Hall 1972; BLM 2001).

Females typically leave their natal harems once they become mature. In Great Basin wild horse herds, this move was permanent within two years (Berger 1986). Males will stay with their original band until they are kicked out. Males that are unable to obtain a harem remain alone or form bachelor groups which are loosely organized groups with a dominant male. Individuals often roam by themselves for several days, but may rejoin the original group or another bachelor group (Hall 1972; Feist 1971).

Reproduction

Pryor Mountain mares are polyestrous, primarily during the breeding season between late-March to mid-July. During estrus, mares will be receptive for 4 to 6 days, non-receptive for about 15 days, and then return to estrus. This cycle sometimes continues as late as September or October until the mare has been bred. Postpartum estrous occurs in mares an average of 7-8 days after giving birth, though mares have been observed in heat 3-4 days after giving birth (K. Grams, pers. comm.). This varies from the domestic horse, which will breed at any time of the year.

Pryor Mountain mares can be bred and produce foals at as early as two years old. Stallions generally begin breeding at three to four years, compared to domestic horses that can begin breeding at one. Mares aged 5-14 years appear to be the primary foal producers; the fertility of younger and older mares has been controlled by treatment since 2001 (BLM 2001).

The gestation period for Pryor Mountain horses is 336-340 days, approximately the same as domestic horses. Foaling primarily takes place during May-June (BLM 2006). Mares will leave the harem to give birth and select a birthing site. Birthing sites for mares in the Great Basin included mountainous slopes, ravines, flat brush and steppe areas, and flat grassland areas (Berger 1986). The foaling rates for females ≥ 3 years was 49% between 1976 and 1989 (Garrott and Taylor 1990). The foaling rate for Pryor Mountain horses was 62% during 1992-1997 (Singer et al. 2000). These averages are less than the 75-89% reported for other wild herds (Singer et al. 2000; Berger 1986).

Population Dynamics and Survival

In 2006, the Pryor Mountain population sex ratio was balanced, with 79 female and 80 male horses (BLM 2006). Between 1976 and 1986, the sex ratio of adults averaged 52 M:100 F and skewed ($P < 0.05$) towards females (Garrott and Taylor 1990). Foal sex ratios were 1:1 in 1970-1986 and 1992-1997 (Garrott and Taylor 1990; Singer et al. 2000). Foal survival averaged 71% between 1996 and 2005. Survival is impacted by climate, predators, injury, and abandonment. Injury and abandonment can result from

interchange between mares and stallions (BLM 2001). The 0.98 survival rate is the highest reported for wild horse populations (Singer et al. 2000). The population structure for the PMWHR herd has historically been pyramidal, with the majority of the population in the youngest category, typical of wild ungulate herds (Garrott and Taylor 1990; Singer et al. 2000).

Annual survival rates for adults are typically 93-99% in most years and are only lower than 90% in years with severe snow cover (Garrott and Taylor 1990). Mortality is limited across most age classes, with more deaths of younger horses. Mountain lion (*Felis concolor*) predation was high in 2004, with 4 of 28 foals surviving, a survival rate of 14%. There is no evidence that other predators are impacting the population. The population average growth rate for the population between 1976 and 1986 was 18%, excluding 1978 (Garrott and Taylor 1990). The managed herd growth rate averages 7%; removal and contraception limit the size of the herd. Few horses exceed 17 years on the PMWHR due to environmental extremes; domestic horses frequently live 20-25 years. Mares appear to have a shorter lifespan, possibly related to energy expended on foal production (BLM 2006).

Status and Threats in Greater Yellowstone Area

Legal Status

Protection of wild horses in the western US began in 1959 with the passing of Public Law 86-234, which prohibited the use of motorized vehicles to hunt wild horses and burros on all public lands. This was the first federal legislation to protect wild horses and burros. The Pryor Mountain horses were further protected by the establishment of the PMWHR in 1968 by Secretarial Order which created a 32,000-acre refuge.

The Wild Free-Roaming Horses and Burros Act of 1971 explicitly protected wild horses and burros and gave them legal status. The Act placed the horses and burros under the jurisdiction of the Department of Agriculture and Department of the Interior and provided for the designation of specific ranges as sanctuaries by the secretaries. The Act also provided for the control, study, and management of wild horses and burros "in a manner that is designed to achieve and maintain a thriving natural ecological balance."

Threats

Maintaining a healthy rangeland is important to the long-term management of the Pryor Mountain horse population. The 2004 NRCS inventory and assessment of the health of the PMWHR determined a downward trend



occurred on 76% of transects, severe erosion occurred on approximately 57% of the range, and the range health functioned at a moderate to a moderate-extreme divergence from the historic climax plant community. Based on grazing models, NRCS determined the carrying capacity of the range varied between 45 and 142 horses (Ricketts 2004). Without controls on the horse population the rangeland is not be able to support the herd.

The carrying capacity of the PMWHR requires that the horse population be limited to a number near the estimated absolute minimum viable population size required to limit the loss of genetic variation to 1% per generation (Cothran and Singer 2000). Low genetic variability can result in decreased fecundity, increased mortality, and decreased disease resistance. The dramatic loss of genetic variation over a short time period is possible at low numbers and could reduce long-term adaptability and survivability of the population (BLM 2006; Cothran 1992; Cothran and Singer 2000). Genetic variation in the Pryor Mountain horses is relatively high compared to domestic breeds and other wild horse populations, though the risk of loss exists (Cothran and Singer 2000; Cothran 2002). During 1991-1997, Cothran and Singer (2000) found no trend towards loss of genetic diversity.

Disease does not currently threaten the Pryor Mountain population, though equine infectious anemia (also known as swamp fever, mountain fever, slow fever, or Coggins disease) was found in wild horse herds in the Uinta Basin of eastern Utah in 1998. If present, this disease caused by a virus produces anemia, intermittent fever, and severe weight loss. The virus is transmitted by the exchange of bodily fluids, usually blood, and can be transmitted to unborn foals by mares that have high enough levels of the virus. Once an animal is infected, it is infected for life.

Management Activities

Historical Management

Prior to the establishment of horse refuges and the Wild Free-Roaming Horses and Burros Act of 1971, unclaimed and unbranded horses were removed from the range to reduce competition with cattle for forage and were slaughtered for pet food and fertilizer. When Taylor Grazing Act of 1934 was passed to control and monitor livestock grazing on public land and associated grazing districts were created, conflict over horse grazing permit violations began (Fazio 1997; Brownell 1999). This conflict between lessees and land management officials led to the establishment of the PMWHR by the Secretary of the Interior in 1968. In 1969 the range was expanded to include an additional 1,680 acres of Bighorn Canyon NRA. The range was expanded again in 1975 to include around 3,000 acres of BLM land. By 1984, 10,211 acres of

undesignated range had been added by lease or agreement. This temporarily included the Sorenson Extension Area of Bighorn Canyon NRA, totaling 46,811 acres for use by the horses (Brownell 1999; BLM 1984).

The PMWHR is managed by an interagency group consisting of the BLM (lead agency), USFS, and NPS. All federally managed horse ranges have a Herd Management Area Plan (HMAP), a site-specific plan that defines objectives for the herd management area and outlines procedures for achieving objectives and evaluating success. The PMWHR HMAP must be consistent with the BLM's Billings Final Resource Management Plan and developed in coordination with the NPS and USFS for compatibility with agency policies, regulations, and long range planning decisions (BLM 1984). The HMAP for the PMWHR, developed in 1984 and amended in 1992, outlines management options, direction of the range, and assesses environmental impacts to all resources resulting from proposed options. Management of the range located in Custer National Forest must also meet the Custer National Forest Plan goals, objectives, and forest policy.

The 1984 Herd Management Area Plan outlines management policy and guidelines that address range, livestock trailing, recreation, minerals, acquisition, wildlife, off-road vehicles, timber, wilderness, wild horses, and cultural resources. According to the Plan, horse numbers are to be managed to balance population levels with forage available for horses in herd area maintain the good condition of range or provide opportunity for improvement, herd health and viability, wildlife habitat, and watershed. The 1984 HMAP resource objectives included maintaining a viable herd that displays the typical Spanish characteristics of the Pryor Mountain wild horses, maintain range that is in good condition, prevent further deterioration of range sites in less than good condition, and achieve an upward trend in range condition on all range sites for a healthy, more viable horse herd (BLM 1984).

The initial stocking rate in 1984 was 121 horses, based on the 1981 carrying capacity of the land and in excess of the 100 horse minimum recommended by the BLM Program Guidance and National Wild Horse Advisory Board at the time. The Appropriate Management Level (AML) was reduced in 1992 to $95 \pm 10\%$ horses by revision to the HMAP. As of 2006, the AML was defined as the "number of adult wild horses (six months and older), determined through the BLM's planning process, to be consistent with the objective of achieving and maintaining a thriving natural ecological balance and multiple-use relationship" (BLM 2006).

In 1971, the BLM began capture and excess operations in attempt to manage the population closer to the estimated carrying capacity of the range. Prior to the use of fertility controls which began in 2001, herd size was managed by capture and removal. Excess horses are adopted through the BLM's Adopt-A-Horse Program, which began in



1973 on the PMWHR as a humane method of reducing herd numbers. After the 1977-1978 winter die off, horses were relocated from the Dryhead to the Tillett Ridge area to offset the possible effects of inbreeding and bring populations closer to carrying capacity, though some stallions returned to their original herd area. Introduction of new horses and reintroduction of adopted horses were considered as possible solutions to promote a viable population.

Current Management

In a 2006 Memorandum of Understanding (MOU), the interagency management group established mutual goals and objectives relating to the management of the range. The primary goal for management of the PMWHR recognized in this MOU is: "Wild horses are to be managed in a manner that is designed to achieve and maintain a thriving natural ecological balance in keeping with the multiple use management concept for public lands." Managers strive to balance a sustainable number of horses based on the carrying capacity of the range and viable population size.

In addition to natural mortality, fertility control and removals are currently used to achieve and maintain AML. Fertility control is used to reduce herd growth rates and recruitment while removals are used for necessary and immediate herd size reductions (BLM 2006). Treatments were initially given to younger mares to allow them more time to mature and support a foal and to older mares to allow them a year or more of better physical condition on the range. In 2005 and 2006, fertility control was only applied to mares 11 years old or older to partially suppress herd growth rates in order to manage for healthy horses

on healthy rangelands and manage the herd closer to the AML. Natural mortality, including unpredictable predation, was also expected to bring the population closer to but not below the AML (BLM 2006).

Mares are darted with the immunocontraceptive porcine zona pellucida (PZP) vaccine which supports a minimum feasible level of management and results in fewer disturbances to the herd (BLM 2006). PZP is a two-shot application easily administered in the field that meets most of the requirements for an ideal contraceptive agent, including safety and efficacy. PZP appears to be completely reversible when administered annually for up to five consecutive years, possibly six or seven years (Kirkpatrick and Turner 2002). PZP does not appear to have ill effects on behavior, already pregnant mares, the survival of foals, the subsequent fertility of the foals, or (Powell 1999; Kirkpatrick and Turner 2002, 2003). Treated mares are monitored for reactions; as of 2006, over 50% of mares showed no reaction, 20-25% developed a small nodule, and 5-15% showed temporary swelling around the injection site (BLM 2006). Darting typically takes place July.

Removals typically occur between two to four years. Removals have been conducted by gather on horses, helicopter gather, and by bait-trapping. Harem stallions and core breeding age mares are intended to remain on the range. No more than half the horses in an age classes are intended for removal and management retains horses of rare color in the herd. The selection of removed horses may depend on an individual's susceptibility to bait-trapping. A population census is conducted year-round on the ground by BLM employees, student interns, and public volunteers. Horses are tracked annually and can be individually recognized by facial and leg markings, coat color, scars, and group associations (BLM 2006).



References

- Berger, Joel. 1986. *Wild horses of the Great Basin*. Chicago: University of Chicago Press.
- Brownell, J.L. 1999. Horse distribution in the Pryor Mountains region preceding the creation of the Pryor Mountain Wild Horse Range. Unpublished report. Billings, MT.
- Bureau of Land Management. 1984. Pryor Mountain Wild Horse Range Herd Management Area Plan. Billings, MT: Billings Resource Area.
- , 2001. Environmental Assessment and Gather Plan: Pryor Mountain Wild Horse Range, FY2001 Wild Horse Population Gather & Selective Removal. BLM-MT-010-1-44. Billings, MT: Billings Field Office. Also online at http://www.blm.gov/mt/st/en/fo/billings_field_office/wild_horses/eas/2001.html.
- , 2006. Environmental Assessment for the Pryor Mountain Wild Horse Range Population 2006. BLM-MT-010-FY06-19. Billings, MT: Billings Field Office. Also online at http://www.blm.gov/mt/st/en/fo/billings_field_office/wild_horses/eas/2006.html.
- Coates, K.P. and S.D. Schemnitz. 1989. The bighorn sheep of Bighorn Canyon National Recreation Area and Pryor Mountain Wild Horse Range: Ecological relationships and management recommendations. Final report for National Park Service and Bureau of Land Management. Las Cruces, NM: New Mexico State University.
- , 1994. Habitat use and behavior of male mountain sheep in foraging associations with wild horses. *Great Basin Naturalist*. 54(1): 86-90.
- Cothran, E.G. 1992. Genetic analysis of the Pryor Mountain Wild Horse Reserve. Unpublished report. Lexington, KY.
- Cothran, E.G. 2002. Genetic Analysis of the Pryor Mountain Wild Horse Herd, MT. Report to Bureau of Land Management. Lexington, KY: University of Kentucky.
- Cothran, E.G. and F.J. Singer. 2000. Analysis of genetic variation in the Pryor Mountain wild horse herd. In *Managers' Summary – Ecological studies of the Pryor Mountain Wild Horse Range, 1992-1997*, comp. F.J. Singer and K.A. Schoenecker, 91-104. Fort Collins, CO: US Geological Survey, Midcontinental Ecological Science Center.
- Fazio, P.M. 1997. The fight to save a memory: Creation of the Pryor Mountain Wild Horse Range. *Annals of Wyoming: The Wyoming History Journal*. 69(2): 28-47.
- Feist, J.D. 1971. Behavior of feral horses in the Pryor Mountain Wild Horse Range. Master's thesis, University of Michigan.
- Garrott, R.A. and L. Taylor. 1990. Dynamics of a feral horse population in Montana. *Journal of Wildlife Management*. 54(4): 603-612.
- Hall, R. 1972. Wild horse: Biology and alternatives for management, Pryor Mountain Wild Horse Range. Billings, MT: Bureau of Land Management, Billings District Office.
- Hanley, T.A. and K.A. Hanley. 1982. Food resource partitioning by sympatric ungulates on Great Basin rangeland. *Journal of Range Management*. 35(2): 152-158.
- Kirkpatrick, J.F. and A. Turner. 2002. Reversibility of action and safety during pregnancy of immunization against porcine zona pellucida in wild mares (*Equus caballus*). *Reproduction*. Supplement 60:197-202.
- Kirkpatrick, J.F. and A. Turner. 2003. Absence of effects from immunocontraception on seasonal birth patterns and foal survival among Barrier Island wild horses. *Journal of Applied Animal Welfare Science*. 6(4): 301-308.
- Kissell, R.E., L.R. Irby, and R.J. Mackie. 1996. Competitive interactions among bighorn sheep, feral horses, and mule deer in Bighorn Canyon National Recreation Area and Pryor Mountain Wild Horse Range. Final report. Bozeman, MT: Montana State University.
- Knight, D.H., G.P. Jones, Y. Akasji, and R.W. Myers. 1987. Vegetation ecology in the Bighorn Canyon National Recreation Area. Final report to National Park Service and University of Wyoming National Park Service Research Center. Laramie, WY: University of Wyoming.
- MacFadden, B.J. 1992. Fossil horses: Systematics, paleobiology, and evolution of the family Equidae. New York: Press Syndicate of the University of Cambridge.



- Medicine Crow, J. 1992. *From the heart of the Crow country: The Crow Indians' own stories*. New York: Orion Books.
- Nabokov, P. and L. Loendorf. 1994. Every morning of the world. Ethnographic resources study for National Park Service.
- Powell, D.M. 1999. Preliminary evaluation of porcine zona pellucida (PZP) immunocontraception for behavioral effects in feral horses (*Equus caballus*). *Journal of Applied Animal Welfare Science*. 2(4): 321-335.
- Ransom, J., F.J. Singer, L. Zeigenfuss. 2005. Annual report for 2004 wild horse research and field activities. Reston, VA: US Geological Survey. Also online at http://www.fort.usgs.gov/Products/Publications/pub_abstract.asp?PubID=21512.
- Ricketts, M.J. 2004. Pryor Mountain Wild Horse Range Survey and Assessment. Bozeman, MT: Natural Resources Conservation Service.
- Singer, F.J., L. Zeigenfuss, L. Coates-Markle, and F. Schweiger. 2000. A demographic analysis, group dynamics, and genetic effective number in the Pryor Mountain wild horses population, 1992-1997. In *Managers' Summary – Ecological studies of the Pryor Mountain Wild Horse Range, 1992-1997*, comp. F.J. Singer and K.A. Schoenecker, 73-89. Fort Collins, CO: US Geological Survey, Midcontinental Ecological Science Center.
- Sponenberg, D.P. 2000. Deciding which feral horse populations qualify as a genetic resource. *Resource Notes*. Bureau of Land Management, National Science & Technology Center. Also available online at <http://www.blm.gov/nstc/resourcenotes/rn25.html>.
- Wyman, W. D. 1945. *The wild horse of the West*. Lincoln: University of Nebraska Press.

