Sustaining Wild and Free-roaming Horses and Burros—
History, Vision, Reality, Nightmare, Paths and Needed Action

North America to Eurasia

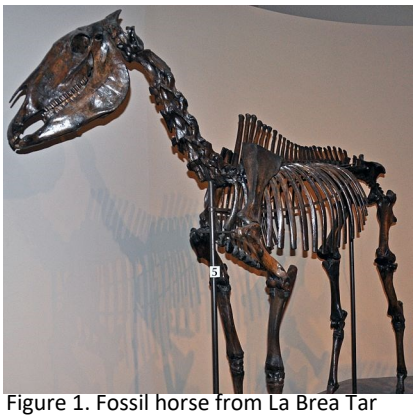
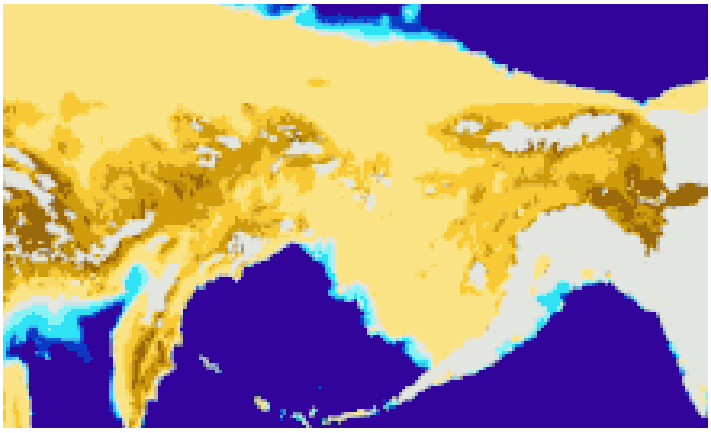


Figure 1. Fossil horse from La Brea Tar Pits, CA USA[1].

Horses evolved in North America (Fig. 1) and migrated to Eurasia during the early Pleistocene (Fig. 2)[2]. During the Ice Age, they lived in many habitats with other large herbivores including three giant ground sloths, flat-headed peccary, yesterday's camel, large-headed llama, diminutive pronghorn, shrub ox, Harlan's muskox, American mastodon and Columbia mammoth.



Saber tooth cats (Fig. 3), American lions, American cheetahs, giant short-faced bears, and dire wolves preyed upon excess horses[4] and dispersed grazing.

Figure 3. Saber tooth Cat skull from La Brea Tar Pits, CA USA[5]

About the end of the Ice Age, horses and the other species listed above became extinct in North America.

In Eurasia, horses developed into several new species. Horse domestication and breeding empowered hunting, agriculture, cities, transportation, civilization, sports, and conquering armies.

Figure 4. Genghis Khan[6] led the mounted Mongolian army as it conquered a vast empire.

As humans came to value horses, they selected for preferred traits and developed breeds (Fig. 5).

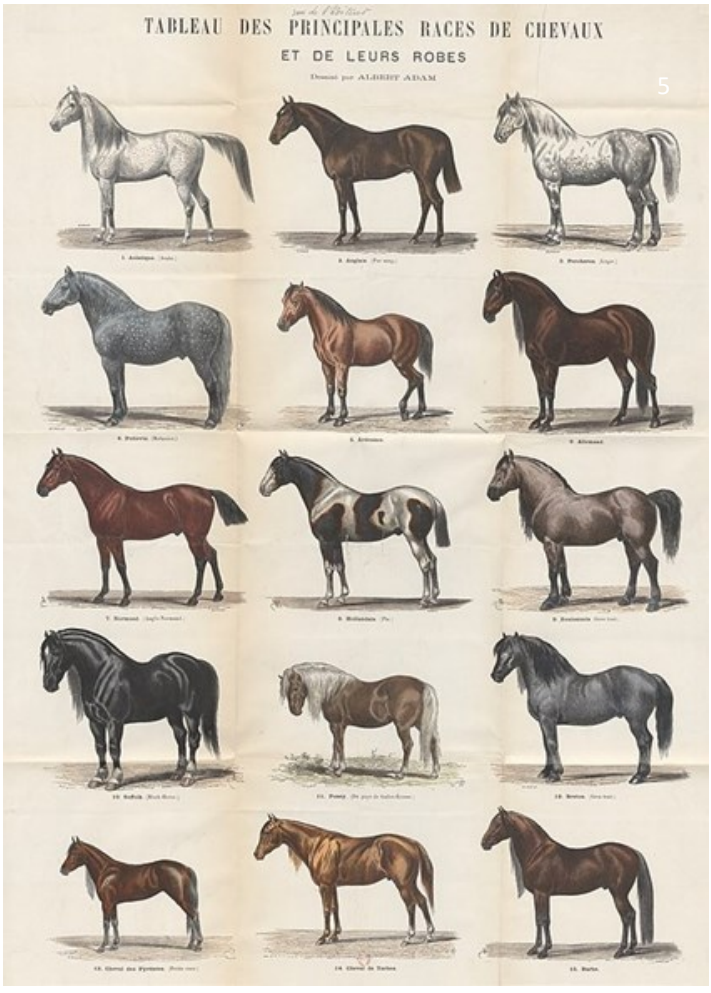


Figure 5. Many breeds of modern horses were developed in Europe[7] before bringing them to America (from Wikimedia commons).

Horses in America

Many breeds of horses and burros were brought to the "New World" from the "Old World" for centuries after 1492. Horses became cherished by some tribes of Native Americans (Fig.7).

Figure 7. These people are from the Crow Tribe [8]

Different breeds and genetics were valued for different purpose, for example—speed for racing (Fig. 8), endurance for horseback (Fig. 9), and carriage transportation, strength for farming and hauling (Fig. 10), agility for working cattle, and beauty for social status, as breeding continued.

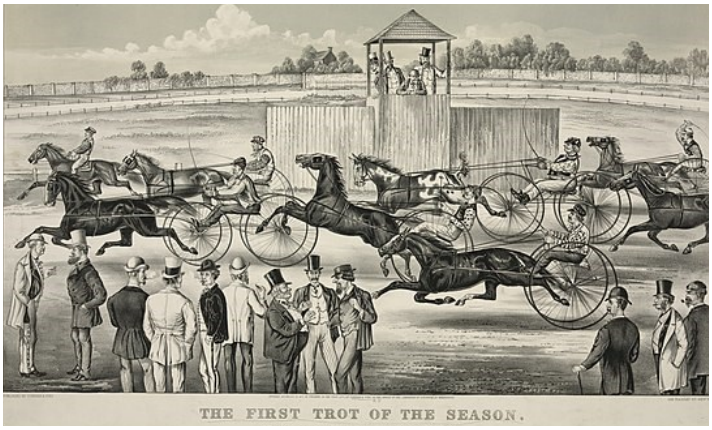


Figure 8. Speed was valued for racing[9].

In Nevada, diaries, and letters from trappers, emigrants and explorers (1820s—1860s) do not mention wild horses[10]. After the California Gold Rush, people who had passed through Nevada came back with horses, looking for opportunities in mining and agriculture. In 1861 Nevada passed its first "Act Concerning Estray Animals", listing horses first[11]. By 1873 the recorded number of horses in the counties of Nevada was up to 21,874, and by 1880 it was 41,386[12]. By 1880, horses were being sold from Nevada to other states[11].

The US cavalry (Fig. 9) and Agriculture (Fig. 10) provided

Figure 9. 8th U. S. Cavalry in New Mexico, c1870[13]

Figure 10. Twenty horse harvester at work in California[14]

markets for Nevada horses. As long as the military and society needed horses, horse ranching (Fig. 11) was a profitable business.

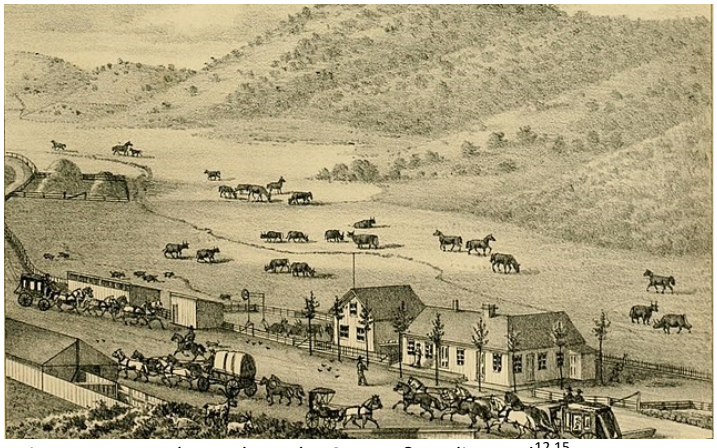


Figure 11. Nevada ranch on the Carson & Bodie Road[12,15].

Sometimes a plentiful supply depressed prices, which in turn discouraged ranchers from gathering horses up for sale[10,11,16]. The public outcry over excess horse numbers led to passage of state legislation in 1897 permitting the removal of "unbranded wild" horses[10,17].

Ranchers often maintained horse herds by culling inferior animals and turning out better stallions (Fig. 12). Many ranching operations on big rangeland ranches are still performed on horseback.

Figure 12. Wild stallion Lazarus and part of his band in West Warm Springs HMA, OR[18].

Horses no longer needed, were sold for human consumption or pet or other animal food (Fig. 13) as they still are in Canada, Mexico, and most of the world.

Figure 13. Canned food in Russia[19].

When the internal combustion engine provided horsepower (Fig. 14-16), demand for horses faded. In a weak

Figure 14. Model A Ford on display[20].

market, more horses were turned out or escaped and became feral, free-roaming or "wild horses" living free[21].

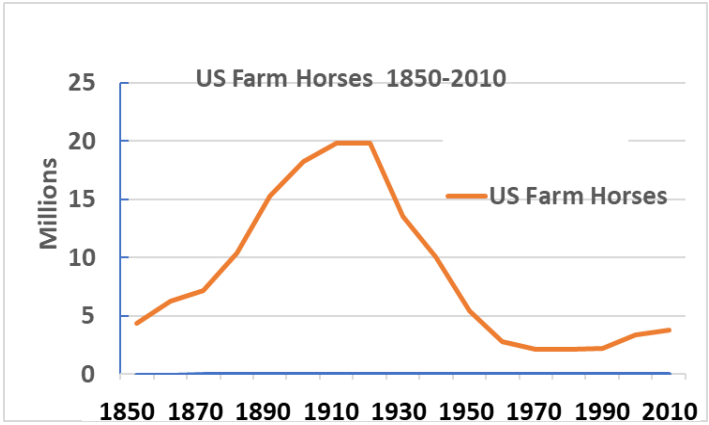


Figure 15. Horse numbers peaked about 1910[22].

Figure 16. Horse herd on Sheldon Antelope Range[23] before removal for wildlife habitat management[24].

On the Public lands, "mustangers" (Fig. 17) rounded up horses to sell. Some roundups were cruel or inhumane.

Figure 17. Catching horses[25]

Nostalgia for the Old West in the 1960s and the inhumanity of some cruel roundups motivated hundreds of thousands of letters to Congress, mostly from school children.

Thelma Johnson, "Wild horse Annie" (Fig. 18) made humane treatment of wild horses her life's passion, successfully campaigning for county action (1952), and State (1955) and federal (1959 & 1971) laws[26].

Figure 18. Thelma Johnson, Wild Horse Annie[27].

The 1971 Wild and Free-Roaming Horse and Burro Act passed the US Senate (Fig. 16) 98 to 0 by providing for recognition, ongoing management and inclusion with other land uses (multiple use).

Figure 19. Capital Dome, Washington DC[28].

Vision for Public Land Management

Sustainable Multiple-Use with Public Involvement

Free-Roaming horses and burros were proclaimed an "integral part of the natural system of the public lands" where they were roaming in 1971[29]. The Act was built on a foundation of compromise expressing the established tradition of sustained yield for multiple existing land uses.

The Secretary shall manage wild free-roaming horses and burros to achieve and maintain a thriving natural ecological balance with appropriate management levels (AML). ''Excess animals'' must be removed from an area to preserve and maintain a "thriving natural ecological balance and multiple-use relationship." Gathers maintain herd numbers. Calling gathers "reductions" misleads people. The goal is maintaining sustainable populations.

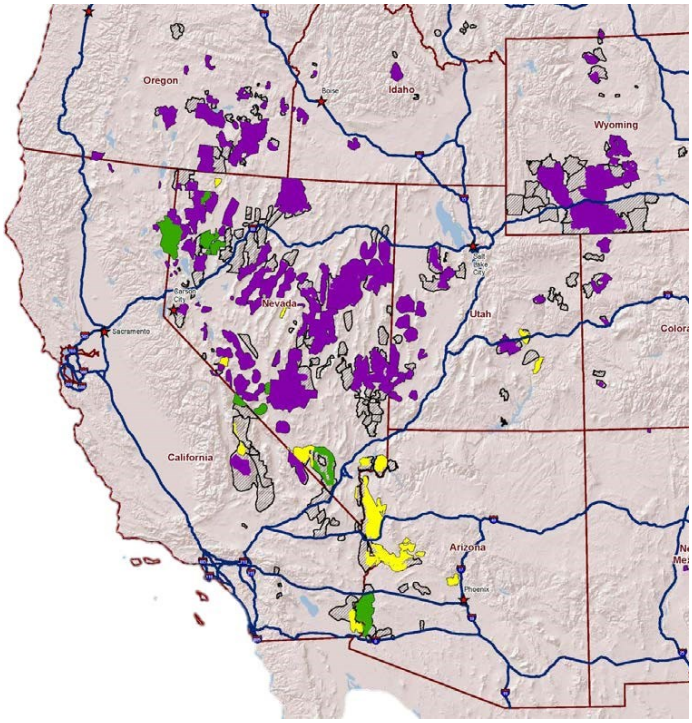


Figure 20. 177 BLM horse herd management areas (HMAs) (purple), burro HMAs (yellow) , both horses and burro (green). Herd areas (gray), are areas no longer intended for FRHB[30]. 53 US Forest Service wild horse territories generally abut a BLM HMA[31].

BLM herd management areas (Fig. 20) are in dry, less resilient lands that few people could afford to homestead. Hence, they remained public lands managed by the BLM. Nevada is the driest state but had 54% of the on-range horses and burros in 2021[32].

The high-AML maximum should be not too high, to maintain a "thriving natural ecological balance and multiple use relationship." A low-AML minimum should not too low, to maintain genetic diversity (Fig. 21). Gathering in the space between high and low avoids annual roundups.

Figure 21. Horses on a BLM HMA[33].

All management activities shall be at the minimal feasible level in consultation with the state wildlife agency to:

- Protect the natural ecological balance of all wildlife species;
- Protect the land from the deterioration associated with overpopulation; and
- Sustain ecosystems and habitats for thriving wild and free-roaming horses and burros, wildlife, livestock, habitats and multiple land users.

Many legal and policy actions have affected horse and burro management[34].

Amendments in the 1976 Federal Lands Policy and Management Act[35] allowed aircraft (Fig. 22) in gathering.

Figure 22. Gathering horses on the Warm Springs HMA[36].

Congressional appropriation policy riders and BLM policy have stopped slaughter or euthanasia of chronically unadoptable horses[34] (Fig. 23).

Figure 23. Thousands of horses gathered off the range are adopted each year[37].

In 1972 the Clean Water Act corrected nationwide problems with point and non-point source pollution so the waters of the US could be fishable and swimmable, to bring them up to standard so they could provide their beneficial uses. On rangelands, erosion including severely eroded streams were major pollution sources[38]. Across the US wetland habitats were shrinking.

The 1973 Endangered Species Act[39] declared the primacy of protecting ecosystems, especially from federal actions, to sustain habitats for biological diversity (Fig. 24).

Figure 24. Male sage-grouse on Lek for mating Photo by Gale Dupree

In 2010 the BLM Wild Horse and Burro Management Handbook[46] specifically addressed management for riparian functions. Riparian vegetation slows water, allowing sediment and roots to become floodplains and rich organic soil, the sponge that holds water and supports water-loving vegetation that forms and binds well-rooted soil, preventing erosion[30,31]. Riparian Values include: recreation and beauty; water quality; water and habitat for free-roaming horse and burros (Fig. 25), livestock, fish and wildlife, and endangered species or species of concern. Unfortunately, a riparian focus came after AML was set in 1984-1986[47].

Figure 25. Horses grazing sage-grouse brood rearing riparian habitat[42].

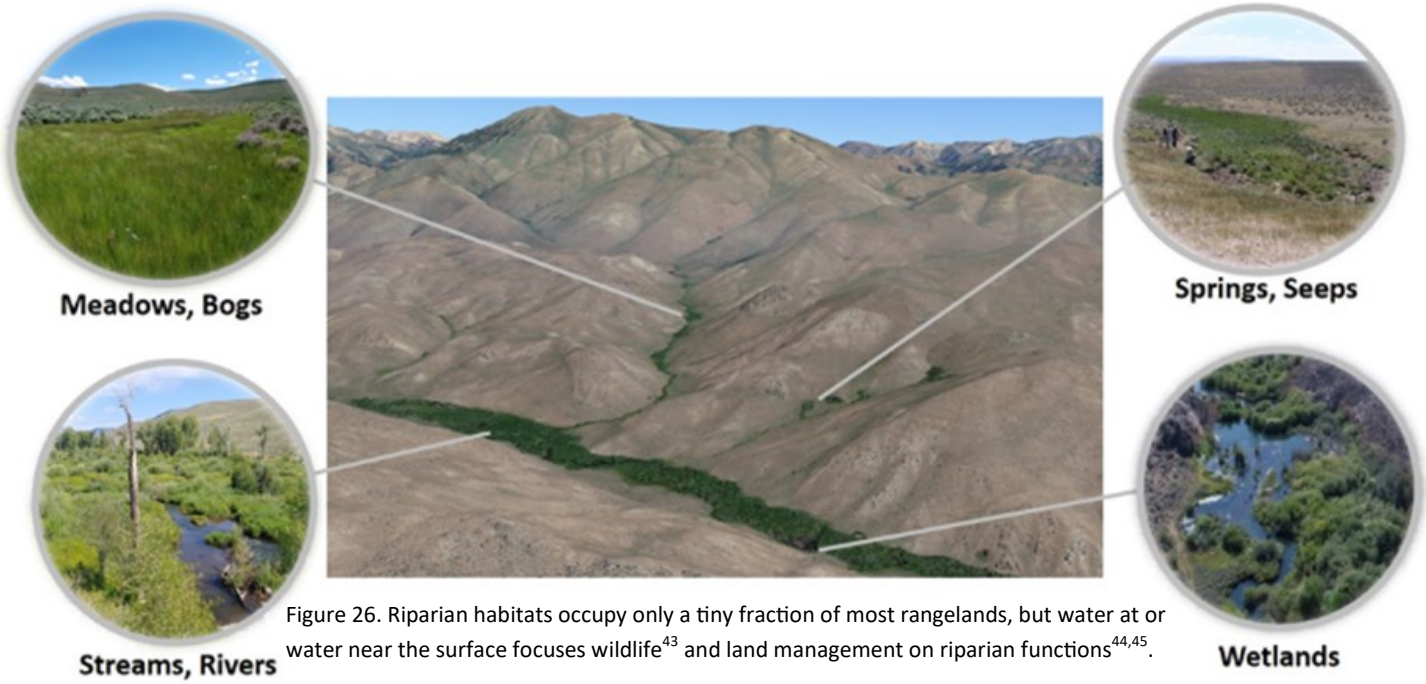


Figure 26. Riparian habitats occupy only a tiny fraction of most rangelands, but water at or water near the surface focuses wildlife[43] and land management on riparian functions[44,45].

The 1976 Federal Lands Policy and Management Act[27] and National Forest Management Act[40] strengthened multiple use, sustained yield, and public involvement for planning public land management.

By this time the National Environmental Policy Act[41] came to have a significant role in BLM and Forest Service Decision making.

Soon thereafter, riparian areas became recognized for their crucial role in providing ecosystem functions and wildlife habitat, especially in more arid rangelands.

Three fourths of desert fish and wildlife use or depend on riparian areas (Fig. 26), travel corridors and hotspots for biodiversity:

- Fish, tadpoles and invertebrates live in water.
- Most species drink riparian-stored water.
- Many seek riparian green forage or prey.
- Many find cover in riparian vegetation.

The Conservation community is therefore becoming more engaged in horse herd management[48,49].

The Reality

Reproduction of free-roaming horses is not controlled by humans, breeding for a planned foal crop. With no effective predation, continued growth causes populations to double in a predicted period (e. g. 18% = 4 years)[42,43], until limited by gathering, disease, or lack of food or water.

Land management agencies had to develop their capacity to manage horse and burro populations. Suddenly a bureaucracy had to address what markets had motivated citizens to do. At first, the agencies had little data, limited staff, no infrastructure, laws that needed modification, and they continue to have many publics to serve[18,26]. Populations soon more than doubled. By 2007 they had nearly gotten populations back down to high AML -- 28,806 with gathers and adoptions (Fig. 27).

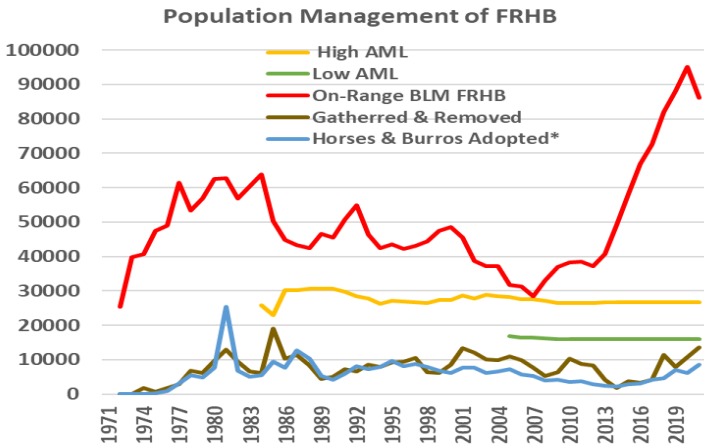
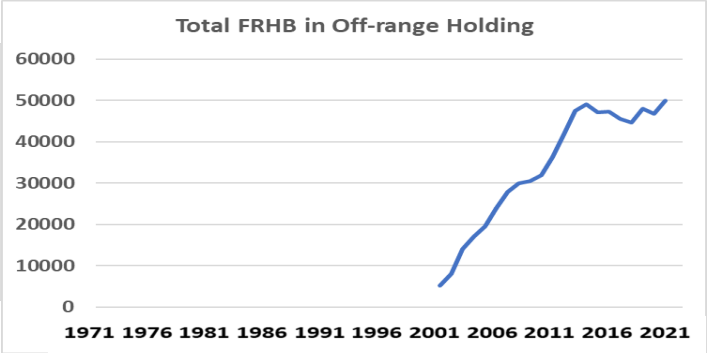


Figure 27. Horses and burros gathered and removed, adopted and on range populations compared to AML over fifty years[47].

But, this management was not sustained. With the Great Recession, adoptions diminished and off-range holding increased (Fig. 28). The expenses to care for off-range holding came to dominate agency budgets which further increased political debate that reduced gathering[34,51]. Lack of a vision[51,] for a sustainable future then limited budgets[34,53-55]. Populations grew exponentially again,



Globally, horse impacts to ecosystems can be positive or negative depending on their intensity of grazing[56-58]. Horses are healthiest and happiest at AML[59]. Eventually populations crash - after starvation and accelerating habitat destruction. Feeding hay to wild horses increases risks to human safety and habitat damage (Fig. 29).

Figure 29. Local people fed hay to horses out of forage in the Cold Springs Horse Territory (photo by S. Swanson).

Since 2014 Nevada horses and burros outweigh all big game animals combined: moose, mountain goats, mule deer, pronghorn, elk, and bighorn sheep (Fig. 30). Nevada bighorn sheep range overlaps HMAs by 40%[60].

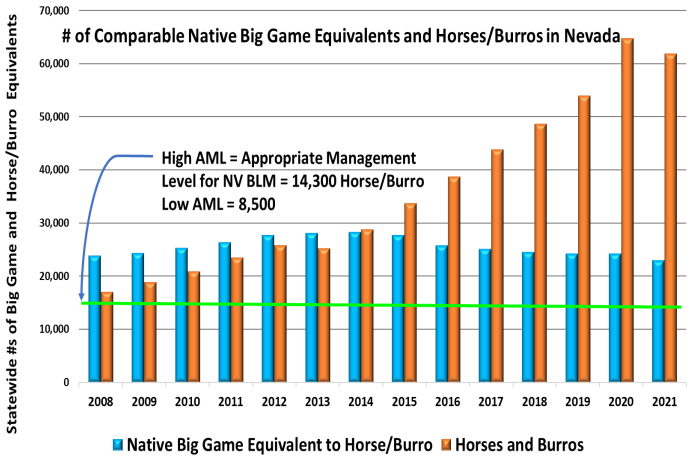


Figure 30. Nevada free-roaming horse & burro and big game numbers each adjusted for forage consumption[61].

When horse and burro numbers exceed AML, wildlife suffers. Sage-grouse population decline (λ<1) correlates directly with % over AML of horse populations (Fig. 31).

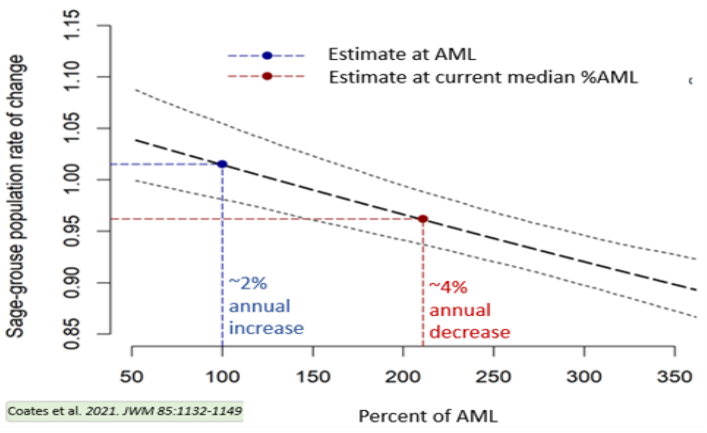


Figure 31. Sage-grouse decline 4%/year where horses are twice AML. Graph used by permission[62]

Horse impacts to sage-grouse include altered breeding behavior, diminished forage and cover (reduced cover increases predation), and less resilient ecosystems in the form of shrinking riparian brood-rearing habitat (Fig. 32) and a cheatgrass/fire cycle removing sagebrush[42,62-67].

Figure 32. Late brood-rearing habitat shrinks as riparian areas lose functions[44,45].

While horses may travel miles to forage away from water, they also travel miles to find green plants. Green forage attracts horses to riparian areas even more than cattle (Fig. 33), especially during dry summer months[45,66,67].

Figure 33. Cattle used riparian meadows 30 times more than other land in their allotments, horses used them 51 times more than other land in their HMAs or territories. Native big game use was incidental[42].

While agencies require most ranchers to move livestock and take them to private lands for part of each year, free-roaming horses and burros graze public land year-round. Grazing in one area throughout the growing season does not allow preferred plants a time for growth and recovery. Repeated grazing, trampling, and lack of leaf area for photosynthesis stresses and eventually kills forage and riparian stabilizer plants causing erosion, loss of organic matter and water storage (Fig. 34).

Figure 34. Cherry Spring, in the High Rock HMA, has been denuded of vegetation due to severe, chronic overuse by wild horses and burros and has lost significant topsoil due to erosion by wind and water[68].

To function properly[44,45], riparian areas need more recovery than damage. Many strategies can help manage cattle grazing for riparian areas[66,67]:

- Short grazing and long recovery periods
- Occasional or planned growing season rest
- Riparian pasture management
- Moderate to light intensity
- Cool or early season use only or mostly
- Off-riparian-area water access
- Regrowth before winter
- Varied grazing seasons year to year
- Riding, herding, & stockmanship
- Salt/supplement placement

Strategies that move animals are almost always necessary to avoid rangeland riparian degradation by livestock but these strategies are not allowed for free-roaming horses. Horses are like native ungulates and must be maintained within their carrying capacity (AML) to prevent habitat destruction e.g. loss of soil. Without effective predators, people must gather excess animals to prevent inhumane starvation or more inhumane dying of thirst (Fig. 35).

Figure 35. Horse foal just prior to dying of dehydration. Photo credit Phil Baribeau

The Nightmare

When we fail to maintain AML, exponential growth soon becomes ecologically devastating, hugely expensive, inhumane and a political crisis.

Figure 36. Horses above AML can lose body condition and health[69].

Hungry horse populations (Fig. 36) continue to grow but at a slower rate of 12-15% vs. 18-22%[50,51,59,70] when horses and habitats are unhealthy, mares fail to reproduce in some dry years and deaths increase. Eventually deaths exceed births. During such conditions, emergency gathers (Fig. 37) become the only option to prevent die offs.

Figure 37. Water trap[71] used to gather dehydrated excess horses.

Repeated overgrazing weakens and kills preferred perennial plants, opening space for invasive weeds (Fig. 38).

Figure 38. Unpalatable weeds[72] can replace grazing stressed native plants, speeding up weed invasion.

After loss of perennial grasses, competitive annual grasses take over[63,65]. But, they may fail to grow in dry years or provide so much fine fuel in wet years (Fig. 39) that big fires (fig. 40) consume the forage. Frequent fires in a cheatgrass fire cycle prevents return of native wildlife and sagebrush.

Figure 39. Cheatgrass grew abundantly in 2005 and 2006[73].

Figure 40. Fires burned more than 3 million acres of Nevada rangeland in 2005—2007[74].

After crossing an ecological threshold (fig. 39-41), plant communities rarely recover[63,65,75]. Seedings are expensive and often fail, especially where grazing into and through the spring decimated stands of winterfat, a key winter forage for horses, livestock and wildlife. Without plants to protect soil, erosion takes essential top soil. The more soil lost, the more difficult the recovery. More care and time are needed for the less certain results.

Figure 41. Horses above AML graze forage plants so often the plants die and ecosystems like this riparian area lose their functions[36,37,55]. These free-roaming horses mismanaged by Nevada are on private property in the Virginia Range near Reno[76].

Riparian plants that thrived on groundwater can no longer grow roots when the water drains away in a gully. The sponge that used to be critical for storing water becomes a drain pipe taking water to where it sinks away into a fan or onto a salty playa where it evaporates (Fig. 42).

Figure 42. Intermittent stream in Nevada that depended on riparian functions to prolong flows, but goes dry[77].

The nightmare of exponential growth of excess horses is in nobody's best interest. Excess free-roaming horses and burros (FRHB) create more excess FRHB (Fig. 43) as they destroy habitat.

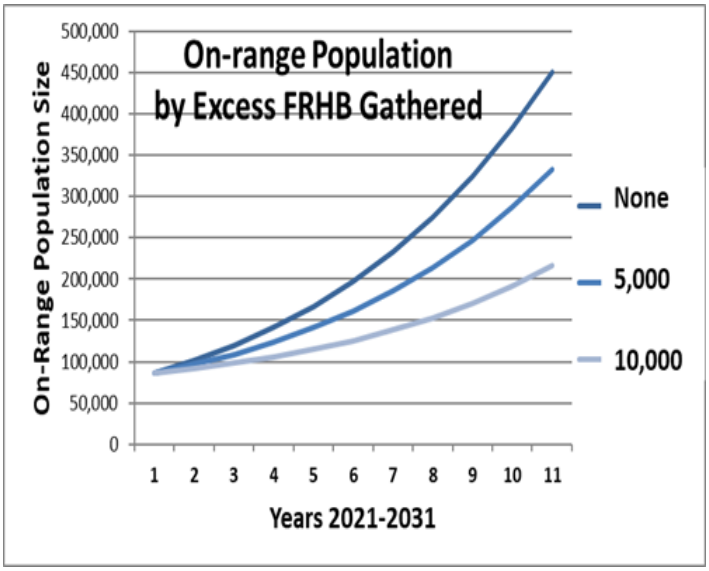


Figure 43. When the number of horses gathered each year is not enough to keep pace with reproduction, the number of additional excess horses increases annually[50,51,70,78].

Political difficulties make continued exponential growth more possible and more frightening. Reliance on fertility control does not achieve AML. At best, it can only stabilize current numbers.

Runaway exponential growth expands the devastation to more lands (Fig. 44).

Figure 44. Vast expanses of bare ground on horse habitat cannot be sustainable[79].

Excess horses represent commitments of federal funds, $850./horse to gather and process, $5.75/day for six months of off-range holding in corrals or $2.50/day for the life of the horse on private pastures[61]. Failure to appropriate sufficient funds for a sustainable program based on AML results in more horses and even higher costs later.

Figure 45. Starving horses has long been recognized as inhumane[80].

Failure to gather sufficient horses results in inhumane conditions for horses and native wildlife[54,55] (Fig. 45).

Starvation sucks out the vitality of life.

Dying of thirst is painful.

Paths Forward for Versions of a Future

People and groups have different ideas about how to confront the current reality and avoid the nightmare. Yet simple solutions for complex ecosystems and political contexts tend not to be effective unless base on a complex understanding. Political debate has been intense, with many positioned sides each blocking the simple ideas of others.

Simple Ideas		Challenging Realities
Deny there is a problem and focus only on the stresses of gathers while celebrating the heritage of wild horses living free. If herd areas run out of forage or water let horses spread out.		Even if the public and agencies allowed expansion of herd management areas by allocating more land to FRHB, populations will ultimately need control or destroy their home. If the numbers are larger, so is the problem of excess horses.
Since horses are feral and compete with native wildlife, remove them all from public lands.		Many in the public cherish wild horses and burros and this would not be legal or possible.
Let predators control horse numbers.		Although some mountain lions prey on horses[81,82], cougar predation does not[51], and is unlikely to[82], limit any free-roaming horse herds.
Livestock are not native and cause environmental problems in too many areas where not properly managed, so let wild horses graze where livestock currently graze.		Criteria for livestock grazing should be applied to horses and burros[75] which have a similar impact. However, horses and burros roam free year-round, so many strategies used for livestock[66,67] will not apply, necessitating reliance on AML.
Since the problem is too much population growth, apply fertility control[83,84] to limit future growth and allow populations to eventually get to AML, or not.		While much research focuses on this, currently available methods, other than spaying mares, have limitations and lack durability[85,86]. Short-term or reduced effectiveness requires more frequent gathering which become harder. Less than 100% effectiveness allows populations to grow and does not achieve AML[86,87]. Re-gathering horses for continued fertility control, or before achieving AML, is as expensive as gathering for removal or for a year of off-range pasturing[69]. Herds above AML damage habitat[55,57,62].
Experiment with areas managed in different ways, letting each show the results of that strategy.		Lands allocated to natural control may never recover[55,63] and many of the horses there would suffer a painful death[54,80]. Learning from each experiment would divert funds from management.
Since the problem is too many horses for the thriving natural ecological balance, simply follow the law.		While the law calls for slaughter of unadoptable excess horses, this has been halted by public opinion or BLM since 2005 and by Congress since 2010. Congress also hasn't funded achieving AML, citing high costs and growing horse numbers in off-range holding.
Continue muddling along.		Not getting to AML and letting horses curtail their population growth[59] by starvation is inhumane and permanently damages ecosystems[55]. Gathering excess horses only during emergencies incurs great long-term environmental and economic cost[86,87,89].
If wild horses are wildlife, let hunting control populations by issuing tags for excess animals.		This is currently illegal and will likely remain so for many reasons including lack of cultural acceptance and risk of killing domestic horses legitimately using public or private lands.
The WHB Program should pay for itself		Delay in getting to AML prevented this and increases cost.

Politically challenging situations often require a coalition of diverse interests coming together for a common voice.

National Horse and Burro Rangeland Management Coalition

Free Roaming Equids and Ecosystems Sustainability Network

The Path Forward is from a coalition of organizations representing:

- Humane treatment of animals;
- Agriculture;
- Professional land management;
- Wild horse conservation; and
- Local and state government.

The Path Forward calls for:

- Targeting gathers and removals at densely populated areas to reduce herd size and progress towards AML;
- Treating gathered horses to suppress population growth before release;
- Relocating horses to large cost-effective, humane pastures;
- Promoting adoptions to reduce costs

The 2019-2020 BLM Report to Congress[61] reflects this approach. It calls for management of wild horse and burro herds in three phases:

1. Stabilize on-range population growth in 4-5 years;
2. Reach AML nationally (over the next decade);
3. Maintain AML in perpetuity.

Over the next fifteen to eighteen years:

Annually gather 20,000 - 30,000 animals;

Annually remove 18,000 to 20,000 animals permanently from public rangelands (placed into off-range holding) until AML is achieved;

Procure off-range corrals and pastures to care for and feed animals removed from the range;

Treat (temporary long-term or permanent fertility control) 3,500 to 9,000 gathered animals for 10 years and fewer for 5 years;

Annually place 6,000 - 7,000 animals into private care;

Identify partner organizations to care for many off-range animals;

Continue research to improve long-term fertility control treatments.

The Coalition for Healthy Nevada Lands, Wildlife and Free-Roaming Horses celebrates that progress seems possible and believes faster gathering reduces impacts and cost. Without AML, fertility control effectiveness is limited by remoteness. Much critically important wildlife habitat (Fig. 46) is impacted by inaccessible herds above AML.

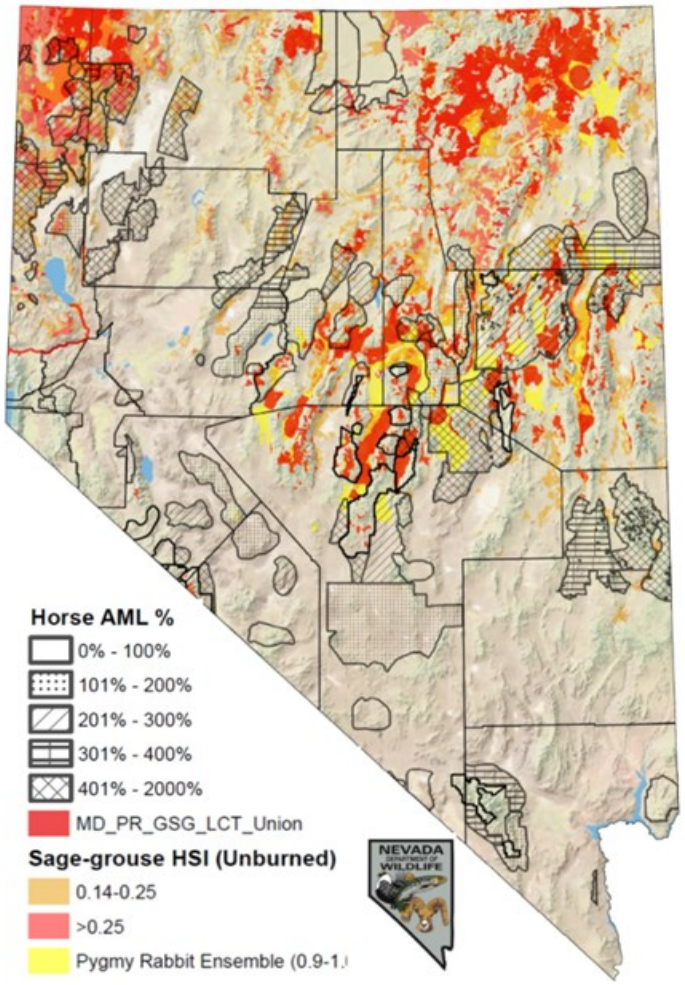


Figure 46. Nevada Department of Wildlife GIS based map overlaying herd management areas by % over appropriate management level in March 2021, priority habitat for mule deer, greater sage-grouse and lahontan cutthroat trout, unburned greater sage-grouse habitat by habitat suitability index, and pygmy rabbit habitat[90].

The BLM has also adopted a Comprehensive Animal Welfare Program to further reduce any stress to horses from handling which is generally minimal[91]. Stockmanship or low-stress handling skills also reduce stress in gathering[92].

A Sustainable WFRHB Program for Healthy Western Lands

Success in getting to sustainability depends largely on the timing and numbers gathered. Not gathering horses and just using fertility control can only suppress growth, not get to AML[79,87]. Even gathering 25,000 excess horses annually, treating half the mares (6,347) with GonaCon plus a booster (PZP would require more boosters) and removing untreated horses fails (Fig. 47). Treated pregnant mares will foal and colts that become mares will not be treated. Untreated horses reproduce. Also after fertility control, any gather includes both treated and untreated horses. Eventually few untreated horses get removed even in large gathers because most gathered mares are treated. The population will continue growing unless the vast majority of excess animals are removed.

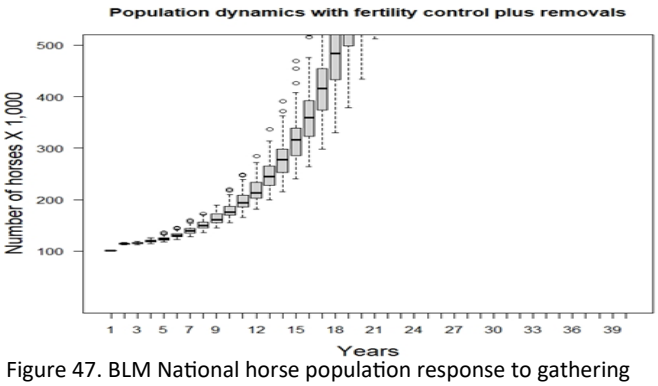


Figure 47. BLM National horse population response to gathering 25,000 horses per year and removing all but 6,237 that are treated with a fertility drug (assumed to be 100% effective after the first year) and then released[93].

Conversely, removing 25,000 excess horses in getting to AML and then treating mares with GonaCon will be effective in maintaining the on-range horse populations[86,87]. (Fig. 48)

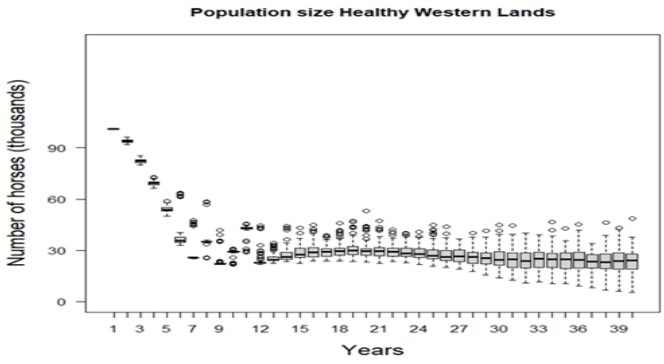


Figure 48. BLM National horse population response to gathering and annually removing 25,000 horses or all excess horses[93].

Furthermore, the off-range populations will stop increasing and decline to low levels[78,86,93] (Fig 49) after AML is reached and maintained because excess mares placed in off-range pastures no longer breed without in-tact stallions and on-range reproduction is low, creating few or no unadoptable excess animals.

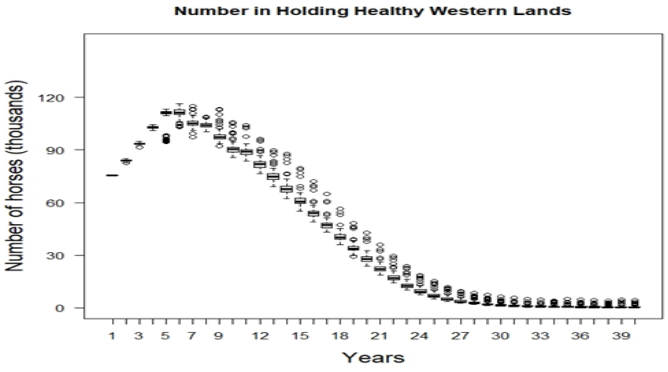


Figure 49. BLM National off-range horse population response to gathering and removing 25,000 horses per year[93].

Gathering to AML quickly and as needed to maintain AML greatly reduces long-term costs. (Fig. 50)

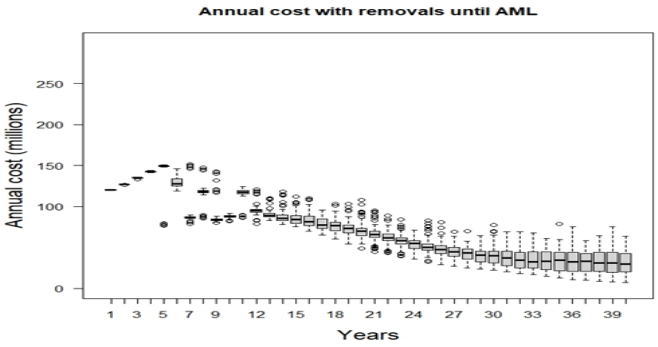


Figure 50. BLM National horse population management costs (as distributed by BLM) responding to gathering and removing 25,000 horses per year[93].

Once at AML, the number for adoption can be managed by adjusting the rate of fertility control. Excess on-range young must be gathered and adopted or also treated for herds to stay between low and high AML (16, 071 - 27,882). By gathering excess horses less than 5 years old, all gathered horses could be adopted every year. Using longer acting or permanent fertility control treatments could reduce the frequency of needed gathers[87]. On-range horses will be healthy (Fig. 51).

Figure 51. Horses grazing on healthy rangeland[94].

Because free-roaming horses on public lands continue reproducing, excess horses must be gathered and pastured on private lands in off-range non-reproducing herds. Fortunately, the US has an abundance of prairie grasslands (Fig. 52) where off-range horses could live out their lives on pasture.

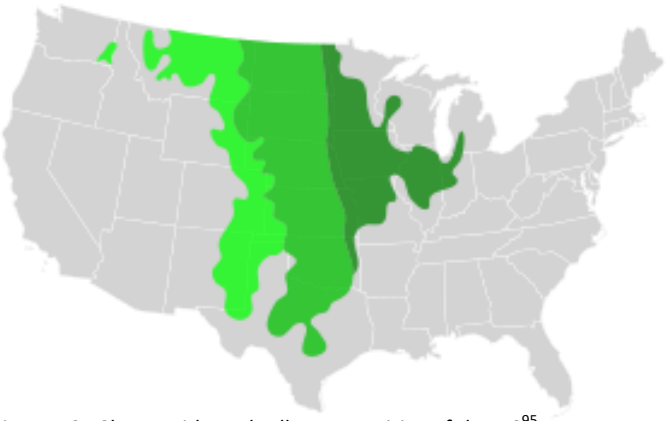


Figure 52. Short, mid– and tall-grass prairies of the US[95].

Ironically, most of the 7,246,835 US horses[96] seem to live near people (Fig. 53).

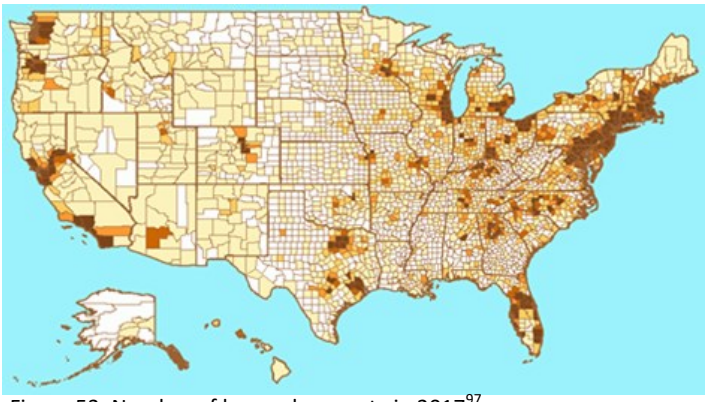


Figure 53. Number of horses by county in 2017[97].

The number of excess horses gathered and removed per year drives economic and environmental impacts. Gathering 10,000 or fewer horses continues to add to on-range populations (Fig. 54), impacts, and costs (Fig. 55). Removing 20,000 excess horses per year achieves AML and spending enough to remove 30,000, excess horses annually to achieve AML saves money in the long term.

Failure to keep within AML created a big challenge. The long-term least-cost path is gathering to AML fast. To do so requires infrastructure and funding for initially gathering and pasturing many excess horses. Costs for off-range holding will be high, but all costs will be higher if agencies are not funded to achieve AML (Fig. 54-55)[78,86,87,93].

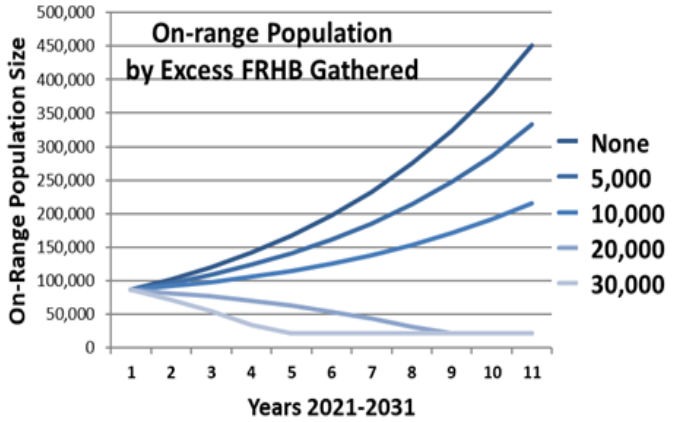


Figure 54. Gathering 10,000 or fewer horses per year allows the on-range population to grow without fertility control[78]

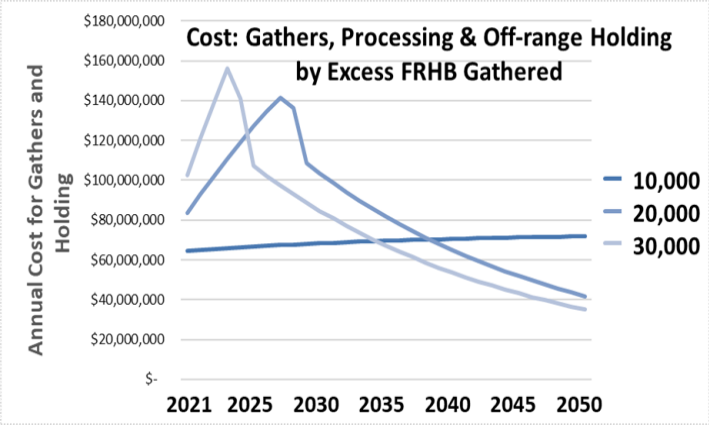


Figure 55. Gathering too few horses to get to AML continually increases costs[98]. Gathering and removing 20,000 or more causes off range holding costs to peak and then decline after AML and all gathered horses are adopted[78,86,87,93].

Investing now could make the Wild and Free-Roaming Horse and Burro Program sustainable[50],54,86,93.

Had we gathered to AML and placed 6,570 more horses into long-term holding in 2007, we would have 30,000 fewer horses in long-term holding and few to no unadoptable excess on-range horses today[99,100].

Delaying necessary action increases environmental and economic costs[34,42,49,55,57,62,87-90,93,101].

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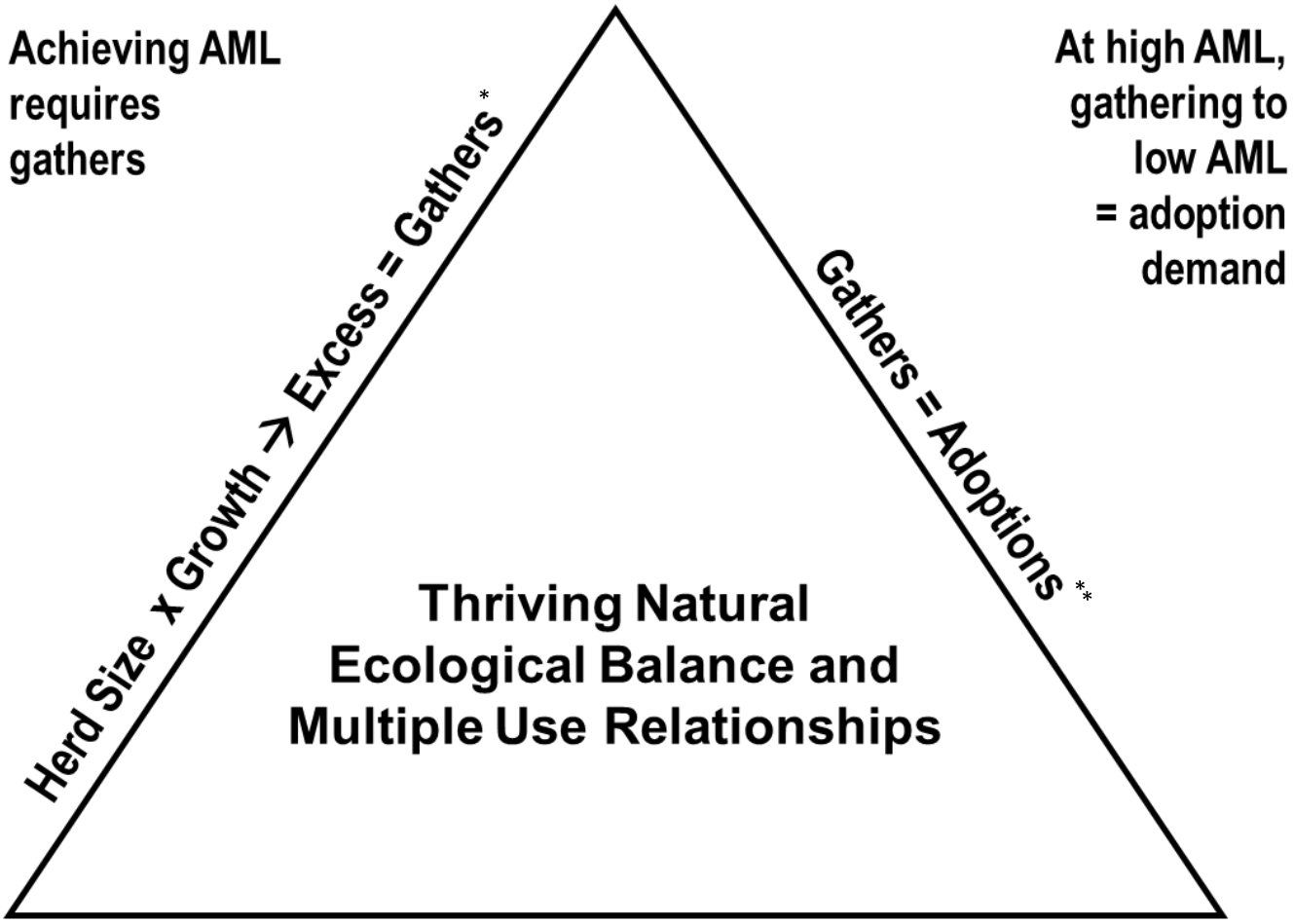
Free-roaming Horse Sustainability Triangle



* Fertility control can limit growth rates to help maintain AML only after achieving AML

** Before AML excess unadoptable horses can live out their lives in nonreproducing herds on private pastures

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