Current BLM Wild Horse and Burro Research Projects, December 2024

Institution; Project Name	Dates; Budget[1]	**Goals and Status**	**Implications**
BLM-funded WHB research projects; FERTILITY CONTROL			
1. Northwest Wildlife Conservation, with Cornell University**;** Improvements to SpayVac vaccine	2023-2027; $318,483 FY2022	Goals: Test SpayVac porcine zona pellucida [PZP] vaccine contraceptive effectiveness when injected in the neck or rump, compared to controls Status: Mares were vaccinated in June 2023, stallions were introduced two months later. Foal rate monitoring started in 2024. Progesterone levels and foaling appears lower in treated mares than in untreated 'control' animals.	PZP vaccines have been used for over a decade, but a 1-shot PZP vaccine with long contraceptive effects could be more useful.
2. USDA - APHIS - National Wildlife Research Center; Identification of a single-dose, long-lasting adjuvant for Oocyte Growth Factor vaccine	2023-2026; $512,721 in FY2022, plus $170,803 in FY2024	Goals: 1. Test the contraceptive effects of oocyte growth factor [OGF] vaccine formulations that cause high immune responses. Status: Vaccine formulation screening began in June 2023. Testing for the two most immunogenic vaccine formulations began in 2024. Extra funding in FY2024 will allow for a higher sample size and more frequent monitoring.	Any humane, safe, effective vaccine that causes long-term infertility, or sterility, could reduce growth rates and save costs.
3. California Institute of Technology; Long-term contraception through inhibition of Juno, an egg receptor required for fertilization	2023-2025; $547,700 FY2022	Goals: Proof of concept study *in vitro* and in mice, that will develop and test a virally-vectored method to limit fertility. Status: Researchers have confirmed that synthesized proteins bind to 'Juno' on oocyte surfaces *in vitro*, and will soon insert Juno-binding protein DNA into virus-like vectors, then test in laboratory mice.	Any humane, safe, effective vaccine that causes long-term infertility, or sterility, could reduce growth rates and save costs.

[1] Dates listed are for planned research and publication activity. Budgets listed here only reflect obligated BLM funding to researchers. Costs of WHB gathers, animal holding and care, agency administrative costs, and any researchers' in-kind contributions are not included here. BLM made six awards to proposals from the FY2024 request for proposals / notice of funding opportunity (L24AS00091); those awards are noted as 'FY2024.' Projects that were funded from the FY2022 funding opportunity are noted as 'FY2022.'

Institution; Project Name	Dates; Budget[1]	**Goals and Status**	**Implications**
4. Oregon State University; Uterine tube occlusion after transcervical polidocanol foam infusion in mares	2024-2026; $73,157 FY2024	Goals: Proof of concept study in privately-owned mares, to test whether a minimally invasive procedure causes scarring where the oviduct enters the uterus, to prevent fertilization. Researchers will monitor for any post-procedure discomfort. Status: Project is to begin in FY2025.	A humane, safe, minimally invasive sterilant could reduce growth rates and save costs.
BLM-funded WHB research projects; FERTILITY CONTROL (cont.)			
5. Purdue University; Development of a contraceptive vaccine that induces long-lasting infertility in horses	2024-2027; $494,092 FY2024	Goals: Test whether a fertility control vaccine against the Izumo sperm surface protein prevents fertility in privately-owned mares. A water-soluble Izumo- and PZP-vaccines will be prepared with the antigen bound to collagen nanoparticles designed for long-term immune response. Status: Recombinant Izumo proteins have been prepared for use in a trial vaccine formulation.	Any humane, safe, effective vaccine that causes long-term infertility, or sterility, could reduce growth rates and save costs.
BLM-funded WHB research projects; INTERACTIONS WITH ENVIRONMENT AND CLIMATE			
6. Utah State University with USDA ARS; A protocol for predicting habitat resilience to climate change on WHB habitats	2022-2026; $226,242 FY2022	Goals: Map 'usable space' for WHBs, then use remotely-sensed data and climate projections to evaluate WHB habitat conditions in the past and under future conditions. Status: 10 years of WHB aerial survey data have been used to develop and test models of habitat suitability, as a function of spatially and temporally variable environmental factors. Preliminary results are in preparation for publication.	BLM needs to have predictions about what climate change could mean for WHB habitats in the future.
7. US Geological Survey; Livestock and wild horse influences on vegetation and wildlife in sagebrush ecosystems	2022-2026; $802,724 FY2022	Goals: Create a public, west-wide geospatial database with a long-term time series of livestock grazing levels & wild horse herd sizes. Model current & future effects of livestock & WHB on vegetation, sagebrush-obligate birds, and other ecosystem health indicators. Status: Spatial database is in beta testing. USGS is completing preliminary analyses on effects of environmental covariates, including time series of wild horse density.	This project will gauge the separate ecological effects of wild horses and livestock.

Institution; Project Name	Dates; Budget[1]	**Goals and Status**	**Implications**
8. US Geological Survey; Mapping wild horse densities across broad landscapes of the Western United States	2024-2026; $240,081 FY2024	Goals: Create long-term time series of WHB densities at fine scales (pixels, not polygons). WHB density is usually measured at the scale of herd management area boundaries. Status: This is an addendum to project #7. Awarded in FY2024; project began in FY2025	Detailed maps of past density will improve scientific analyses of wild horse effects.
BLM-funded WHB research projects; INTERACTIONS WITH ENVIRONMENT AND CLIMATE (cont.)			
9. US Geological Survey, with Utah DWR and USU; Spatial dynamics and resource partitioning among feral, wild, and domestic ungulates in a western arid landscape	2024-2028; $243,187 FY2024	Goals: Use GPS radio collar data from wild horses, mule deer, pronghorn antelope, and domestic cattle and sheep to assess habitat use overlap in western Utah. Status: Wildlife and domestic species radio collaring is funded by and ongoing via collaboration with Utah Division of Wildlife Resources [UDWR] and Utah State University [USU]. Horse radio collaring was in early FY2025.	Ecological interactions across species can be measured in terms of what parts of shared habitats they use.
BLM-funded WHB research projects; SURVEYS/DEMOGRAPHY/GENETICS/WELFARE/PLACEMENT/HUMAN DIMENSIONS			
10. US Geological Survey; Development of population model and cost analysis for managing wild horses	2016–2025; $459,859	Goals: Create and update "PopEquus" software to compare costs and population outcomes that result from various removal and fertility control management actions. Status: Link to model: https://rconnect.usgs.gov/popequus/ In FY25 USGS is beta-testing a new extension for wild burros.	BLM offices are using PopEquus to compare management alternatives.
11. Texas A&M University; BLM Wild Horse and Burro genetic monitoring	2020-2025; Contract, up to $182,625	Goals: Analyze genetic diversity based on hair samples from gathers, for ongoing BLM's WHB population monitoring. Status: Microsatellite DNA genotyping has informed BLM's herd management for over 2 decades; reporting is ongoing.	BLM monitors genetic diversity and risks of inbreeding depression.
12. US Geological Survey; Testing and optimizing new genomic markers for wild horses	2024-2026; $89,883 FY2024	Goals: Compare the utility of single nucleotide polymorphisms (SNPs) for genetic monitoring, as opposed to the currently used genetic markers (microsatellites) Status: Awarded in FY2024; project to begin in FY2025.	Modern methods may provide more detailed information at lower cost.

Institution; Project Name	Dates; Budget[1]	**Goals and Status**	**Implications**
BLM-approved WHB research projects *funded entirely by other sources*			
Aarhus University (Denmark) with Texas A&M; Inbreeding status and climate change adaptability of feral horse populations	2024-2027; $0 BLM	Goals: Use whole-genome genotyping across multiple wild horse populations to assess genetic diversity, relatedness, and potential evolutionary adaptation to local environments. Status: Genetic samples from 25 herds identified have been genotyped at Texas A&M University.	Whole-genome genetic methods may provide more detail about these questions than microsatellite DNA.
Utah State University; Mountain lion prey selection in SE Nevada	2021-2025; $0 BLM	Goals: Assess levels of horse and other ungulate prey in mountain lion diets, before and after a wild horse gather. Status: Initial studies published in peer-reviewed journal. Predation on horses is mainly in foals and yearlings, but different lions specialize to different extents.	Predation is mainly on foals, but seems to not prevent herds from growing overall.

Recent research and related publications related to wild horses and burros
Mostly Western USA-centric; since approximately December 2023

The BLM symbol before a citation indicates BLM-funded and / or BLM-supported work. Some non-BLM-supported publications are listed here because they may relate to wild horse and burro management. For lists of papers from 2021 to 2023, see the September 2022 and December 2023 summaries to the advisory board. Topics are ordered based on listings in the 2021 BLM WHB strategic research plan.

Fertility Control

BLM Bruemmer, J.E., Eckery, D.C., Eisenfelder, M. and Mundell, C. 2023. 138 Immunization against oocyte growth factors in feral mares. Journal of Equine Veterinary Science 124:104440. (*Meeting abstract only*) https://doi.org/10.1016/j.jevs.2023.104440

Schulman, M.L., Hayes, N.K., Wilson, T.A. and Grewar, J.D. 2024. Immunocontraceptive efficacy of native porcine zona pellucida (pZP) treatment of Nevada's Virginia Range free-roaming horse population. Vaccines 12(1):96. https://www.mdpi.com/2076-393X/12/1/96

Rutberg, A.T., Turner Jr, J.W. and Herman, K. 2022. Fertility control and the welfare of free-roaming horses and burros on US public lands: the need for an ethical framing. Animals 12(19):2656. https://doi.org/10.3390/ani12192656 (*by mistake this 2022 article was not included in previous lists to the advisory board*)

Asa, C.S., Griffin, S.L.B., Eckery, D., Hinds, L.A. and Massei, G. 2024. Foreword to the special issue on 'fertility control for wildlife in the 21st century.' Wildlife Research 51(1). https://www.publish.csiro.au/WR/pdf/WR23142

Ecology, Environmental Interactions, and Climate

BLM Hennig, J.D., Beck, J.L. and Scasta, J.D. 2024. Feral horses and pronghorn: a test of the forage maturation hypothesis in an arid shrubland. Animal Behaviour 210:55-61. https://doi.org/10.1016/j.anbehav.2024.01.01

BLM Esmaeili, S., Schoenecker, K.A. and King, S.R. 2024. Resource availability and heterogeneity affect space use and resource selection of a feral ungulate. Ecosphere 15(8):e4939. https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/ecs2.4939

BLM Teige, E.C., Maxwell, L.M., Jordan, S.E., Rutherford, T.K., Dietrich, E.I., Samuel, E.M., Stoneburner, A.L., Kleist, N.J., Meineke, J.K., Selby, L.B. and Foster, A.C. 2023. Annotated bibliography of scientific research on greater sage-grouse published from October 2019 to July 2022. US Geological Survey Open File Report 2023-1082. https://pubs.usgs.gov/publication/ofr20231082/full

BLM Davies, K. 2024. How variation in activity time and duration at water sources affects feral horse vulnerability to cougar predation in southern Nevada. Utah State University Undergraduate Honors Capstone Projects 989. https://digitalcommons.usu.edu/honors/989

BLM Iacono, P.C., Schoenecker, K.A., Manlove, K.R., Jackson, P.J. and Stoner, D.C. 2024. Evaluating mountain lion diet before and after a removal of feral horses in a semiarid environment. Ecosphere 15(7):e4919. https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.4919

BLM Beck, J.L., M.C. Milligan, K.T. Smith, P.A. Street, A.C. Pratt, C.P. Kirol, C.P. Wanner, J.D. Hennig, J.B. Dinkins, J.D. Scasta, and P.S. Coates. 2024. Free-roaming horses exceeding appropriate management levels affect multiple vital rates in greater sage-grouse. Journal of Wildlife Management (2024):e22669. https://wildlife.onlinelibrary.wiley.com/doi/full/10.1002/jwmg.22669

BLM Behnke, T.L., Street, P.A. and Sedinger, J.S. 2023. Climate and non-native herbivores influence reproductive investment by Greater Sage-grouse. Ecosphere 14(5):e4498. https://doi.org/10.1002/ecs2.4498

Platte, R.C. and Torland, R.E. 2024. Influence of wildfire and feral horse use on mule deer summer range occupancy. Wildlife Research 51(1). Internet link

Rubin, E.S., Conrad, D., Harding, L.E. and Russo, B.M. 2024. Associations between a feral equid and the Sonoran Desert ecosystem. Wildlife Monographs 215(1):e1083.https://doi.org/10.1002/wmon.1083

Lundgren, E.J., Bergman, J., Trepel, J., Le Roux, E., Monsarrat, S., Kristensen, J.A., Pedersen, R.Ø., Pereyra, P., Tietje, M. and Svenning, J.C. 2024. Functional traits—not nativeness—shape the effects of large mammalian herbivores on plant communities. Science 383(6682):531-537. https://doi.org/10.1126/science.adh2616

Rowland, P.I. and Lovelock, C.E. 2024. Global impacts of introduced ungulates on wetland carbon and biodiversity: A review. Biological Conservation 290:110432. https://www.sciencedirect.com/science/article/pii/S0006320723005335

Trepel, J., le Roux, E., Abraham, A.J., Buitenwerf, R., Kamp, J., Kristensen, J.A., Tietje, M., Lundgren, E.J. and Svenning, J.C. 2024. Meta-analysis shows that wild large herbivores shape ecosystem properties and promote spatial heterogeneity. Nature Ecology & Evolution 8(4):705-716. https://www.nature.com/articles/s41559-024-02327-6

O'Donnell, R.P., Fox, J. and Ingraldi, M.F. 2023. Environmental DNA in the management of invasive and native amphibians: American bullfrogs and barred tiger salamanders on the Grand Canyon-Parashant National Monument. Sonoran Herpetologist 36:28-30. Link via ResearchGate

Dilsaver, L.M., 2023. Obstacles to removing non-native species from a national park. In Parks Stewardship Forum (Vol. 39, No. 1). https://escholarship.org/uc/item/3tc8n7zn

Rambaldi Migliore, N., Bigi, D., Milanesi, M., Zambonelli, P., Negrini, R., Morabito, S., Verini-Supplizi, A., Liotta, L., Chegdani, F., Agha, S. and Salim, B. 2024. Mitochondrial DNA control-region and coding-region data highlight geographically structured diversity and post-domestication population dynamics in worldwide donkeys. PLoS One 19(8):e0307511. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0307511

Molvar, Erik M., Roger Rosentreter, Don Mansfield, and Greta M. Anderson. 2024. Cheatgrass invasions: History, causes, consequences, and solutions. Report by Western Watersheds Project. https://westernwatersheds.org/wp-content/uploads/2024/02/Cheatgrass-Literature-Review-final.pdf

Berman, D.M., Pickering, J., Smith, D. and Allen, B.L. 2023. Use of density-impact functions to inform and improve the environmental outcomes of feral horse management. Wildlife Biology 2023(5):e01107. https://doi.org/10.1002/wlb3.01107 (from Australia)

WHB In General, and Human Dimensions

Frey, N., Beck, J.L., Singletary, L., Snell, L., Scasta, D. and Hadfield, J. 2024. Western US residents' knowledge of wild free-roaming horses and their management on federal public lands. Rangeland Ecology & Management 92:12-23. Link via bioone.org

Taylor, W.T.T., Belardi, J.B., Barberena, R., Coltrain, J.B., Marina, F.C., Borrero, L.A., Conver, J.L., Hodgins, G., Admiraal, M., Craig, O.E. and Lucquin, A. 2023. Interdisciplinary evidence for early domestic horse exploitation in southern Patagonia. Science Advances 9(49):eadk5201. https://www.science.org/doi/pdf/10.1126/sciadv.adk5201

Moore, C.R., Kimball, L.R., Goodyear, A.C., Brooks, M.J., Daniel Jr, I.R., West, A., Taylor, S.G., Weber, K.J., Fagan, J.L. and Walker, C.M. 2023. Paleoamerican exploitation of extinct megafauna revealed through immunological blood residue and microwear analysis, North and South Carolina, USA. Scientific Reports 13(1):9464. https://www.nature.com/articles/s41598-023-36617-z

Britton, J.L., Del Grosso, A., Ellis, C. and Hunold, C. 2023. Wild horse roundups and removals: affect, gender, interspecies politics. Humanimalia 14(1):207-248. https://humanimalia.org/article/view/14311/18502

Smith, Z. 2024. Creation of eco-terrorism: a history of actions by the Earth First!, Earth Liberation and Animal Liberation Front from the 1980s-2000s. History Thesis, State University of New York Buffalo State University. *(addresses the 11/30/1997 arson crime at the BLM Burns corral)* https://digitalcommons.buffalostate.edu/cgi/viewcontent.cgi?article=1062&context=history_theses

Fitzgerald, T. 2024. Wild horses and burros in economic perspective. Rangeland Ecology and Management 98:530-538. www.sciencedirect.com/science/article/pii/S1550742424001866

Health and Welfare

[BLM] Schoenecker, K.A., King, S.R., Hennig, J.D., Cole, M.J., Scasta, J.D. and Beck, J.L. 2024. Effects of telemetry collars on two free-roaming feral equid species. PLoS One 19(5):e0303312. https://doi.org/10.1371/journal.pone.0303312

Stothart, M.R., McLoughlin, P.D., Medill, S.A., Greuel, R.J., Wilson, A.J. and Poissant, J. 2024. Methanogenic patterns in the gut microbiome are associated with survival in a population of feral horses. Nature Communications 15(1):6012. https://www.nature.com/articles/s41467-024-49963-x (*Canadian island horses*)

Private Care Placement

Stowe, C.J. and White, H. 2024. Characteristics of potential adopters of wild horses and their willingness-to-pay for wild horses. Journal of Applied Animal Welfare Science 2024:1-13. https://doi.org/10.1080/10888705.2024.2317278

Scasta, J.D., Stewart, W., Hutchinson, E., Koepke, K., Lima, P.D.M.T., Laverell, D.M., Kersh, A. and Stam, B. 2024. From wild to watchful: integrating BLM donkeys (burros) for sheep ranch protection. Sheep and Goat Research Journal 39 (July):12-19.

Dalke, K. and Hunt, M.O. 2017. Mustangs and domestic horses: examining what we think we know about differences. Humanimalia, 8(2):46-62. https://humanimalia.org/article/download/9630/10156 (*about post-adoption*)

Watkins, T., and K. Flavin. 2024. From range to ranch; assessing the Bureau of Land Management's wild horse and burro adoption and incentive program. Report by the Property and Environment Research Center. http://perc.org/adoptions

Genetics

[BLM] Cothran, E.G., Khanshour, A., Funk, S.M., Conant, E., Juras, R. and Davis, B.W. 2024. Genetic dynamics of mustang and feral horse populations in the western United States. *BioRXiv* 2024:1. *(preprint)* doi: https://doi.org/10.1101/2024.01.28.577652

Colpitts, J., McLoughlin, P.D. and Poissant, J. 2024. Inbreeding depression in Sable Island feral horses is mediated by intrinsic and extrinsic variables. Conservation Genetics 25(1):1-15. https://doi.org/10.1007/s10592-023-01549-8

Todd, E.T., Tonasso-Calvière, L., Chauvey, L., Schiavinato, S., Fages, A., Seguin-Orlando, A., Clavel, P., Khan, N., Pérez Pardal, L., Patterson Rosa, L. and Librado, P. 2022. The genomic history and global expansion of domestic donkeys. Science 377(6611):1172-1180. https://www.science.org/doi/full/10.1126/science.abo3503