

8. WILD HORSE AND BURRO CONSIDERATIONS

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Introduction

Wild horses (*Equus caballus*) and wild burros (*E. asinus*), like domestic livestock, can alter sagebrush ecosystem structure and composition and affect habitat quality for sagebrush dependent species (Beever and Aldridge 2011). The presence of Federally protected wild horses and wild burros can also have substantial effects on the capacity for habitat restoration efforts to achieve conservation and restoration goals. In the Conservation Objectives Team Report (USDOI FWS 2013), the presence of wild horses and burros was considered a threat to Greater sage-grouse (*Centrocercus urophasianus*; hereafter, GRSg) habitat quality, particularly in the sage-grouse's western range (USDOI FWS 2013). Four years after the Conservation Objectives Team Report was published, wild horse population sizes on Bureau of Land Management (BLM) and Forest Service lands have almost doubled (USDOI BLM 2017).

Lands with Federally protected wild horses and burros are managed for multiple uses, so it can be difficult to separate their ecological effects. However, scientific studies designed to isolate the effects of various land uses lead to the conclusion that landscapes with greater wild horse and burro abundance tend to have lower resilience to disturbance and resistance to invasive plants than similar landscapes with herds at or below target levels (Beever and Aldridge 2011; Chambers et al. 2017 [hereafter, Part 1], section 5.3.8). Many studies corroborate the general understanding that wild horses can lead to biologically significant changes in sagebrush ecosystems, particularly when their populations are overabundant relative to forage and water resources. In the Great Basin, areas without wild horses had higher shrub cover, plant cover, species richness, native plant cover, and overall plant biomass, and lower cover of grazing-tolerant, unpalatable, and invasive plant species such as cheatgrass (*Bromus tectorum*), when compared to areas with horses (Beever et al. 2008; Boyd et al. 2017; Davies et al. 2014; Smith 1986; Zeigenfuss et al. 2014). There were also measurable increases in soil penetration resistance and erosion, decreases in ant mound and granivorous small mammal densities, and changes in reptile communities (Beever et al. 2003; Beever and Brussard 2004; Beever and Herrick 2006; Ostermann-Kelm et al. 2009).

Top: Wild horses at Cherry Spring in the Maverick-Medicine Herd Management Area, Nevada (photo: USDOI Bureau of Land Management). Middle left: Wild horses in Divide Basin Horse Management Area, Wyoming (photo: USDOI Bureau of Land Management). Middle right: Wild burros at Wood Hills spring in the Elko, Nevada, BLM District (photo: USDOI Bureau of Land Management). Bottom left: Wild Horses at Victoria spring in the Antelope Triple B complex (photo: USDOI Bureau of Land Management). Bottom right: Wild horse gather by the BLM (photo: USDOI Bureau of Land Management).

Wild horses can have severe impacts on water source quality, aquatic ecosystems, and riparian communities (Barnett 2002; Beever and Brussard 2000; Earnst et al. 2012; Kaweck 2016; Nordquist 2011; USDO FWS 2008, 2012) and can sometimes exclude native ungulates from water sources (Gooch et al. 2017; Hall et al. 2016; Ostermann-Kelm et al. 2008; Perry et al. 2015; USDO FWS 2008). Bird nest survival may be lower in areas with wild horses (Zalba and Cozzani 2004), and bird populations have recovered substantially after livestock or wild horses, or both, have been removed (Batchelor et al. 2015; Earnst et al. 2005, 2012). Wild horses can spread nonnative plant species, including cheatgrass, and may limit the effectiveness of reseeding projects (Beever et al. 2003; Couvreur et al. 2004; Jessop and Anderson 2007; Loydi and Zalba 2009). Even after domestic livestock are removed, continued wild horse use above appropriate management levels can cause ongoing detrimental ecosystem effects (Davies et al. 2014; USDO FWS 2008), which may require several decades for recovery (e.g., Anderson and Inouye 2001).

Wild burros can have grazing and trampling impacts that are similar to wild horses (Carothers et al. 1976; Douglas and Hurst 1983; Hanley and Brady 1977) and can substantially affect riparian habitats (e.g., Tiller 1997) and native wildlife (e.g., Seegmiller and Ohmart 1981). Where wild burros and GRSG co-occur, year-round use by burros in low elevation habitats may lead to a high degree of overlap between burros and GRSG (Beever and Aldridge 2011).

In contrast to managed domestic livestock grazing (see section 7), neither the seasonal timing nor the intensity of grazing by Federally protected wild horses and burros can be managed, except through efforts to manage their numbers and distribution. Wild horses roam freely on the range year-round, and wild horse populations have the potential to grow 15 to 20 percent or more per year (Dawson 2005; Eberhardt et al. 1982; Garrott et al. 1991; Roelle et al. 2010; Scorolli and Cazorla 2010; Wolfe 1980). Although annual growth rates may be marginally lower in some areas where mountain lions (*Puma concolor*) can take foals (Turner 2015; Turner and Morrison 2001), horses tend to favor use of more open habitats (Schoenecker et al. 2016) that are dominated by grasses and shrubs and where ambush is less likely. For the majority of wild horse herds, there is little evidence that population growth is significantly affected by predation. As a result of the potential for wild horse populations to grow rapidly, impacts of wild horses on water, soil, vegetation, and native wildlife resources can increase exponentially unless there is active management to limit their population sizes.

On lands administered by the BLM, there were an estimated 72,674 BLM-administered, Federally protected wild horses and burros as of March 1, 2017, not including foals born in 2017 (USDO BLM 2017). Approximately 60 percent of those are present within 13 million acres (5 million hectares) of GRSG habitat. Federal protections exist for an estimated 7,100 wild horses and 900 wild burros that occupy approximately 2 million acres (800,000 hectares) of Forest Service-administered lands. Approximately 446,065 acres (180,523 hectares) of active Territories administered by the Forest Service contain GRSG habitat, which is occupied by an estimated 3,400 wild horses and burros. Some wild horses also inhabit other Federal lands in the sagebrush biome, including lands administered by the National Park Service, U.S. Fish and Wildlife Service, or Department of Defense, and Native American reservations and tribal lands.

Although wild horses and burros can present challenges to achieving desired habitat conditions, wild horse management is a necessary requirement of planning for long-term sagebrush ecosystem and GRSG conservation. This section relates to management of Federal lands and the terms “wild horses”

and “wild burros” are used throughout. However, the specific legal status for any given wild horse or burro population has a large influence on management objectives and the ability to manage wild horse and burro impacts.

In the biological sense, all free-roaming horses and burros in North America are feral, meaning that they are descendants of domesticated animals brought to the Americas by European colonists. Horses went extinct in the Americas by the end of the Pleistocene, about 10,000 years ago (MacFadden 2005; Webb 1984). Burros evolved in Eurasia (Geigl et al. 2016). The published literature refers to free-roaming horses and burros as either feral or wild. In the ecological context the terms are interchangeable, but the term “wild” horse is associated with a specific legal status. Wild and free-roaming horses and burros under the jurisdiction of the BLM and Forest Service are designated “wild” as legally defined by the Wild Free Roaming Horses and Burros Act of 1971 (WFRHBA) as amended (Public Law 92–195), and are under the protection, management, and control of the BLM and Forest Service. Only those horses whose unbranded and unclaimed ancestors were present on BLM and Forest Service lands at the time of the passage of the WFRHBA are managed in accordance with the WFRHBA, and only those lands where wild horses and burros were found when the WFRHBA was passed can be managed to maintain Federally recognized wild horse and burro populations.

Other populations of feral horses and burros on Federal lands (i.e., those on lands administered by the U.S. Fish and Wildlife Service, National Park Service, or Department of Defense; and Native American reservations and tribal trust lands) are generally subject to other Federal regulations and relevant State laws, but are not subject to provisions of the WFRHBA. This section draws on scientific studies of feral horses and burros, some of which also have wild horse or wild burro legal status. Clarification of which horses and burros are considered Federally protected is provided in the BLM regulation (43 CFR 4700 [FR 2011]), BLM wild horse and burro management handbook and manuals (USDOI BLM 2010a,b,c,d), Forest Service manual (FSM 2260.5), and Forest Service regulation (36 CFR 222.20(b)(13), 36 CFR 222.63 [FR 2012]). The legal designation of a particular herd is not expected to change the animals’ ecological effects, but it will influence management options. Discussions about management in this section reflect constraints for Federally designated wild horses and burros.

This section begins with information on wild horse and burro management structure, population estimates and spatial distribution, and management actions to maintain wild horses and burros at appropriate management levels. Then it discusses using resilience and resistance concepts to inform management of wild horses and burros. It concludes with management considerations at the project scale. This section refers mainly to wild horses because wild burros are not nearly as numerous as wild horses in most areas of the sagebrush biome.

Wild Horse and Burro Management Structure

For lands administered by the BLM, Herd Areas (HAs) are defined as areas where wild horses and burros existed at the time of passage of the WFRHBA. Herd Management Areas (HMAs)—the subset of lands designated for active management of wild horses and burros as part of multiple use management—can be designated only within HAs during land use planning activities. In most cases, each HMA is intended to support only wild horses or wild burros, but there are some HMAs that contain both. For HAs that do not have an HMA designation, it generally has been determined that resources are limiting and that wild horse and

burro populations cannot be maintained for the long term. The Forest Service-administered Wild Horse Territories (WHTs), Wild Burro Territories (WBTs), and Wild Horse and Burro Territories (WHBTs) are designated according to the species that occupy the Territory. There are some Territories without any wild horses or burros that are considered “inactive,” where it has been determined that there are not sufficient resources to maintain wild horses and burros, or where wild horses and burros no longer exist. The numbers of wild horses and burros in HMAs, WHTs, WBTs, or WHBTs and the overlap with GRSG habitat are in text box 8.1.

When two or more HMAs, WHTs, WBTs, or WHBTs are located close to one another, with the potential for wild horses and burros to move freely among them, those areas may be managed collectively as a “complex” (or “joint management area”). Complexes sometimes cross administrative boundaries between BLM field or district offices and Forest Service districts.

The spatial scales of wild horse management are the entire population at the West-wide scale; complexes or groups of HMAs or WHTs, WBTs, and WHBTs with interchange for the regional scale; and individual herds for the local scale. A National Academies of Science report (National Research Council 2013) suggested that wild horse management should be focused more broadly on meta-populations, in which HMAs, WHTs, WBTs, and WHBTs are grouped where interchange occurs, regardless of administrative boundaries. Thus, relative to the spatial scales presented in section 1 of this report, the BLM and Forest Service manage wild horses between the regional and local project levels. The actual spatial scale for any given wild horse population should be determined in consultation with the local staff that manages those populations (i.e., BLM wild horse and burro specialist; Forest Service rangeland management specialist).

Importantly, each HMA, WHT, WBT, and WHBT has an established target population size range for wild horses (and a separate target for wild burros, if they are present), known as the appropriate management level (AML). The BLM and Forest Service view AML as a target population size range which, if maintained, should allow for a thriving ecological balance and multiple use relationship (43 CFR 4710.3-1 [USDOI BLM 2010b]; 43 CFR 4770.3(c) [USDOI 2012]; 36 CFR 222.60(b)(3), 36 CFR 222.61(a)(1), 36 CFR 222.69(a)

Text Box 8.1—Wild Horse and Burro Population Sizes

The BLM manages wild horses and burros within a total of 177 Herd Management Areas (HMAs), which range in size from 3.0 square miles (777 hectares) to 2,033.8 square miles (526,754.2 hectares). As of March 1, 2017, the estimated number of wild horses and burros managed by BLM was 72,674. A total of 105 HMAs overlap with approximately 13 million acres (5 million hectares) of GRSG habitat.

The Forest Service manages 34 active and 19 inactive wild horse and burro administrative units that include: Wild Horse Territories (WHTs; 27 active, 16 inactive), Wild Burro Territories (WBTs; 4 active, 3 inactive), and Wild Horse and Burro Territories (WHBTs; 3 active). These range in size from 5.4 square miles (1,398.6 hectares) to 530.4 square miles (137,373.6 hectares). The Forest Service manages approximately 8,000 wild horses and burros. Thirteen active Territories overlap with approximately 446,000 acres (180,000 hectares) of GRSG habitat.

One thousand or more wild horses on three WHTs and five HMAs live on or near Bi-State GRSG habitat (about 70,000 Forest Service acres [28,000 hectares] and 82,403 BLM acres [33,348 hectares]) (Bi-State Technical Advisory Committee 2012). The Bi-State population has been identified as a Distinct Population Segment of GRSG and is managed under a separate conservation Action Plan.

[FR 2012]). This view reflects an assumption that wild horse and burro populations at AML should allow for land health standards to be met (USDOI BLM 2010a). The AML generally is a range between a low and high value, to allow for some variability in population size across years (USDOI BLM 2010a). The AML is typically determined at the activity planning level through site-specific analysis or, in some cases, through the land use planning process. Monitoring information that couples data on wild horse and burro populations and rangeland status and trends is used to establish or adjust AMLs (text box 8.2). Progress toward attainment of site-specific and landscape-level management objectives or multiple use objectives is also considered. Future studies at local scales could test the assumption that wild horse and burro populations at AML allow for land health standards to be met.

Text Box 8.2—Monitoring Considerations for Wild Horses and Burros

Reliable estimates of population sizes and habitat data provide the basis for management decisions regarding wild horses and wild burros. Understanding the annual growth rates of wild horse and burro populations and the status and trends of rangelands occupied by wild horses and burros is essential for making informed management decisions.

Inventory (monitoring) data for wild horse and burro populations include information on the numbers of animals, their use patterns, and spatial distribution. Habitat data include grazing utilization, range ecological condition and trend, actual use, and climate (weather) data. Habitat monitoring data collection should be coordinated with other resource programs (e.g., range, watershed, wildlife) to maximize efficiency and minimize duplication.

Data and analyses of populations and habitats are used in concert to:

- Establish or adjust Appropriate Management Levels (AMLs);
- Make a determination of excess wild horses or burros (i.e., establish the need to gather and remove excess animals in order to reach and stay at AML);
- Develop or revise Herd Management Area (HMA) boundaries; and
- Evaluate conformance with Land Health Standards, Land Use Plan goals and objectives, or other site-specific or landscape-level objectives.

Data and methods used to inform decisions should be scientifically defensible. The public should be able to understand the methods used and how they are implemented and also to access the data used to make decisions.

Data on Population Estimates and Spatial Distribution of Wild Horses and Burros

Population estimates for each HA and HMA are reported annually in the Public Land Statistics (http://www.blm.gov/public_land_statistics/); spatial data are available via the BLM GeoCortex, which is available to managers for analyses and planning and is useful in determining the number of excess animals present on the range (<https://webmaps.blm.gov/Geocortex/Html5Viewer/Index.html?viewer=whb>). The Forest Service reports population estimates for each territory on the Forest Service wild horse and burro program website (<https://www.fs.fed.us/wild-horse-burro/territories/index.shtml>). The BLM and Forest Service have recently adopted a statistically valid, standardized methodology for estimating wild horse population sizes (Lubow and Ransom 2009, 2016; Ransom 2012) that accounts for animals that were present, but not seen by observers. In

most cases, reported population estimates are based on the statistical analysis of aerial survey data; BLM policy calls for each HMA (and complexes that include both BLM lands and Forest Service WHTs, WBTs, or WHBTs) to be surveyed at least once every 2 years (USDOI BLM 2010e). For both agencies, population size estimates are projected for intervening years based on the best available information about expected population growth rates for each area. As previously discussed, wild horse growth rates can typically be assumed to be about 15 percent to 20 percent per year (National Research Council 2013) unless there is a contraceptive project to limit reproduction. However, in some places the annual growth rate may be greater than 20 percent. The range-wide population estimates are used to develop BLM geospatial data (accessible at the BLM GeoCortex site) and the status of a population relative to high AML within a particular HMA.

Although it is the intended management goal that wild horses remain only on HMAs, WHTs, or WHBTs, the current reality is that Federally protected wild horses are also present on many HAs and on other Federal, State, tribal, and private lands outside of these administrative boundaries. As a result, the user must be cautiously aware that the data representing boundaries of and populations within HMAs, HAs, WHTs, WBTs, and WHBTs may not portray the actual spatial distribution of all wild horse and burro populations. Continued increases in wild horse and burro populations, relative to AML, will result in a more widespread distribution of herds, including into areas outside designated boundaries. In areas where road or trail access allows for observations and on-the-ground documentation of horse sign (e.g., trailing, scat piles, evidence of horse grazing and browsing), the local designated staff is likely to have a broad understanding of where the animals tend to go in different seasons, which water sources they rely on, and the general pattern of their movements.

Management Actions to Maintain Wild Horses and Burros at Appropriate Management Levels

The 1971 WFRHBA directs the BLM and Forest Service to remove excess animals from the range (43 CFR 4720.1 and 36 CFR 222.69, respectively) to maintain a thriving natural balance. The number of wild horses or burros greater than a designated high AML for a HMA, WHT, WBT, or WHBT is considered to be the number of “excess” animals in the area. In order to take management action, the agencies must make two determinations: (1) that an overpopulation exists, and (2) whether or not it will be necessary to remove excess animals.

Historically, the BLM and Forest Service reduced herd population sizes to the low value of AML. This was accomplished by removing excess animals from the range. The population would then typically grow to reach the high value of the AML range within 3 to 4 years, unless some form of contraception was used to limit population growth rates. Natural regulation via starvation or dehydration is generally not acceptable to many members of the public (National Research Council 2013).

After removal, animals were placed in holding facilities, offered to the public for adoption, and then kept in holding facilities indefinitely if there was no adoption demand. However, removing all excess wild horses and holding them in off-range facilities for the remainder of their lives would be prohibitively expensive (Garrott and Oli 2013). In many recent years, the BLM has not had the budgetary capacity to remove more than approximately 3,500 animals per year

from the range. Further, the more than 45,000 BLM-administered, captive wild horses currently in long-term holding (of which about 850 are horses from Forest Service Territories) require over \$50 million per year to maintain. As a result, populations of wild horses and burros across all BLM-administered lands (and on some Forest Service Territories) have not been gathered so frequently. Average population sizes are now more than three times greater than the high end of the total AML and these populations are growing.

In 2015, the BLM, the Forest Service, and other agencies identified certain areas as the most important habitats for GRSG and other sagebrush obligates. None of those areas overlapped with Forest Service-administered wild horse or wild burro populations. The BLM developed a 5-year gather schedule to achieve AML by 2020 in 22 HMAs that overlapped areas identified as the most important habitats for GRSG and other sagebrush obligates. However, under budget projections made in FY2017, the BLM will not have the fiscal capacity to conduct gathers within GRSG Priority Habitat Management Areas until 2020 or later, and has no capacity to manage wild horse populations that overlap with GRSG General Habitat Management Areas. Unless there are Congressionally directed changes to the BLM program, it is expected that the number of wild horses within GRSG habitat could surpass 65,000 horses in 2019. Furthermore, maintaining any wild horse population at or below AML will require an active and ongoing program of population growth suppression or scheduled removals (or both) of excess animals. Without such a program, habitat restoration will quickly be at risk as wild horse populations again grow to exceed AML.

Currently used population growth suppression methods include gelding and the immunocontraceptives porcine zona pellucida (PZP) and GonaCon (National Research Council 2013). Both vaccines may be effective for only 1 year, unless booster doses are given (National Research Council 2013). Repeated PZP boosters require annual darting or recapture of the vast majority of wild horses under BLM or Forest Service management, which is infeasible on many HMAs and Territories, would be prohibitively expensive to apply across the range of wild horses and burros, and may lead to more stress for wild horses as a result of frequent capture. The BLM is supporting ongoing research initiatives to develop and test longer-term contraception for wild horses and burros and to improve contraceptive efficacy and production (USDOI BLM 2015). However, planning decisions that propose to remove excess horses or utilize population growth suppression on any BLM lands are often appealed and litigated by interested members of the public. This results in a high degree of uncertainty about the ability of designated Federal agencies to maintain wild horse populations within AML.

Using Resilience and Resistance Concepts and the Science Framework to Inform Management of Wild Horses and Burros

Information on relative ecosystem resilience to disturbance and resistance to invasive annual grasses can be used to help understand the responses of sagebrush ecosystems, species at risk, and other resources to wild horse and burro use and to the interactions of wild horse and burro use with other potential disturbance factors such as wildfire and invasive plants. Information on resilience and resistance to invasive annual grasses, coupled with information on current

and projected wild horse and burro population sizes relative to AML and other predominant threats and disturbance factors, can be used to inform conservation and restoration strategies in sagebrush ecosystems across scales.

Part 1 of the Science Framework provides an approach based on an understanding of ecosystem resilience to disturbance and resistance to invasive annual grasses that uses assessments at the mid-scale (ecoregional or GRSG Management Zone) (fig. 1.1) to help prioritize areas for management and determine effective management strategies (Chambers et al. 2017). The approach is based on: (1) the likely response of an area to disturbance or stress due to threats or management actions (i.e., resilience to disturbance and resistance to invasive annual grasses), (2) the capacity of an area to support target species or resources, and (3) the predominant threats. The geospatial data layers and analyses used in the approach are described in Part 1, sections 8.1 and 8.2. The process involves overlaying key data layers including resilience and resistance to invasive annual grasses as indicated by soil temperature and moisture regimes (Maestas et al. 2016), sage-grouse breeding habitat probabilities (Doherty et al. 2016), the densities or distributions of other sagebrush dependent species, and the primary threats for the ecoregions or Management Zones in the assessment. The maps and analyses that managers derive from this process are an essential component of prioritizing areas for management actions and developing management strategies.

Wild horse and burro densities and AMLs can be used similarly to other threats and disturbance factors in the analyses. Managers can devise categories to evaluate the degree to which wild horse and burro populations are within or exceed AMLs for HMAs, WHTs, WBTs, and WHBTs. Here, three abundance categories relative to AML were developed based on available abundance estimates for BLM lands and Forest Service lands: within AML, more than 100 percent to 200 percent of AML, and more than 200 percent of AML. The wild horse HMAs were overlaid with these three abundance categories (fig. 8.1). Note that this figure also depicts HAs where the target population for wild horses is zero, but where wild horses are present.

The three abundance categories were overlaid with: (1) the three resilience and resistance categories derived from soil temperature and moisture regime information, and (2) GRSG breeding habitat probabilities (see Part 1, sections 8.1 and 8.2). This analysis does not include areas outside the boundaries of HMAs, HAs, WHTs, WBTs, and WHBTs where horses and burros have expanded their use. The data used in the analyses can be found at: <https://www.sciencebase.gov/catalog/item/576bf69ce4b07657d1a26ea2>.

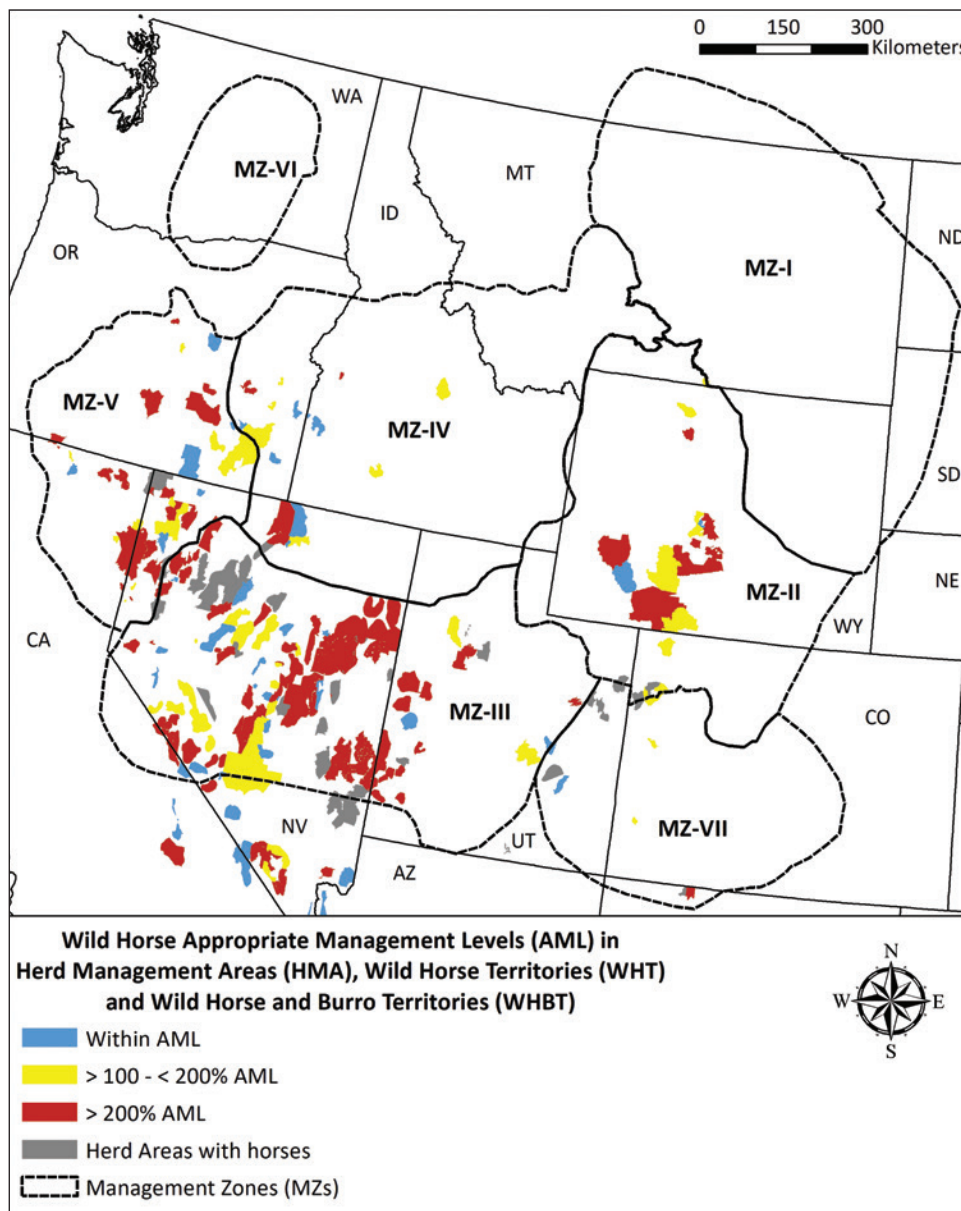


Figure 8.1—Categories of estimated wild horse abundance as of March 1, 2017 relative to Appropriate Management Level (AML) for wild horse Herd Management Areas (HMAs) on BLM lands and Wild Horse Territories (WHTs) and Wild Horse and Burro Territories (WHBTs) on Forest Service lands. Gray polygons indicate Herd Areas where the target population for wild horses is zero, but where wild horses are present. Estimated wild horse abundance exceeds AML in most HMAs, WHTs, and WHBTs.

Analyses of Appropriate Management Levels, Ecosystem Resilience and Resistance, and Breeding Bird Habitat Probabilities

Sixty percent of HMAs, WHTs, and WHBTs managed by the BLM and Forest Service are in areas categorized as having low resilience and resistance (fig. 8.2, table 8.1). In contrast, 33 percent have moderate resilience and resistance and only 7 percent have high resilience and resistance. In the area with low resilience and resistance, 60 percent has wild horse abundance that exceeds 200 percent of the horse AML.

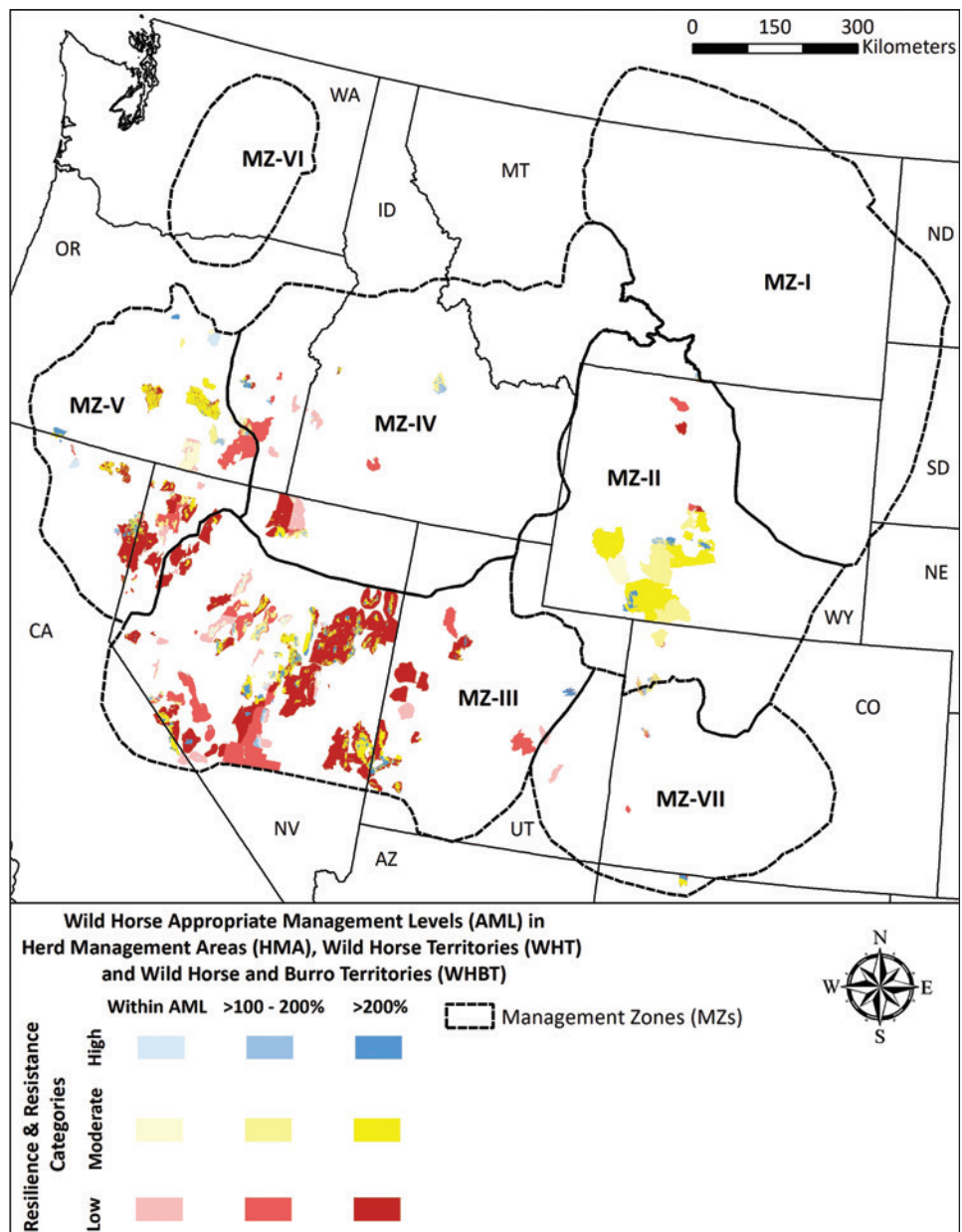


Figure 8.2—Categories of estimated wild horse abundance as of March 1, 2017 relative to Appropriate Management Level (AML), overlaid with the resilience and resistance classes within wild horse Herd Management Areas (HMAs) on BLM lands and Wild Horse Territories (WHTs) and Wild Horse and Burro Territories (WHBTs) on Forest Service lands. Most HMAs, WHTs, and WHBTs are in low to moderate resilience and resistance categories and exceed AML.

Table 8.1—The area and percentage of Herd Management Areas, Wild Horse Territories, and Wild Horse and Burro Territories for the Bureau of Land Management and Forest Service by wild horse Appropriate Management Level (AML) class and resilience and resistance class. Percentages within a Management Zone (MZ) add to 100.

Percent Horse AML class	Resilience and resistance					
	Low		Moderate		High	
	Acres	%	Acres	%	Acres	%
MZ I						
<100	0	0	0	0	0	0
>100–200	0	0	4,326	57	3,200	43
>200	0	0	0	0	0	0
Total	0	0	4,326	57	3,200	43
MZ II						
<100	0	0	414,831	8	2,204	1
>100–200	182,045	4	1,578,883	31	68,236	1
>200	108,086	2	2,548,764	50	166,862	3
Total	290,131	6	4,542,478	89	237,302	5
MZ III						
<100	1,161,465	8	233,713	2	146,235	1
>100–200	2,965,677	19	368,132	2	168,363	1
>200	7,916,216	52	1,743,470	11	618,498	4
Total	12,043,358	79	2,345,315	15	933,096	6
MZ IV						
<100	560,601	27	67,981	3	19,771	1
>100–200	490,895	23	198,977	9	89,076	4
>200	560,706	27	90,401	4	49,144	2
Total	1,612,201	77	357,359	16	157,991	7
MZ V						
<100	193,058	4	426,958	8	186,252	4
>100–200	942,681	18	336,100	6	85,331	2
>200	1,618,840	31	1,119,312	22	276,522	5
Total	2,754,579		1,882,370		548,105	
MZ VII						
<100	130,987	38	0	0	0	0
>100–200	47,132	13	64,758	19	29,502	8
>200	8,427	2	40,236	12	27,286	8
Total	186,546	53	104,994	31	56,788	16
All MZs						
<100	2,046,111	7	1,143,483	4	354,462	1
>100–200	4,628,430	17	2,551,176	9	443,708	2
>200	10,212,274	36	5,542,187	20	1,138,311	4
Total	16,886,815	60	9,236,846	33	1,936,481	7

Differences in both resilience and resistance and the abundance categories exist among Management Zones for wild horses (fig. 8.2, table 8.1). In Management Zone III, where the majority of wild horses are found, lands managed for wild horses are primarily within low resilience and resistance areas (79%). In the area with low resilience and resistance, 52 percent has wild horse abundance in excess of 200 percent of the horse AML. In Management Zones IV and V, lands managed for wild horses also are primarily within low resilience and resistance areas: 77 percent and 53 percent, respectively. In both of these areas, most lands managed for wild horses have horse abundance greater than 100 to 200 percent of the horse AML.

For wild burro populations, most of the land area in HMAs, WBTs, and WHBTs included in this analysis is in low resilience and resistance areas (80 percent), followed by moderate resilience and resistance areas (18 percent) (fig. 8.3, table 8.2). Moreover, 73 percent of the lands managed for wild burros in this analysis have wild burro abundance in excess of 200 percent of the burro AML.

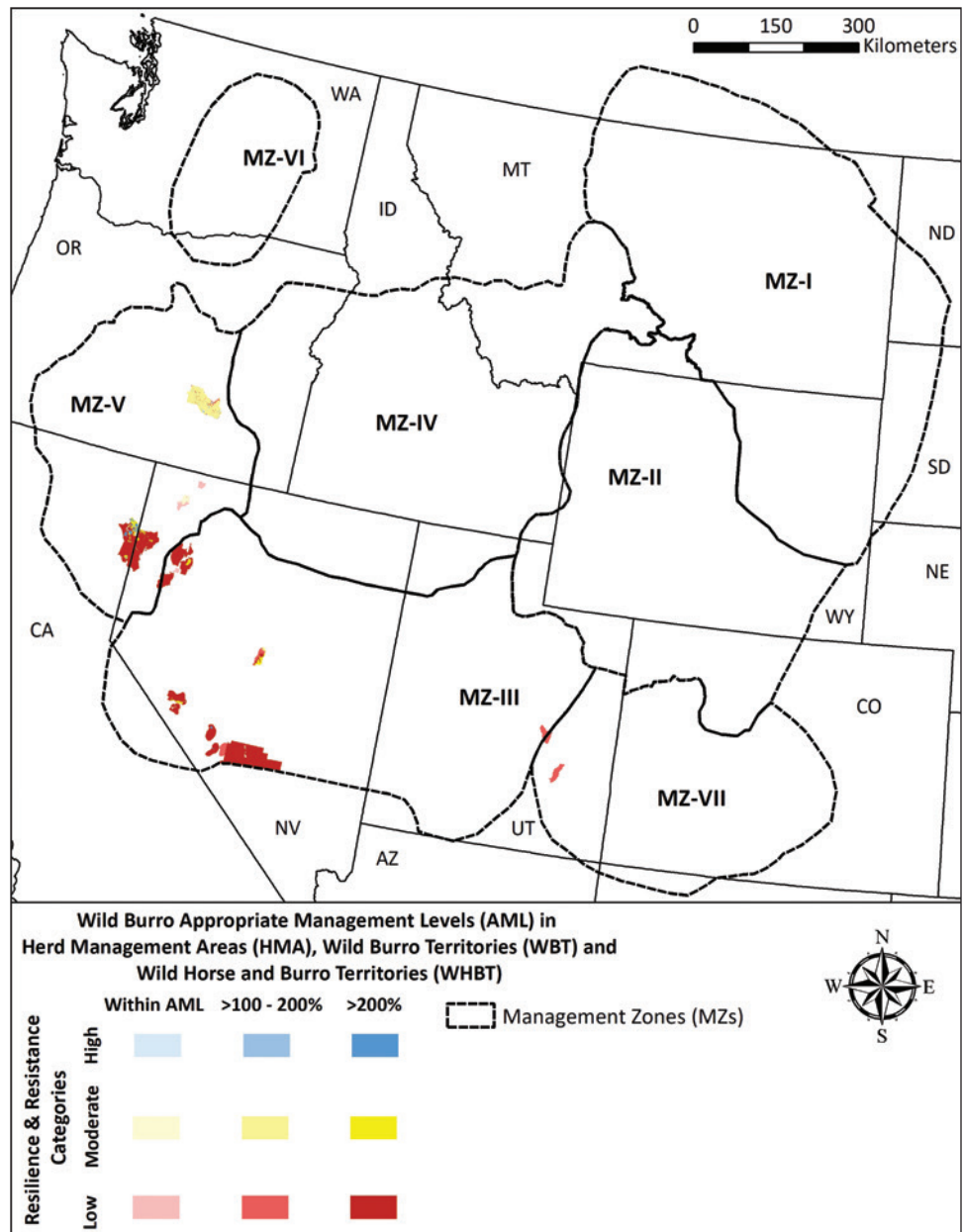


Figure 8.3—Categories of estimated wild burro abundance as of March 1, 2017 relative to Appropriate Management Level (AML), overlaid with the resilience and resistance classes within wild burro Herd Management Areas (HMAs) on BLM lands and Wild Burro Territories (WBTs) and Wild Horse and Burro Territories (WHBTs) on Forest Service lands. Estimated wild burro abundance exceeds AML in most HMAs, WHTs, and WHBTs.

Table 8.2—The area and percentage of Herd Management Areas, Wild Burro Territories, and Wild Horse and Burro Territories for the Bureau of Land Management and Forest Service by wild burro Appropriate Management Level (AML) class and resilience and resistance class. Percentages within a Management Zone (MZ) add to 100.

Percent Burro AML class	Resilience and resistance					
	Low		Moderate		High	
	Acres	%	Acres	%	Acres	%
MZ III						
<100	18,063	1	0	0	0	0
>100–200	162,160	8	9,563	1	0	0
>200	1,655,499	87	59,095	3	4,076	0
Total	1,835,722	96	68,658	4	4,076	0
MZ V						
<100	77,478	5	44,492	3	0	0
>100–200	30,008	2	442,165	29	20,651	1
>200	795,307	52	80,589	5	51,215	3
Total	902,793	59	567,246	37	71,865	4
MZ VII						
<100	0	0	0	0	0	0
>100–200	130,987	100	0	0	0	0
>200	0	0	0	0	0	0
Total	130,987	100	0	0	0	0
All MZs						
<100	95,541	3	44,492	1	0	0
>100–200	323,155	9	451,728	13	20,651	1
>200	2,450,806	68	108,351	4	55,290	1
Total	2,869,502	80	635,940	18	75,941	2

In Management Zones III and V the highest percentage of land is in low resilience and resistance areas with wild burro abundance more than 200 percent of the burro AML. Most of the burros managed by the BLM are located in Arizona and southern Nevada (USDOI 2017), which is outside of the sagebrush biome and the area of this analysis.

Overlaying the categories of wild horse abundance relative to AMLs with the sage-grouse breeding habitat probabilities shows that 42 percent of the lands managed for wild horses occur in the low, 40 percent in the moderate, and 18 percent in the high GRSG breeding habitat probability (fig. 8.4, table 8.3). In the high breeding habitat probability areas, which are the highest priority for protection, and in the moderate breeding habitat probability areas, which often provide opportunities for conservation actions, about two-thirds of the lands managed for wild horses have horse abundance in excess of 200 percent of the horse AML.

Analysis of the sage-grouse breeding habitat probabilities overlaid on categories of wild burro abundance relative to AML shows that 46 percent, 46 percent, and 8 percent of those GRSG breeding habitats managed for wild burros and included in this analysis occur in the low, moderate, and high breeding habitat probability areas, respectively (table 8.4). Within low, moderate, and high GRSG breeding habitat probability areas, 69 percent, 72 percent, and 38 percent, respectively, of the lands managed for wild burros have burro abundance greater than 200 percent of the burro AML. Management Zone V has a higher land area managed for wild burros with GRSG breeding habitat than Management Zone III, and a higher percentage of the wild burro population is in moderate and high GRSG breeding habitat probability areas.

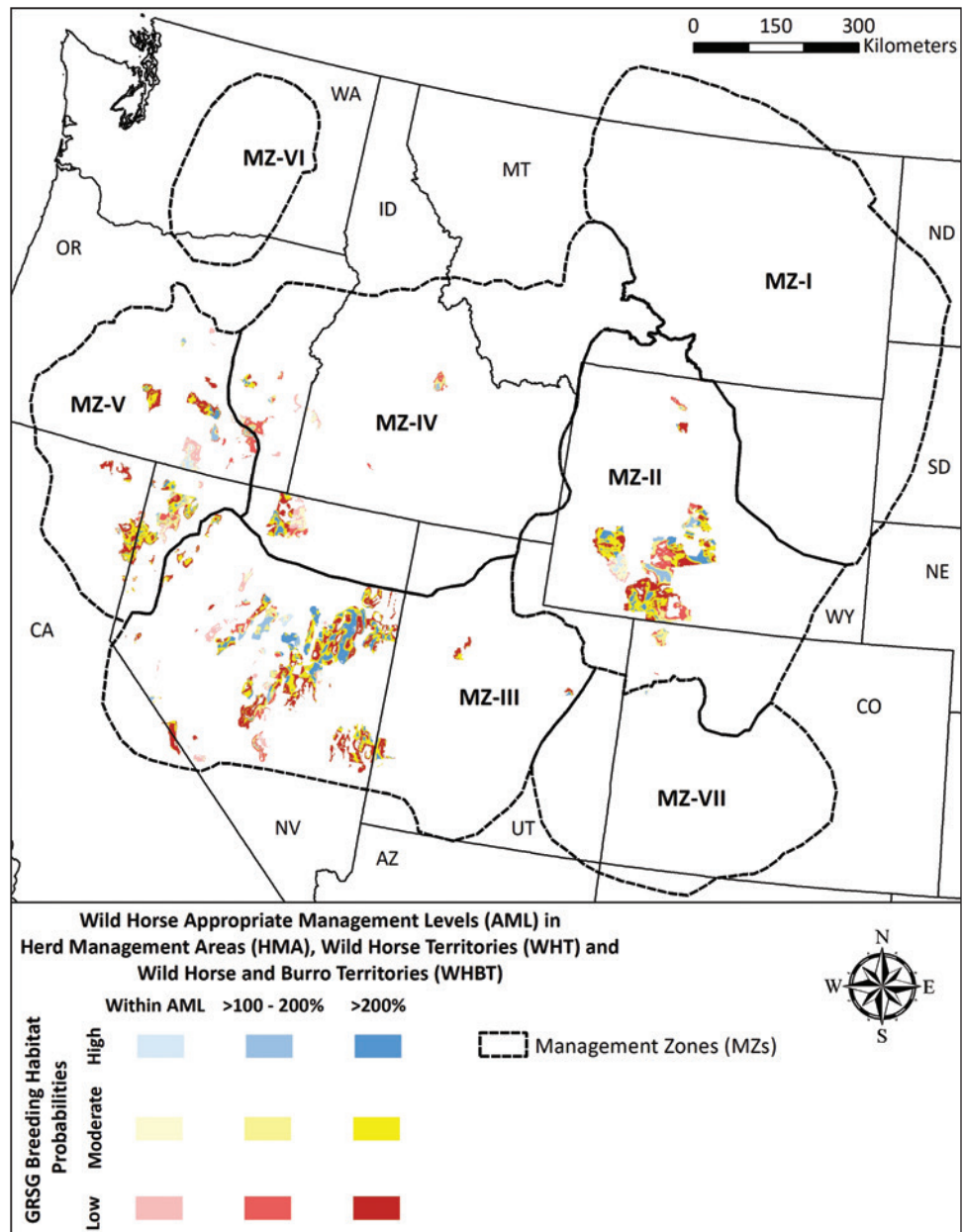


Figure 8.4—Categories of estimated wild horse abundance as of March 1, 2017 relative to Appropriate Management Level (AML), overlaid with the GRSG breeding habitat probabilities within wild horse Herd Management Areas (HMAs) on BLM lands and Wild Horse Territories (WHT) and Wild Horse and Burro Territories (WHBTs) on Forest Service lands. Estimated wild horse abundance exceeds AML in many areas with moderate to high GRSG breeding habitat probabilities.

Table 8.3—The area and percentage of Herd Management Areas, Wild Horse Territories, and Wild Horse and Burro Territories for the Bureau of Land Management and Forest Service by wild horse Appropriate Management Level (AML) class and Greater sage-grouse (GRSG) breeding habitat probability class. Percentages within a Management Zone (MZ) add to 100.

Percent Horse AML class	GRSG breeding habitat probability					
	Low		Moderate		High	
	Acres	%	Acres	%	Acres	%
MZ II						
<100	92,230	2	198,329	4	77,042	2
>100–200	573,836	13	557,183	13	255,275	6
>200	924,545	21	1,298,137	29	462,370	10
Total	1,590,610	36	2,053,649	46	794,686	18
MZ III						
<100	353,147	5	148,052	2	85,319	1
>100–200	312,594	4	319,359	5	273,905	4
>200	2,319,075	33	2,028,561	29	1,185,258	17
Total	2,984,816	42	2,495,972	36	1,544,482	22
MZ IV						
<100	234,091	16	208,371	14	10,955	1
>100–200	293,756	20	160,647	11	33,053	2
>200	212,954	14	224,679	15	95,330	7
Total	740,802	50	593,697	40	139,338	10
MZ V						
<100	281,312	9	161,838	5	94,638	3
>100–200	334,833	10	320,755	10	142,127	4
>200	867,460	27	832,302	26	178,115	6
Total	1,483,605	46	1,314,895	41	414,880	13
MZ VII						
<100	0	0	0	0	0	0
>100–200	252	3	2,494	29	5,748	68
>200	0	0	0	0	0	0
Total	252	3	2,494	29	5,748	68
All MZs						
<100	960,780	6	716,590	4	267,954	2
>100–200	1,515,271	9	1,360,438	8	710,108	4
>200	4,324,034	27	4,383,679	27	1,921,073	12
Total	6,800,085	42	6,460,707	40	2,899,135	18

Using the Science Framework to Inform Management Decisions

Primary considerations for wild horse and burro management from the Science Framework approach are presented next (see tables 1.3, 1.4).

- In general, areas that support medium to high sage-grouse breeding habitat probabilities or other important resources are high priorities for management (table 1.3: cells 2A, 2B, 2C, 3A, 3B, 3C), especially low resilience and resistance categories that lack the potential to recover from disturbances such as excessive wild horse and burro use without significant intervention (table 1.3: cells 2C, 3C). These areas could be considered priorities for wild horse and burro gathers and fertility control where horse and burro abundance exceeds target AMLs and the area is not highly degraded.
- Areas with moderate and, especially, high resilience and resistance often have the potential to recover through successional processes (table 1.3: cells 1B, 1C, 2B, 2C).

Table 8.4—The area and percentage of Herd Management Areas, Wild Burro Territories, and Wild Horse and Burro Territories for the Bureau of Land Management and Forest Service by wild burro Appropriate Management Level (AML) class and Greater sage-grouse (GRSG) breeding habitat probability class. Percentages within a Management Zone (MZ) add to 100.

Percent Burro AML class	GRSG breeding habitat probability					
	Low		Moderate		High	
	Acres	%	Acres	%	Acres	%
MZ III						
<100	107	1	0	0	0	0
>100–200	9,882	3	12,082	4	8,717	3
>200	168,963	58	86,373	30	2,943	1
Total	178,952	62	98,455	34	11,660	4
MZ V						
<100	23,217	2	68,662	7	18,022	2
>100–200	147,908	14	91,557	8	50,412	5
>200	263,516	24	364,745	34	44,423	4
Total	434,640	40	524,964	49	112,857	11
All MZs						
<100	23,217	2	68,662	5	18,022	1
>100–200	157,790	12	103,638	8	59,130	4
>200	432,479	32	451,118	33	47,366	3
Total	613,486	46	623,418	46	124,518	8

- These areas represent significant opportunities to improve habitat and could also be considered priorities for wild horse and burro gathers and fertility control where horse and burro abundance exceeds target AMLs and removals are likely to result in habitat improvement.
- In areas where wild horses and burros exceed target AMLs (including occupied areas outside of HMAs, HAs, WHTs, WBTs, and WHBTs), managers should carefully consider the current spatial extent and growth potential of any nearby wild horse herds and their potential effects on management actions to improve habitat.
- New postfire rehabilitation areas and areas that provide sagebrush habitat connectivity for GRSG and other species at risk are conservation priorities and, thus, could be priorities for wild horse and burro gathers, where abundance exceeds AMLs.

Ecological type or ecological site descriptions and their associated state-and-transition models (STMs) can be used to help evaluate potential effects of wild horse and burro use and the likely success of conservation and restoration actions. In the Science Framework, generalized ecological types and STMs have been developed for the range of environmental conditions in the eastern and western portions of the sagebrush biome (see Part 1, Appendices 5 and 6). The ecological types and STMs are characterized according to their resilience to disturbance and resistance to invasive annual grasses based on soil temperature and moisture regimes and other biophysical characteristics such as plant community composition. They provide information on the alternative states, ranges of variability within states, and processes that cause plant community shifts within states as well as transitions among states. These ecological types and STMs can be used to: (1) identify the different ecological types that exist within the HMA or Territory and determine their relative resilience to disturbance and resistance to invasive annual grasses; (2) evaluate the current ecological dynamics of the

ecological types or ecological sites and, where possible, their restoration pathways; (3) increase understanding of the potential effects of wild horse and burro use; and (4) determine the likelihood of conservation and restoration actions succeeding given ongoing wild horse and burro use (Part 1, section 9).

Section 7 uses these STMs to illustrate potential livestock management strategies for ecological types that support GRS populations and that may benefit from improved livestock grazing management. Information on how to use these resilience-based ecological types and STMs for managing ecosystem threats across the sagebrush biome is in Part 1, section 9.2. Information on how to use resilience-based ecological types and STMs for selecting appropriate treatments for assessing postwildfire recovery and restoration decisions in sagebrush and juniper-piñon ecosystems in the Great Basin is in Miller et al. (2014, 2015) and Pyke et al. (2017), respectively.

Management Considerations at the Project Scale

An assessment of the ecological sites in the project area and their relative resilience to disturbance and resistance to invasive annual grasses can help determine the potential for conservation and restoration treatments to succeed. More detailed information can be obtained from ecological site descriptions for those areas where they have been developed (see <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/ecoscience/desc/>). Ecological type and ecological site descriptions provide basic information on the climate and soil characteristics of an area and the potential of the area to support a dynamic set of plant communities. The associated STMs provide information on the current states and the potential transitions among them due to disturbances and other drivers such as wild horse and burro use as well as management treatments. Assessing the states and the plant communities within the states based on STMs provides information on both the disturbances and the drivers that have led to the current state and the potential restoration pathways. For example, plant communities within the reference state or within states that have feasible restoration pathways may respond favorably to conservation and restoration actions if the wild horse population can be managed at or below AML. However, plant communities in other states, such as an invaded state or annual state (see figs. 7.2, 7.6) may not respond favorably to conservation and restoration actions if the wild horse population cannot be managed at or below AML. Ecological types or ecological sites with relatively low resilience and resistance to invasive annual grasses often require more than one intervention for restoration efforts to succeed and wild horse and burro use can have significant effects on project success.

Effects of wild horses and burros on project success depend on the number of wild horses and burros that can reach the site. If the project site is located within an HMA, WHT, WBT, or WHBT, then grazing and trampling pressure from wild horses should be expected in most cases. Even if the project area is outside any HMA, WHT, WBT, and WHBT, managers should carefully consider the current spatial extent, and growth potential, of any nearby wild horse population. Higher population sizes tend to lead to an expanded spatial area used by the wild horse population. If the number of wild horses is at AML, and there are measures in place to limit the population's growth rate, then wild horse use across the landscape may be distributed enough that a conservation or restoration project could achieve habitat quality goals. Thus, managers should carefully evaluate the likelihood of success of planned conservation and restoration activities if a local or adjacent wild horse population cannot be kept at AML.

Project success is also likely to be influenced by distance to the nearest drinking water source for wild horses. The greater the distance, the lower the grazing pressure that can be expected. Horses require access to large amounts of water; an individual can drink an average of 7.4 gallons [28.0 liters] of water per day (Groenendyk et al. 1988). Despite a general preference for habitats near water (e.g., Crane et al. 1997), wild horses will routinely commute long distances (e.g., 10+ miles [16 kilometers] per day) between water sources and palatable vegetation (Hampson et al. 2010). Managers should expect that any restoration project less than 5 miles [8 kilometers] from water will be subject to use by wild horses in the area. Riparian and wildlife habitat improvement projects that intend to increase the availability of grasses, forbs, riparian habitats, and water are likely to attract and be subject to heavy grazing and trampling by wild horses that live near the project.

Managers need to understand and consider the potential effects of wild horses and burros on conservation and restoration projects and plan accordingly. For certain habitat restoration projects, managers may want to consider installing fencing to discourage use by wild horses, particularly around riparian areas. On BLM and Forest Service lands, temporary fencing for habitat rehabilitation is generally acceptable on HMAs, HAs, WHTs, WBTs, and WHBTs. But permanent fencing often requires a more in-depth environmental assessment or land use plan revision, and should be designed in a way that allows for wild horse and burro movement throughout the rest of the HMA or Territory. The Forest Service also requires National Environmental Policy Act analysis for fence installation. Fencing that excludes wild horses and burros from riparian areas or water development projects that are designed to disperse both riparian and upland use by wild horses and burros are important management tools to protect riparian habitat. Fencing riparian areas to exclude wild horses and burros is generally acceptable as long as water from the area continues to be available to them, and solid pipe fencing is used that can withstand pressure from wild horses and burros. Continued monitoring to assess changes in plant communities and wild horse and burro abundance should be part of any conservation or restoration project where these animals are found.

If AML cannot be achieved, it may be more reasonable to forego a habitat restoration project entirely instead of spending time and resources on projects with a low probability of success. Managers deciding about any project that is near a wild horse or burro population should consider population sizes of wild horses and burros relative to the AML, including explicit schedules for wild horse and burro removals or population growth suppression treatments that are adequate to limit population growth. Unfortunately, high populations of wild horses or burros can substantially affect the ability of land managers to implement conservation measures in some areas. A potential project area with high current wild horse or burro population sizes may become suitable for restoration if the manager can influence priorities and policies such that wild horse and burro populations in the project area are reduced to and maintained at or below high AML.

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