

Synthesis

Framing contemporary U.S. wild horse and burro management processes in a dynamic ecological, sociological, and political environment

J. DEREK SCASTA, Department of Ecosystem Science and Management, University of Wyoming, 1000 E. University Ave., Laramie, WY 82071, USA jscasta@uwyo.edu

JACOB D. HENNIG, Department of Ecosystem Science and Management, University of Wyoming, 1000 E. University Ave., Laramie, WY 82071, USA

JEFFREY L. BECK, Department of Ecosystem Science and Management, University of Wyoming, 1000 E. University Ave., Laramie, WY 82071, USA

Abstract: The Wild Free-Roaming Horses and Burros Act (WFRHBA) of 1971 established all “unbranded or unclaimed” equids on U.S. public lands as “living symbols of the historic and pioneer spirit of the West.” Today, >72,000 feral horses (*Equus ferus caballus*) and burros (*E. asinus*; WHB) live on western U.S. public rangelands. The number of WHBs exceeds the Bureau of Land Management’s maximum Appropriate Management Level (AML) of 26,715 by a factor of approximately 2.7 and has nearly doubled from 2007–2015. The AML was set to balance WHB numbers with rangeland health and support other uses such as wildlife habitat and livestock grazing. Thus, public land management agencies must manage WHB under the multiple-use context. This becomes more problematic when WHB populations go largely unmanaged and excessive equid grazing negatively impacts rangeland vegetation, native wildlife, and livestock forage. In addition, approximately 46,000 WHBs exist in off-range holding facilities, further straining federal budgets. Contemporary management actions are being constrained by: (1) litigation that has stymied federal government WFRHBA enforcement efforts, (2) public emotional concerns that lack reconciliation with the current situation, and (3) increasing complexity in the laws and subsequent amendments shaping WHB management policy. Collectively, these factors impede the implementation of concrete solutions to restore AML. Consequently, stakeholders are increasing polarized over how WHBs are or should be managed. While the ecological and animal health and welfare implications of unmanaged WHB populations are somewhat understood, publicly acceptable strategies to maintain healthy populations, healthy and functioning rangelands, and multiple uses that sustain wildlife and local communities remain unresolved.

Key words: burro, *Equus asinus*, *Equus ferus caballus*, feral horses, human dimensions, human–wildlife conflicts, management, policy, public rangelands, Wild Free-Roaming Horses and Burros Act

WILD EQUID SPECIES native to North America became extinct approximately 10,000 years ago (Luís et al. 2006). Today, extant North American free-roaming horses (*Equus ferus caballus*) and burros (*E. asinus*; WHB) are the result of intentional or accidental introductions by European explorers in the late fifteenth century and others since then (Luís et al. 2006).

In the United States, degradation of public rangeland resources by high levels of domestic livestock and increasing numbers of WHBs prompted the passage of the Taylor Grazing Act of 1934 (Public Law 73-482). Subsequently,

increasing public concern over declining numbers as well as mistreatment and harassment of WHBs led to calls for protection of free-roaming equids. These concerns eventually led to the passage of the Wild Free-Roaming Horses and Burros Act (WFRHBA) of 1971 (Public Law 92-195). This act has been amended twice through the Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law 94-579) and the Public Rangelands Improvement Act (PRIA) of 1978 (Public Law 95-514).

Currently, an estimated 13,191 burros (Figure 1A) and 59,483 horses (Figure 1B) inhabit U.S.

public rangelands with 45,235 additional horses and 1,196 burros in off-range holding facilities (Bureau of Land Management [BLM] 2017*d*). Public adoption of WHBs has also been declining with 472 burros and 2,440 horses adopted in 2016 (2014–2016 mean was 2,187 horses and 373 burros, respectively) as compared to the best adoption year for both equids, which was 1995 with 1,949 burros and 7,706 horses adopted, respectively (Figures 1A and 1B; BLM 2017*a, b, c, d*). Today, feral horse population estimates are the highest since the passage of the WFRHBA in 1971 (Figure 1B). Relative to the current national maximum Appropriate Management Level (AML; Buckley and Buckley 1982), of 26,715 animals on-range, as set by law (Buckley and Buckley 1982), the current populations of 72,674 exceed the AML by a factor of approximately 2.7 (Figure 2A; BLM 2017*d*).

The estimated annual average growth rates of WHB populations on western United States can exceed 20% (Eberhardt et al. 1982) with a range of finite annual population growth rates (λ) from 1.15–1.27 for 21 management areas and 31 management area-by-year combinations (Garrott et al. 1991). It is important to note that not all free-roaming horses achieve such high growth rates. Feral horse populations in New Zealand are increasing at an estimated 9.6% annually (Linklater et al. 2004). In Nevada, certain feral horse herds are decreasing in size annually due to high foal mortality (Greger and Romney 1999), and feral horses in Georgia are growing 4.3% annually (Goodloe et al. 2000).

Variation in population growth rate estimates may be confounded by aerial count techniques and historical estimates (Linklater et al. 2004). However, the most spatially robust assessment of feral horses in the western United States concluded that many bands were “increasing at or near biological maximum” (Garrott et al. 1991). Burro growth rates can also achieve growth in this same range, with estimates from Australia ranging from 23–28% (Choquenot 1990).

We analyzed WHB populations from 2007–2017 with linear regression and found a significant ($P < 0.001$) and strong ($r^2 = 0.86$) linear trend line. Our analysis suggested that WHB increased by 4,033 animals per year during that period and doubled in size from 2007 (28,563

total horses and burros) to 2015 (58,150 total horses and burros; Figure 2B). Moreover, since 1971, the number of animals on-range has never been within the AML (Figure 2A). These estimates included only horses under BLM jurisdiction and do not account for horses on U.S. Forest Service (USFS) or tribal lands. The number of feral horses currently occupying tribal land may exceed 90,000 (Government Accountability Office [GAO] 2017).

The WFRHBA provides protection and management of WHBs on U.S. public land. However, what the WFRHBA specifies should be done, and how it should be done, are not always clear. Subsequent legislation (FLPMA and PRIA) also contain additional mandates for federal oversight of WHBs with specific amendments to the WFRHBA. Historical equid–human emotional relationships, coupled with diverse stakeholder views regarding what constitutes multiple-use of western public lands and proper government oversight of such uses, further complicates WHB management in the United States (Hurwitt 2017). Competing ecological and human dimensions factors confound the management of feral horses not only in the United States, but also in other countries such as Australia (Nimmo and Miller 2007) and Argentina (Scorolli 2018).

Herein we summarize the status of WHBs on U.S. public lands in the western United States, examine historical human–horse relations, review agricultural and ecological concerns, discuss relevant federal legislation, and compare competing litigation cases relative to the issue. Our approach synthesizes the issues surrounding burgeoning WHB populations on public lands in the western United States and frames contemporary management processes within a dynamic ecological, sociological, and political context.

Humans and horses

To better understand the contemporary WHB issues in the United States or any country, it is important to reflect on the historical foundation for the human–horse relationship. To do this, we examine the role humans had in domesticating horses, the role horses played in the development of human society, and the current state of human–horse relations.

Approximately 6,000 years ago, humans

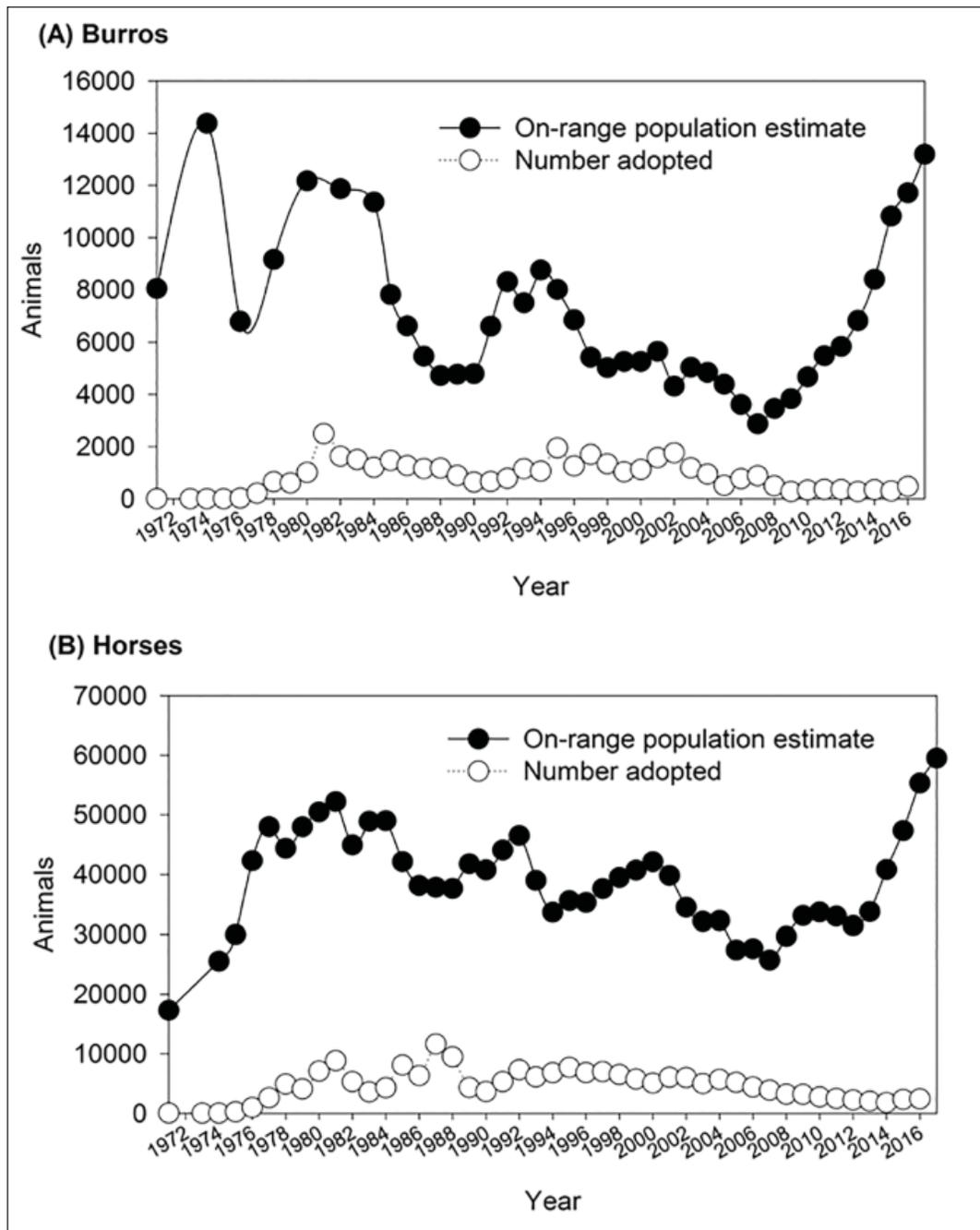


Figure 1. National trends for (A) burro (*Equus asinus*) and (B) horse (*E. ferus caballus*) populations and adoptions from 1971–2017. Figures based on Bureau of Land Management (BLM) data compiled from multiple sources: BLM (2017a, b, c, d).

began domesticating horses in Eurasia, with the Botai people of ancient Kazakhstan being the likely originators of domestication (Levine 1999). The use of horses in the early years of domestication was not limited to riding or pulling, as evidence suggests horses were also important sources of milk and meat (Outram et al. 2009). Domestication of horses ultimately allowed humans to expand beyond agricultural centers to more marginally

productive areas. Horses radically changed how humans travelled, herded other domestic livestock, hunted, and conducted warfare and commerce (Kelekna 2009). In North America, horses became integral to the everyday lives of many Native American tribes upon their reintroduction to the continent, and horses helped to spread early explorers across the continent (Mitchell 2015).

The transformative power of the horse

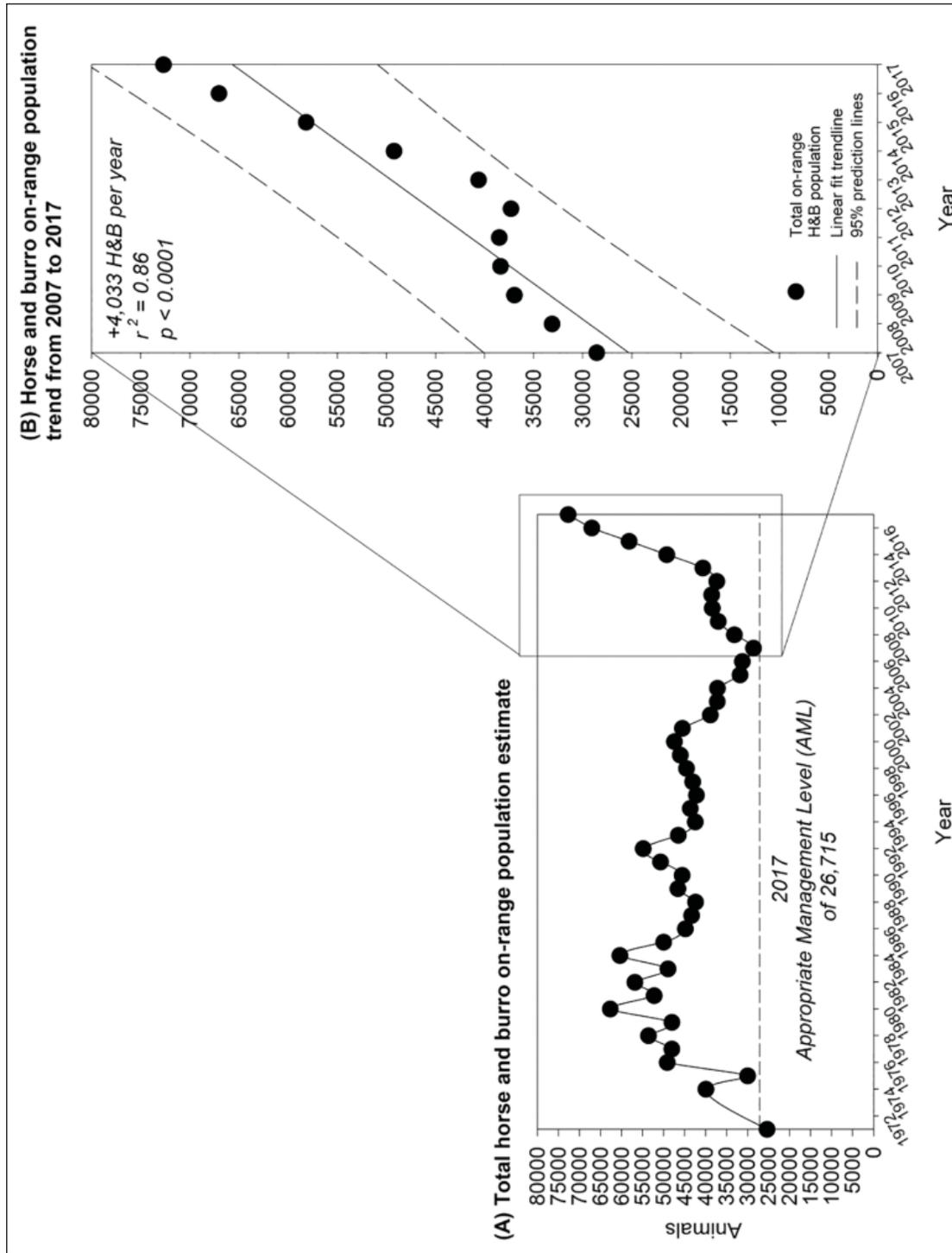


Figure 2. National trend for combined horse (*Equus ferus caballus*) and burro (*E. asinus*) populations from (A) 1971–2017 relative to the 2017 maximum Appropriate Management Level (AML) of 26,715 horses and burros and (B) a partial linear regression of horse and burro population estimates from 2007–2017. Figures based on Bureau of Land Management (BLM) data compiled from multiple sources: BLM (2017a, b, c, d).

to human societies was quite powerful on an individual level because it relied on the establishment of trust between 2 physically mismatched organisms (Kelekna 2009). The larger, stronger, and faster horse allowed a smaller, weaker, and slower, but more intelligent human to place metal, leather, or rope in its mouth, mount its back, and direct it where to go (Travis 2008). In essence, human

and horse operated together as a single unit (Mitchell 2015), and warfare, travel, and stature were all transformed (Kelekna 2009). This trust-based relationship extends to implications of power and protection, which is contingent upon the human caring for the horse and vice versa (Robinson 1999). Thus, the domestication of the horse, the intimate trust relationship, and the versatile role horses played in the

development of human society have demanded a level of care and respect that has few other existing analogies (Robinson 1999). We suggest the emotional human–horse connection that developed through co-evolution contributes to contemporary WHB management controversies (Smith et al. 2016).

Agricultural and ecological concerns

Much of the discussion concerning WHB management is focused on the dietary, temporal, and spatial conflict between domestic livestock and WHBs (e.g., Scasta et al. 2016, Danvir 2018). However, there are additional concerns relating to conservation of soil, water, and vegetation resources along with the native species that rely on them (Smith 1986a, Danvir 2018). Here we highlight 3 general concerns related to agriculture and ecology.

The management of grazing on western public lands was legislated in 1934 with the Taylor Grazing Act (TGA; Public Law 73-782). The purpose of the TGA was to “stop injury to public grazing lands and provide for their orderly use, improvement, and development.” Thus, the TGA was intended to eliminate unregulated long-term grazing that could result in irreversible land degradation (Hardin 1968).

This was important both historically and conceptually. Because of the TGA, the management of livestock grazing on public lands is now highly regulated and typically restricted to a specific time period and utilization rate. In contrast, WHB grazing occurs year-round with little management of populations (at least in the last decade; Figure 2B). Compared to managed livestock grazing, this translates into potentially higher levels of WHBs use because of a lack of management. Higher WHB use can repeatedly occur during critical life stages of plants, making it a spatiotemporally different plant–herbivore disturbance than that incurred by managed livestock grazing (Danvir 2018). Unmanaged WHB grazing in the western United States has decreased species richness and total plant cover in some areas (Beever et al. 2008). Moreover, horses often select riparian areas (Crane et al. 1997) that can lead to degradation of these habitats that are critical for arid landscapes (Beever and Brussard 2000, Beever and Brussard 2004, Nimmo et al. 2007,

Davies et al. 2014, Boyd et al. 2017).

When considering WHB grazing within the context of resource sustainability and interactions with other animals on the landscape, secondary concerns emerge regarding diet selection. There is a strong correlation between cattle (*Bos taurus*) and horse diets year-round (Scasta et al. 2016). Furthermore, horse diets can be similar to elk (*Cervus elaphus*) for forbs, and to domestic sheep (*Ovis aries*) for browse (Scasta et al. 2016).

As hindgut fermenters, WHBs differ physiologically and morphologically when compared to domestic and wild ruminants. These features drive the disparity between how these animals consume and digest plant materials. Both WHBs have upper incisors while ruminants such as cattle, sheep, elk, and deer (*Odocoileus* spp.) only have an upper dental pad. Coupled with agile lips and tongues, this difference permits WHBs to feed closer to the ground than cattle (Menard et al. 2002).

Equids also employ a different digestive strategy than ruminants. As hindgut fermenters, the primary compartment for fermentation for WHBs is the cecum (Janis 1976). Ruminants, in comparison, have multi-chambered stomachs with the rumen serving as the primary fermentation compartment. The cecum lies after the small intestine, whereas the rumen is before it, resulting in different digestive strategies. Compared to cattle, horses have a shorter passage time (48 hours versus 70–90 hours), less efficient breakdown of cellulosic material (~70% as efficient as cattle), and ultimately a higher-intake strategy.

Consequently, a horse, compared to a cow of equivalent size, must consume 20–65% more plant material by volume to meet its nutritional needs. On the range, this leads to horses consuming greater amounts of vegetation than cattle, with especially impactful effects to riparian areas (Boyd et al. 2017). These morphological and physiological traits make WHBs a “unique disturbance agent” in the arid and semi-arid ecosystems of the western United States (Beever 2003).

The third concern is potential negative interactions between horses and native wildlife (Smith 1986b, Danvir 2018). An example quintessential to the western United States is the potential conflict between horses and



Figure 3. Photo from the Bureau of Land Management of a mare with foal gathered in 2015 from the Cold Creek area of the Wheeler Pass Horse Management Area in Nevada, USA. Based on the Henneke body condition score index (Henneke et al. 1983), this mare is “extremely emaciated.”

greater sage-grouse (*Centrocercus urophasianus*; sage-grouse). The sage-grouse has received unprecedented conservation efforts to avoid listing under the Endangered Species Act (ESA) of 1973. The first call to conserve declining sage-grouse populations occurred 100 years ago (Hornady 1916). The trend for sage-grouse populations, as indexed through male lek counts, is in decline rangewide, including a 2% annual rate of decline from 1965–2015 (Nielson et al. 2015). Sage-grouse have been nominated for listing under the ESA 8 times from 1999–2015. In 2010, during the seventh listing attempt, sage-grouse were determined to be warranted but precluded for listing (Department of the Interior 2010). The eighth and most recent ESA listing decision in 2015 determined greater sage-grouse to be not warranted for listing under the ESA, in large part due to proactive conservation efforts implemented by states since 2010 (Department of the Interior 2015).

Wild equids were listed as a conservation threat to sage-grouse populations (U.S. Fish and Wildlife Service 2013) because approximately half of nationwide free-roaming horse range overlaps sage-grouse habitat (Beever and Aldridge 2011). Empirical evidence suggests horse grazing can negatively alter vegetation within the sagebrush steppe (Davies et al. 2014)

and cause deleterious effects on nesting success and screening cover (Doherty et al. 2014).

There is also increasing evidence of conflicts between horses and native large ungulates, particularly around water sources. The presence of horses has been shown to deter pronghorn (*Antilocapra americana*) use of water (Meeker 1979, Gooch et al. 2017), with similar interactions reported between horses and bighorn sheep (*O. canadensis*; Ostermann-Kelm et al. 2008) and horses and elk (Perry et al. 2015). Negative effects at water sources has also been documented at the community scale, where native wildlife assemblages are negatively affected by wild horse use of water in terms of both species richness and diversity (Hall et al. 2016).

WHB welfare concerns

Human concern for WHB welfare spans the range of human emotions on either side of contemporary management conflicts or opinions (Monahan 2012). For example, members of potentially opposite perspectives have both articulated concerns for WHB welfare (American Wild Horse Campaign 2017, National Horse and Burro Rangeland Management Coalition 2017). These concerns can be generally categorized as concern for the

nutrition and well-being of horses on-range and concern for the safe handling of horses in the process of management activities. Neither concerns are necessarily mutually exclusive to the other or to specific positions on WHB management.

Relative to on-range nutrition concerns, there are examples of horse body condition declining drastically in areas where populations are above AML and rangeland forage, water, and browse become limited during droughts (Garrott 2018). A specific example from Nevada in 2015 shows emaciated horses, which required emergency intervention by the BLM (Figure 3). In this instance, some horses were in such poor body condition that they were euthanized (Brean 2015). In other cases, ranchers have been documented hauling water to keep wild horses outside HMAs alive (Loomis 2017).

Relative to the safe handling concerns, it is important to remember that human intervention to manage WHBs was a major impetus for the WFRHBA. As such, strict protocols are in place stipulating the design of chutes and alleys, distances helicopters must maintain between themselves and horses, timing of year when horses can be gathered, having a veterinarian on site for gathering and processing activities or on-call at holding facilities, and euthanasia protocols for injured or sick horses or burros (Public Law 92-195). Concern for the welfare of WHBs has also led to evaluations of traditionally accepted wildlife research methods applied to management of free-roaming horses (e.g., Hampton et al. 2016).

Understanding the WFRHBA

The history of WHB domestication and reintroduction, agricultural and ecological conflicts, and concern for WHB welfare are all embodied within the WFRHBA. Danvir (2018) and Norris (2018), as part this special issue, also provide a good overview of the legislation. An intimate understanding of the intent and nuances of the WFRHBA is necessary to fully comprehend the contemporary conflict at the nexus of society and ecology in the United States.

Intent

The WFRHBA, in designating any unbranded or unclaimed WHBs on public lands as “wild”

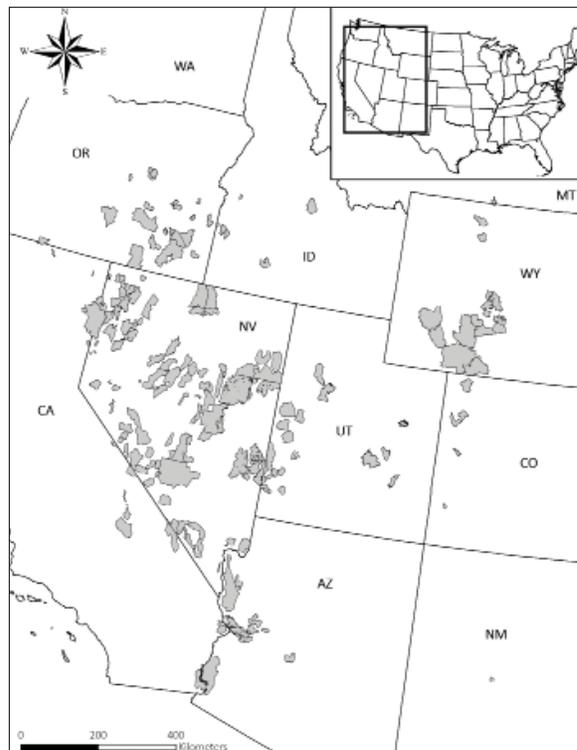


Figure 4. Location of the 177 Herd Management Areas (HMAs) within the western United States (HMA boundaries based on Bureau of Land Management shapefiles).

and “living symbols of the historic and pioneer spirit of the West” (Public Law 92-195, Sec. 2[b]), acknowledged that WHBs “enrich the lives of the American people.” Under the WFRHBA, the BLM and USFS are required to protect WHBs on public lands from “capture, branding, harassment, or death” (Public Law 92-195, Sec. 1). This mandate comes with stringent penalties (Public Law 92-195, Sec. 8), as any party who removes a WHB from public land, converts one to private use, kills or harasses an animal, or processes one into commercial products without approval, is subject to a maximum fine of \$2,000 and/or a maximum prison sentence of 1 year. The WFRHBA considers WHBs to be “an integral part of the natural system of the public lands,” and gives authority to the BLM and USFS to provide habitat for these animals where they presently exist (Public Law 92-195, Sec. 9), areas now called Herd Management Areas (HMAs; Figure 4).

Manage rangeland condition and WHB populations

Through an amendment in the PRIA, which was implemented to “improve the range

conditions of public rangelands” (Public Law 95-514, Introductory Section), the WFRHBA contains the mandate that an inventory be maintained to document the number of animals currently on public lands (Public Law 95-514, Sec. 14[b][1]). This includes the determination of the AML of WHBs on public lands (Public Law 95-514, Sec. 14[b][1]). The AML was derived with consideration to the maintenance of “a thriving, natural ecological balance” as well as supporting the BLM and USFS task to manage for multiple use (Public Law 95-514, Sec. 14[b][2]). Due to the success of the WFRHBA in increasing WHB populations, PRIA recognizes that these animals are above carrying capacity in many areas and recommends “humane adoption or disposal of excess wild free-roaming horses and burros” because they pose a threat to themselves, their habitat, and other rangeland uses and values (Public Law 95-514, Sec. 2[a][6]).

Authority to conduct research of horses and burros

The PRIA also explicitly addresses the need for WHB research. It states, “For the purpose of furthering knowledge of WHB population dynamics and their interrelationship with wildlife, forage and water resources, and assisting [the Secretary of Interior or Agriculture] in making his [or her] determination as to what constitutes excess animals, the Secretary shall contract for a research study of such animals with such individuals independent of Federal and State government as may be recommended by the National Academy of Sciences for having scientific expertise and special knowledge of wild horse and burro protection, wildlife management and animal husbandry as related to rangeland management” (Public Law 95-514, Sec. 14[b][3]).

This language pertains to a research study completed in January 1983; however, FLPMA (Public Law 94-579, Sec. 307[a]) gives Secretarial authority to initiate research “involving the management, protection, development, acquisition, and conveying of the public lands,” which ostensibly covers WHB management, and “The Secretary may conduct investigations, studies, and experiments, on his [or her] own initiative or in cooperation with others, involving the management, protection,

development, acquisition, and conveying of the public lands.”

Mandate to manage public land for multiple-use

Management for multiple-use on rangelands is discussed in both the WFRHBA (Public Law 92-195, Sec. 2[c]) and FLPMA (Public Law 94-579, Sec. 102[a][7]). The term “range” was defined as “the amount of land necessary to sustain an existing herd or herds of WHBs, which do not exceed their known territorial limits, and which is devoted principally but not necessarily exclusively to their welfare in keeping with the multiple-use management concept for the public land” (Public Law 92-195, Sec. 2[c]). Multiple use is defined as “management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people” (Public Law 94-579, Sec. 103[c]).

The FLPMA directs for federal land use planning and public involvement with the declaration that “public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use” (Public Law 94-579, Sec. 102[a][8]). The FLPMA also stipulates that the public have the right to involvement in “rule making, decision making, and planning with respect to the public lands” (Public Law 94-579, Sec. 103[d]). Authority for managing under such principles was given to the Secretary of the Interior.

Maintain the AML

The PRIA orders the federal government to consult with federal, state, and private agencies or individuals to determine maintenance of the AML (Norris 2018). This can be done through removal, destruction, sterilization, or other natural control options. If excess animals exist on public rangeland (i.e., if there are more individuals than the AML dictates), the WFRHBA enumerates a set of options to assist

in returning populations back to the AML. The WFRHBA states that “old, sick, or lame animals shall be destroyed in the most humane manner” (Public Law 95-514, Sec. 14[b][2][A]), however, a general moratorium on the destruction of animals has been in place since 1982 (National Research Council [NRC] 2013). If adoption demand exists, excess animals shall be humanely removed from public land and placed in the care of qualified, private individuals (Public Law 95-514, Sec. 14[b][2][B]). With the 1976 amendment from FLPMA, this includes the use of helicopters and motor vehicles to round up and transport these animals, given that a public hearing is held prior to their use (Public Law 94-579, Sec. 404[9]).

If adoption demand does not exist, excess animals shall be destroyed in the “most humane and cost-efficient manner possible” (Public Law 95-514, Sec. 14[b][2][C]). Furthermore, with the passing of the Fiscal Year 2005 Omnibus Appropriations Act, the WFRHBA allowed for the sale of excess animals if an animal is either >10 years old, or has not been adopted after 3 attempts. An individual that meets these criteria shall be made available for sale without limitation until all excess animals are sold or the AML is attained. However, this has been prevented by Congressional appropriation bills that exclude sale without limitations and prohibit killing healthy horses (Garrott and Oli 2013).

Managing WHBs trespassing on private land

A persistent challenge for WHB management is the trespassing of wild equids on private land. Language within the WFRHBA specifies that landowners may inform the federal government to have the animals removed, but it prohibits them from removing or destroying an animal themselves (Public Law 92-195, Sec. 4). This is a particularly difficult issue in areas with heterogeneous blocks of land ownership such as checkerboard land comprised of alternating 2.6 km² squares of federal and privately owned land that occurs in many western states. This landownership pattern exists within the context of WHBs in California, Nevada, Oregon, and Wyoming.

In Nevada and Wyoming, for example, many horses occur in the “checkerboard,” an area that runs 32.2 km north and 32.2 km south of Interstate 80. This ownership pattern,

coupled with the federal legislation of horse management, makes administration of grazing and management of free-roaming horses inherently difficult (Calef 1952). Checkerboard land complicates WHB management as the WFRHBA mandates horses to be removed from private land. However, the act also suggests that animals may not be removed from an HMA currently within the AML (Public Law 95-514, Sec. 3[c]). As one can see, with horses moving across a landscape that changes ownership every 1.61 km, it becomes tremendously tricky to uphold the law. There is no clear solution as to what to do in these situations, with no clear directive from the WFRHBA.

Differences in stakeholder interpretations impedes WFRHBA implementation

In several instances, wording in the WFRHBA may appear to be ambiguous. For example, “the Secretary shall order old, sick, or lame animals to be destroyed in the most humane manner possible.” The word “shall” can be interpreted either as a strong wish or a command; according to Merriam-Webster Dictionary, “shall” is defined as an auxiliary verb with 2 meanings: (1) will have to (i.e., must), or (2) will be able to (i.e., can). Additional clarification of the definition of the word “shall” includes “used to express a command or exhortation” and/or “used in laws, regulations, or directives to express what is mandatory.” Thus, the federal government is mandated with clear instruction on how to proceed with such WHBs, which is important when stakeholders demand action regarding management regardless of any ambiguity the public may have about such commands.

The word “humane” is also an equivocal term, as its meaning is subjective (Hadidian et al. 2014). This has resulted in the BLM policy to refrain from destroying WHBs or selling them to slaughter. Related to this topic, since 2014, the U.S. Congress has prohibited the slaughter of horses by not appropriating funding for federal horse meat inspectors (Monahan 2012). Therefore, animals removed from the range and not adopted are placed in corrals or pastures for the remainder of their lives. The BLM covers the cost of taking care of these animals in captivity at an annual

Table 1. Case law examples of litigation demonstrating the dichotomous use of the Wild Free-Roaming Horses and Burros Act (WFRHBA) of 1971 as the claim or basis for litigation either as enforcement of the WFRHBA or lack of enforcement of WFRHBA.

Lawsuits FOR managing horses and burros	Lawsuits FOR NOT managing horses and burros
<p>2006 The Fund for Animals v. United States BLM [No. 04-5359, U.S. Court of Appeals, District of Columbia] <u>Claim/Basis:</u> “the Bureau violated the Wild Horses and Burros Act by adopting a strategy that would reduce herd populations to below their appropriate management levels”</p>	<p>1986 Mountain States Legal Foundation v. Hodel [No. 82-1485, U.S. Court of Appeals, Tenth Circuit] <u>Claim/Basis:</u> “to compel the Secretary to remove the wild horses from its lands and to reduce the size of the wild horse herds on adjacent public lands”</p>
<p>2009 Colorado Wild Horse and Burro Coalition v. Salazar [No. 06-1609 (RMC), U.S. District Court, District of Columbia] <u>Claim/Basis:</u> “the decision of the Bureau of Land Management (“BLM”)...to remove all wild horses from the West Douglas Herd Area in Colorado... violates the Wild Free-Roaming Horses and Burros Act”</p>	<p>1995 Fallin v. United States [No. 94-5110, U.S. Court of Appeals, Federal Circuit] <u>Claim/Basis:</u> “the government effected a “taking” by requiring them to provide water to wild horses”</p>
<p>2009 In Defense of Animals v. Salazar [No. 09-2222 (PLF), U.S. Court of Appeals, District of Columbia] <u>Claim/Basis:</u> “would bar the defendants... the Interior Department’s Bureau of Land Management (“BLM”), from implementing a plan to capture or gather approximately 2,700 wild horses located in western Nevada”</p>	<p>2006 Colvin Cattle Co., Inc. v. United States [No. 06-5012, U.S. Court of Appeals, Federal Circuit] <u>Claim/Basis:</u> “government’s alleged failure to prevent the successor to its lease and wild horses from infringing on its water rights constitutes a taking”</p>
<p>2010 Habitat for Horses v. Salazar [No. 10 Civ. 7684 (WHP), U.S. District Court, S.D. New York] <u>Claim/Basis:</u> “claim that the BLM’s decision to remove wild horses from the North Piceance Herd Area (or “North Piceance”) in Colorado violates the Wild Free-Roaming Horses and Burros Act of 1971”</p>	<p>2013 Rock Springs Grazing Association v. Salazar [No. 11-cv-263, U.S. District Court, D. Wyoming] <u>Claim/Basis:</u> “requesting the Court direct the BLM to remove all of the wild horses that had strayed onto the RSGA lands within the Wyoming Checkerboard”</p>
<p>2012 American Wild Horse Preservation Campaign v. Salazar [No. 11-02222 (BAH), U.S. District Court, District of Columbia] <u>Claim/Basis:</u> “challenge to BLM’s administrative decisions related to the management of wild horse populations on public lands”</p>	<p>2015 Nevada Association of Counties v United States [No. 3:13-cv-00712-MMD-WGC, U.S. District Court, D. Nevada] <u>Claim/Basis:</u> “alleging that Federal Defendants have improperly managed Nevada’s wild horses and burros in violation of the Wild Horse Act”</p>
<p>2013 Cloud Foundation v. Salazar [No. 1:09-CV-01651, U.S. District Court, District of Columbia] <u>Claim/Basis:</u> “challenging BLM’s early September planned gather of wild horses on the range”</p>	<p>2015 Pershing County v. Jewell [No. 3:14-cv-00466-MMD-WGC, U.S. District Court, D. Nevada] <u>Claim/Basis:</u> “failure to address wild horse and burro populations that are in excess of the appropriate management levels”</p>

rate of \$49 million, nearly two-thirds of the WHB Program budget (Garrott and Oli 2013). Rising WHB populations, escalating costs and funding constraints, and lack of additional capacity for maintaining captive animals has recently led the BLM to reduce needed removal efforts (Garrott and Oli 2013), translating into increased populations that are far above the maximum AML (Garrott 2018).

These technical nuances of the administrative law puts the federal government in a position where their actions to uphold 1 part of the law may conflict with another and makes them susceptible to litigation. Another example considers the legality of using short- and long-term holding facilities, and the view of advocates and ambiguities with different District Court decisions (Aksentijevich 2014). Consequently, stakeholders on all sides of the issue are left in a near-constant state of disappointment with how WHBs are managed. Unsurprisingly, the federal government faces a litany of lawsuits (Table 1), cutting deeper into WHB Program time and budgets. This impedes the government in managing to maintain healthy WHB populations in balance with other rangeland uses and values (Danvir 2018).

Litigation

This litany of lawsuits, and the dichotomous nature of said lawsuits (Table 1) confounds the WHB issue. Case law examples include plaintiffs disagreeing with the management of horses (Table 1, left column). In these 6 examples, plaintiffs challenge the BLM's decisions to reduce horse numbers. In comparison, examples of plaintiffs suing for a lack of management are also presented (Table 1, right column). These examples challenge the BLM's failure to address horses in excess of the AML, horses on private land, infringement on water rights by unmanaged horses, or generally enforce the WFRHBA. For a regionally direct comparison of such competing litigation, the 2009 *In Defense of Animals v. Salazar* and 2015 *Nevada Association of Counties v. United States* are both focused on management of horses in the state of Nevada—the state with the most horses in the United States (currently >30,000; BLM 2017d). While the legal pressure on the federal government is substantial, it should be noted that the tool of litigation enhances bureaucratic diligence with

respect to the transparency and accountability in the administration of the law.

Conclusion

The nexus of the social, ecological, and political issues surrounding WHB management in the United States as described in this paper provide important insights into why resolution remains elusive. Implementation of the WFRHBA has continued to be among the most divisive natural resource management issues of our time (Symanski 1996, Wagman and McCurdy 2011).

Better integration of science in the WHB Program is imperative (NRC 2013). Symanski (1996) suggested that the recognition and use of sound science and data is particularly important when diverse stakeholders with divergent views are involved in WHB issues. Wagman and McCurdy (2011) exemplify this point by suggesting that the federal government is attempting to eradicate horses, thereby violating federal law. Although clear management activities, based on thorough scientific research, have been touted as the best path forward for solving this issue, the emotional undertones of WHB management as discussed in this paper leads to the pressing question: how does science solve an emotional problem in ecology without further polarizing society? Our assessment of the situation suggests that an integration of social science and education must receive additional emphasis if resolution is ever going to be achieved. A potential path forward could be a national independent survey of the public attitudes and perceptions regarding WHB management and issues. It would also be prudent to foster more dialogue with other countries, such as New Zealand, that have overcome some of the hurdles associated with educating the public about the issue, involving non-governmental groups in leading management strategies and using integrated methods (Parkes and Murphy 2003).

Acknowledgments

Comments provided by E. Harper, HWI Associate Editor, and 2 anonymous reviewers greatly improved the manuscript.

Literature cited

Aksentijevich, N. 2014. An American icon in limbo: how clarifying the standing doctrine could free

- wild horses and empower advocates. *Boston College Environmental Affairs Law Review* 41:399–426.
- American Wild Horse Campaign. 2017. About. American Wild Horse Campaign, Davis, California, USA, <<https://americanwildhorsecampaign.org/about>>. Accessed December 13, 2017.
- Beever, E. A. 2003. Management implications of the ecology of free-roaming horses in semi-arid ecosystems of the western United States. *Wildlife Society Bulletin* 31:887–895.
- Beever, E. A., and P. F. Brussard. 2000. Examining ecological consequences of feral horse grazing using exclosures. *Western North American Naturalist* 60:236–254.
- Beever, E. A., and P. F. Brussard. 2004. Community-and landscape-level responses of reptiles and small mammals to feral-horse grazing in the Great Basin. *Journal of Arid Environments* 59:271–297.
- Beever, E. A., R. J. Tausch, and W. E. Thogmartin. 2008. Multi-scale responses of vegetation to removal of horse grazing from Great Basin (USA) mountain ranges. *Plant Ecology* 196:163–184.
- Beever, E. A., and C. L. Aldridge. 2011. Influences of free-roaming equids on sagebrush ecosystems, with focus on greater sage-grouse. *Studies in Avian Biology* 38:273–292.
- Boyd, C. S., K. W. Davies, and G. H. Collins. 2017. Impacts of feral horse use on herbaceous riparian vegetation within a sagebrush steppe ecosystem. *Rangeland Ecology and Management* 70:411–417.
- Brean, H. 2015. BLM extends Cold Creek roundup after killing 28 emaciated horses. *Las Vegas Review-Journal*, September 8, 2015, Las Vegas, Nevada, USA, <<https://www.reviewjournal.com/news/blm-extends-cold-creek-roundup-after-killing-28-emaciated-horses/>>. Accessed October 6, 2017.
- Buckley, A. W., and W. R. Buckley. 1982. The appropriate degree of management under the Wild Free-Roaming Horses and Burros Act. *California Western Law Review* 19:419–449.
- Bureau of Land Management (BLM). 2017a. Wild horse and burro removal, adoption, population, AML table. U.S. Department of the Interior, Washington, D.C., USA, <<https://www.wildhorseandburro.blm.gov/statistics/PopRemAdopStats71-05.pdf>>. Accessed December 1, 2017.
- Bureau of Land Management (BLM). 2017b. Wild horses and burros adopted into good homes from 2012 to 2016. U.S. Department of the Interior, Washington, D.C., USA, <<https://www.blm.gov/programs/wild-horse-and-burro/about/data/adoptions>>. Accessed December 1, 2017.
- Bureau of Land Management (BLM). 2017c. Wild horse quick facts. Population estimates from 1996 to 2012. U.S. Department of the Interior, Washington, D.C., USA, <https://www.blm.gov/sites/blm.gov/files/wildhorse_quickfacts_doc5.pdf>. Accessed December 1, 2017.
- Bureau of Land Management (BLM). 2017d. Wild Horse and Burro Program data. Public lands statistics and historical data reports for 2013 to 2017 and wild horse and burro on-range population estimates. U.S. Department of the Interior, Washington, D.C., USA, <<https://www.blm.gov/programs/wild-horse-and-burro/about-the-program/program-data>>. Accessed December 1, 2017.
- Calef, W. 1952. Problems of grazing administration in the basins of southern Wyoming. *Economic Geography* 28:122–127.
- Choquenot, D. 1990. Rate of increase for populations of feral donkeys in northern Australia. *Journal of Mammalogy* 71:151–155.
- Crane, K. K., M. A. Smith, and D. Reynolds. 1997. Habitat selection patterns of feral horses in southcentral Wyoming. *Journal of Range Management* 50:374–380.
- Davies, K. W., G. Collins, and C. S. Boyd. 2014. Effects of feral free-roaming horses on semi-arid rangeland ecosystems: an example from the sagebrush steppe. *Ecosphere* 5:1–14.
- Danvir, R. E. 2018. Multiple-use management of western U.S. rangelands: wild horses, wildlife, and livestock. *Human–Wildlife Interactions* 12:5–17.
- Department of the Interior. 2010. Endangered and threatened wildlife and plants; 12-month findings for petitions to list the greater sage-grouse (*Centrocercus urophasianus*) as threatened or endangered. U.S. Fish and Wildlife Service, Washington, D.C., USA, <<https://www.gpo.gov/fdsys/pkg/FR-2010-03-23/html/2010-5132.htm>>. Accessed April 4, 2018.
- Department of the Interior. 2015. Endangered and threatened wildlife and plants; 12-month finding on a petition to list the greater sage-grouse (*Centrocercus urophasianus*) as an endangered or threatened species. U.S. Fish and Wildlife Service, Washington, D.C., USA,

- <http://www.fws.gov/greatersagegrouse/PDFs/20150921_GRSG_FR_Signed.pdf>. Accessed April 4, 2018.
- Doherty, K. E., D. E. Naugle, J. D. Tack, B. L. Walker, J. M. Graham, and J. L. Beck. 2014. Linking conservation actions to demography: grass height explains variation in greater sage-grouse nest survival. *Wildlife Biology* 20:320–325.
- Eberhardt, L. L., A. K. Majorowicz, and J. A. Wilcox. 1982. Apparent rates of increase for two feral horse herds. *Journal of Wildlife Management* 46:367–374.
- Garrott, R. A. 2018. Wild horse demography: implications for sustainable management within economic constraints. *Human–Wildlife Interactions* 12:46–57.
- Garrott, R. A., and M. K. Oli. 2013. A critical cross-road for BLM's wild horse program. *Science* 341:847–848.
- Garrott, R. A., D. B. Siniff, and L. L. Eberhardt. 1991. Growth rates of feral horse populations. *Journal of Wildlife Management* 55:641–648.
- Gooch, A. M. J., S. L. Petersen, G. H. Collins, T. S. Smith, B. R. McMillan, and D. L. Eggett. 2017. The impact of feral horses on pronghorn behavior at water sources. *Journal of Arid Environments* 138:38–43.
- Goodloe, R. B., R. J. Warren, D. A. Osborn, and C. Hall. 2000. Population characteristics of feral horses on Cumberland Island, Georgia and their management implications. *Journal of Wildlife Management* 64:114–121.
- Greger, P. D., and E. M. Romney. 1999. High foal mortality limits growth of a desert feral horse population in Nevada. *Great Basin Naturalist* 59:374–379.
- Hadidian, J., B. Unti, and J. Griffin. 2014. Measuring humaneness: can it be done, and what does it mean if it can? *Proceedings of the Vertebrate Pest Conference* 26:443–448.
- Hall, L. K., R. T. Larsen, M. D. Westover, C. C. Day, R. N. Knight, and B. R. McMillan. 2016. Influence of exotic horses on the use of water by communities of native wildlife in a semi-arid environment. *Journal of Arid Environments* 127:100–105.
- Hampton, J. O., H. Robertson, P. J. Adams, T. H. Hyndman, and T. Collins. 2016. An animal welfare assessment framework for helicopter darting: a case study with a newly developed method for feral horses. *Wildlife Research* 43:429–437.
- Hardin, G. 1968. The tragedy of the commons. *Science* 162:1243–1248.
- Henneke, D. R., G. D. Potter, J. L. Kreider, and B. F. Yates. 1983. Relationship between condition score, physical measurements and body fat percentage in mares. *Equine Veterinary Journal* 15:371–372.
- Hornady, W. T. 1916. Save the sage grouse from extinction, a demand from civilization to the western states. *New York Zoological Park Bulletin* 5:179–219.
- Hurwitt, M. C. 2017. Freedom versus forage: balancing wild horses and livestock grazing on the public lands. *Idaho Law Review* 53:425–463.
- Janis, C. 1976. The evolutionary strategy of the Equidae and the origins of rumen and cecal digestion. *Evolution* 30:757–774.
- Kelekna, P. 2009. *The horse in human history*. Cambridge University Press, Cambridge, United Kingdom.
- Levine, M. A. 1999. Botai and the origins of horse domestication. *Journal of Anthropological Archaeology* 18:29–78.
- Linklater, W. L., E. Z. Cameron, E. O. Minot, and K. J. Stafford. 2004. Feral horse demography and population growth in the Kaimanawa Ranges, New Zealand. *Wildlife Research* 31(2):119–128.
- Loomis, B. 2017. Running wild: a USA Today network investigation. USA Today, Gannett Satellite Information Network, McLean, Virginia, USA, <<https://www.usatoday.com/pages/interactives/wild-horse-management-mustangs-north-america/>>. Accessed February 5, 2018.
- Luís, C., C. Bastos-Silveira, E. Gus Cothran, and M. do Mar Oom. 2006. Iberian origins of new world horse breeds. *Journal of Heredity* 97:107–113.
- Meeker, J. O. 1979. Interactions between pronghorn antelope and feral horses in northwestern Nevada. Thesis, University of Nevada, Reno, Nevada, USA.
- Menard, C., P. Duncan, G. Fleurance, J. Y. Georges, and M. Lila, M. 2002. Comparative foraging and nutrition of horses and cattle in European wetlands. *Journal of Applied Ecology* 39:120–133.
- Mitchell, P. 2015. *Horse nations*. Oxford University Press, Oxford, United Kingdom.
- Monahan, C. J. 2012. *Equine welfare concerns: horse slaughter, wild and unwanted horses*. Nova Science Publishers, Hauppauge, New York, USA.
- National Horse and Burro Rangeland Management

- Coalition. 2017. Horse and burro well-being factsheet. National Horse and Burro Rangeland Management Coalition, USA, <http://www.wild-horserange.org/uploads/2/6/0/7/26070410/2017-whb_factsheet3.pdf>. Accessed December 13, 2017.
- National Research Council (NRC). 2013. Using science to improve the BLM Wild Horse and Burro Program: a way forward. National Academies Press, Washington, D.C., USA.
- Nielson, R. M., L. L. McDonald, J. Mitchell, S. Howlin, and C. LeBeau. 2015. Analysis of greater sage-grouse lek data: trends in peak male counts. Report prepared by Western EcoSystems Technology (WEST), Inc. for Western Association of Fish and Wildlife Agencies (WAFWA), Boise, Idaho, USA, <<https://www.wafwa.org/Documents%20and%20Settings/37/Site%20Documents/Initiatives/Sage%20Grouse/GRSG%20Report%20for%20WAFWA.pdf>>. Accessed March 10, 2017.
- Nimmo, D. G., and K. K. Miller. 2007. Ecological and human dimensions of management of feral horses in Australia: a review. *Wildlife Research* 34:408–417.
- Nimmo, D. G., K. K. Miller, and R. Adams. 2007. Managing feral horses in Victoria: a study of community attitudes and perceptions. *Ecological Management and Restoration* 8:237–243.
- Norris, K. A. 2018. A review of contemporary U.S. wild horse and burro management policies relative to desired management outcomes. *Human–Wildlife Interactions* 12:18–30.
- Ostermann-Kelm, S., E. R. Atwill, E. S. Rubin, M. C. Jorgensen, and W. M. Boyce. 2008. Interactions between feral horses and desert bighorn sheep at water. *Journal of Mammalogy* 89:459–466.
- Outram, A. K., N. A. Stear, R. Bendrey, S. Olsen, A. Kasparov, V. Zaibert, N. Thorpe, and R. P. Evershed. 2009. The earliest horse harnessing and milking. *Science* 323:1332–1335.
- Parkes, J., and E. Murphy. 2003. Management of introduced mammals in New Zealand. *New Zealand Journal of Zoology* 30:335–359.
- Perry, N. D., P. Morey, and G. San Miguel. 2015. Dominance of a natural water source by feral horses. *Southwestern Naturalist* 60:390–393.
- Public Law 73-482. 1934. Taylor Grazing Act of 1934. Authenticated U.S. Government information. United States Government Printing Office, Washington, D.C., USA, <<http://legisworks.org/congress/73/publaw-482.pdf>>. Accessed October 6, 2017.
- Public Law 92-195. 1971. The Wild Free-Roaming Horses and Burros Act of 1971. Authenticated U.S. Government information. United States Government Printing Office, Washington, D.C., USA, <<http://www.gpo.gov/fdsys/pkg/STATUTE-85/pdf/STATUTE-85-Pg649.pdf>>. Accessed October 6, 2017.
- Public Law 94-579. 1976. The Federal Land Policy and Management Act of 1976 as Amended. Authenticated U.S. Government information. United States Government Printing Office, Washington, D.C., USA, <<http://www.gpo.gov/fdsys/pkg/STATUTE-90/pdf/STATUTE-90-Pg2743.pdf>>. Accessed October 6, 2017.
- Public Law 95-514. 1978. Public Rangelands Improvement Act of 1978. 43 USC 1901. Authenticated U.S. Government information. United States Government Printing Office, Washington, D.C., USA, <<http://www.gpo.gov/fdsys/pkg/STATUTE-92/pdf/STATUTE-92-Pg1803.pdf>>. Accessed October 6, 2017.
- Robinson, I. H., 1999. The human–horse relationship: how much do we know? *Equine Veterinary Journal* 31:42–45.
- Scasta, J. D., J. L. Beck, and C. J. Angwin. 2016. Meta-analysis of diet composition and potential conflict of wild horses with livestock and wild ungulates on western rangelands of North America. *Rangeland Ecology and Management* 69:310–318.
- Scorolli, A. L. 2018. Feral horse management in Parque Provincial Ernesto Tornquist, Argentina. *Human–Wildlife Interactions* 12:102–110.
- Smith, M. A. 1986a. Impacts of feral horses grazing on rangelands: an overview. *Journal of Equine Veterinary Science* 6:236–238.
- Smith, M. A. 1986b. Potential competitive interactions between feral horses and other grazing animals. *Journal of Equine Veterinary Science* 6:238–239.
- Smith, A. V., L. Proops, K. Grounds, J. Wathan, and K. McComb. 2016. Functionally relevant responses to human facial expressions of emotion in the domestic horse (*Equus caballus*). *Biology Letters* 12: 20150907.
- Symanski, R. 1996. Dances with horses: lessons from the environmental fringe. *Conservation Biology* 10:708–712.
- Travis, J. 2008. Trail of mare's milk leads to first tamed horses. *Science* 322(5900):368–368.

U.S. Fish and Wildlife Service. 2013. Greater sage-grouse (*Centrocercus urophasianus*) conservation objectives: final report. U.S. Department of the Interior, Washington, D.C., USA.

U.S. Government Accountability Office [GAO]. 2017. GAO-17-680R Animal welfare: information on the United States horse population. U.S. Government Accountability Office, Washington, D.C., USA, <<https://www.gao.gov/assets/690/685897.pdf>>. Accessed December 18, 2017.

Wagman, B., and L. McCurdy. 2011. A national injustice: The federal government's systematic removal and eradication of an American icon. *Ecology Law Currents* 38:8–16.

Associate Editor: Erin Harper

J. DEREK SCASTA is an assistant professor and extension range management specialist at the University of Wyoming with a focus on plant–herbivore interaction ecology. He earned a B.S. degree from Texas A&M University, an M.S. degree from Texas Tech University, and a Ph.D. degree from Oklahoma State University. For the past 14 years, he has worked throughout the Great Plains and Front Range region with private, state, and federal partners.



JACOB D. HENNIG grew up in Milwaukee, Wisconsin before receiving a B.S. degree in fisheries and wildlife from the University of Minnesota and an M.S. degree in natural resources and environmental sciences from the University of Illinois. He has previously published research focused on improving management for waterfowl and upland game birds. Currently, he is a Ph.D. student at the University of Wyoming working to advance understanding of feral horse ecology.



JEFFREY L. BECK is an associate professor of wildlife habitat restoration ecology in the Department of Ecosystem Science and Management at the University of Wyoming. He earned B.S. and M.S. degrees from Brigham Young University, and a Ph.D. degree from the University of Idaho. He and his lab members and colleagues have been collaborating with private, state, and federal partners to provide science results that better inform conservation of wildlife habitats and populations, particularly in sagebrush systems.

