

Robert Farris-Olsen
MT Bar No. 11937
MORRISON SHERWOOD WILSON
DEOLA, PLLP
401 N. Last Chance Gulch
Helena, MT 59601
(406) 508-1089
rfolsen@mswdlaw.com

Counsel for Plaintiffs
**Pro hac vice* applications pending

Jessica L. Blome*
Cal. Bar No. 314898
Cyrus Moshiri*
Cal. Bar No. 315717
GREENFIRE LAW, PC
2748 Adeline Street, Suite A
Berkeley, CA 94703
(510) 900-9502
jblome@greenfirelaw.com
cmoshiri@greenfirelaw.com

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MONTANA
BILLINGS DIVISION**

THE CLOUD FOUNDATION, a nonprofit
corporation, CENTRAL OREGON WILD
HORSE COALITION, a nonprofit corporation,
LISA FRIDAY, individually and on behalf of THE
CLOUD FOUNDATION, GAYLE HUNT,
individually and on behalf of THE CENTRAL
OREGON WILD HORSE COALITION,

Plaintiffs,

v.

UNITED STATES BUREAU OF LAND
MANAGEMENT, an agency of the United States
Department of the Interior, JERRY DAVIS, in his
official capacity as Acting State Director for the
Bureau of Land Management, Montana/Dakotas
State Office, UNITED STATES FOREST
SERVICE, an agency of the United States
Department of Agriculture, and MATTHEW
JEDRA in his official capacity as Forest
Supervisor for the Custer Gallatin National
Forest,

Defendants.

Case No. 1:26-CV-00100-TJC

**DECLARATION OF PHYLLIS
WRAY ISO PLAINTIFFS'
MOTION FOR TEMPORARY
RESTRAINING ORDER AND
PRELIMINARY INJUNCTION**

1 I, Phyllis Wray, hereby declare and state:

2 1. I have personal knowledge of the facts stated in this declaration and, if
3 called as a witness, could and would testify competently thereto under oath.
4

5 2. I am a citizen of the United States residing in the State of Montana.

6 3. I previously served on the Board of Directors of The Cloud
7 Foundation (TCF) in Colorado Springs, Colorado, and continue to assist TCF with
8 technical review and advocacy concerning management of the Pryor Mountain
9 Wild Horse Range. I also served on the Board of Directors of the Pryor Mountain
10 Wild Mustang Center, a nonprofit organization in Lovell, Wyoming.
11

12 4. Finding ways to advocate for the wild horses on Pryor Mountain and
13 ensuring their long-term survival on the land that I've come to love has become a
14 'mission' of sorts for me. Every month for the past ten years I spend a minimum of
15 four to eight days, backpacking and camping throughout many of the most remote
16 areas of the approximately 40,000-acre Range.
17

18 5. During my visits, I hike throughout the Range with several objectives,
19 including: Photographing and documenting band composition; Photographing and
20 documenting body condition and injuries to monitor healing and prognosis;
21 Photographing and documenting the condition of boundary fencing and reporting
22 my findings to the BLM; Photographing and documenting the condition of natural
23 water sources and guzzlers, including reporting maintenance concerns and non-
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1 functioning guzzlers to the BLM; and Observing and documenting seasonal
2 grazing patterns, forage conditions, and overall Range conditions.

3 6. In the course of those visits I have kept contemporaneous written and
4 photographic records identifying individual horses by name, band, sex, and year of
5 birth, and recording the foals born each season and whether they survived. I have
6 maintained those records continuously since 2017.
7

8 7. The first two years of visiting the Range I was very focused on
9 learning about the horses, as a herd, as bands (family units), and as individuals. I
10 found everything about them to be fascinating. They are remarkably beautiful to
11 observe and photograph. It didn't take long for the admiration of their physical
12 beauty to turn into admiration for their ability to thrive in a very challenging
13 environment and terrain.
14

15 8. The experience of spending time in the presence of the Pryor horses
16 has become an integral part of my life. They have offered me the opportunity to
17 learn about their complex social structure and how that structure has ensured their
18 survival in one of the harshest and most extreme environments. To observe and
19 study these horses is a gift—one that has given me a deep appreciation for the
20 incredible adaptations a species can make to the land it inhabits.
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22 9. As the first designated Wild Horse Refuge in the United States, the
23 Pryor horses hold a significant place in our country's recognition of the value of
24 wild horses in our western landscape. On almost every summer visit to the Range,
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1 I meet visitors from around the world who have traveled there specifically to
2 experience the awe of seeing the Pryor horses race across the mountain meadows.
3 Many of those visitors return again and again. The economic value of these horses
4 to both Montana and Wyoming is indisputable. Perhaps even more important,
5 though impossible to quantify, is the pure joy and wonder people experience when
6 observing this remarkable herd.
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9 10. I was already intrigued by the horses' lives – not just by what I was
10 able to observe, but by how they've been able to adapt and exist for hundreds of
11 years. Then, in 2018, the agency responsible for managing the horses and the land
12 (Bureau of Land Management) released their plan to remove horses from the
13 Range due to overgrazing and to prevent or minimize the deterioration of the land.
14 I was determined to understand the process the BLM used to make their
15 determinations regarding range conditions and the number of horses the Range
16 could sustain.
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19 11. The documents the BLM presented to the public in 2018 to justify the
20 removal of horses included assessments of the condition of the Range. I spent
21 hours researching, reading and re-reading the BLM's assessments, in an attempt to
22 understand how they were able to make the claim that there were too many horses.
23 There were two things that stood out. First, what was being presented in the
24 documents regarding the condition of the land was not what I was observing on the
25 Range.
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12. Second, while I don't have a background in range management, I do have experience in research design, methodology, and analyses. In my career as an educator in higher education institutions, I developed and taught curricula associated with research design and methodology. The focus of the courses I taught was on critical analysis of research design, methodology, and data to assist dentists and dental hygienists to determine the validity of research related to treatment modalities and product efficacy. In reviewing the BLM documents, it became very obvious that the BLM had not conducted their assessments in a way that would result in reliable, valid data. There were many areas of the Range that had not been assessed; those that were assessed did not have consistent data collected over multiple years. Forage production is directly related to precipitation and the BLM used precipitation data from only the low elevation (3,500') areas surrounding the Pryor Mountains. They had no precipitation data for the mid- to high elevation (8,700') areas which is significantly different than the low desert areas. These are a just a few of the things that concerned me.

13. Throughout the years I've been focused on learning as much as I can about the land and how the horses have adapted to one of the most diverse and rugged landscapes. I've learned their migratory patterns, how bands utilize the land vs how bachelor stallions utilize the land, the varied seasonal distribution and use of the land based on the year's precipitation, mountain lion predation, weather patterns.

1 14. As soon as the 2023 Environmental Assessment document was made
2 available, I began scrutinizing the rangeland health assessments. The BLM did an
3 excellent job in making it appear that they had significant data and had done
4 comprehensive analyses. Since they included very little actual data, I was
5 skeptical. The data could only be accessed via the Freedom of Information Act
6 process. Once I received the data, I was then able to analyze each assessment – the
7 data collected, the methodology, and the BLM’s conclusions. I analyzed critical
8 sections of the 2023 Pryor Mountain Wild Horse Range Environmental
9 Assessment, including Appendix B (Rangeland Assessments), Appendix C (AML
10 Recalculation), Appendix N (Simulation of Genetic Change), together with
11 associated data obtained through the Freedom of Information Act process.
12

13 15. Through that review, I identified numerous issues related to data
14 collection, methodology, and data analyses. In my opinion, there are significant
15 inconsistencies, contradictions, and overt misrepresentations in the data and
16 determinations made by the BLM that directly affect both the assessment of Range
17 conditions and the AML recalculation. To better understand and evaluate those
18 issues, I consulted with specialists in the field of range management.
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20 16. In addition to hours and hours of research, I’ve had consultations with
21 range specialists to answer many of my questions.
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23 17. I shared my analyses with the Pryor Mountain Wild Mustang Center
24 and contributed to the development of the Center’s public comments. I also shared
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1 my analyses with TCF and contributed to the development of TCF's protest in
2 response to the United States Forest Service Decision Record.

3 18. I scheduled and participated in multiple meetings with the BLM to
4 seek clarification regarding its methodology, data, and conclusions. During those
5 meetings, I explained my concerns regarding inconsistencies, contradictions, and
6 what I believe were material misrepresentations in the data and resulting analyses,
7 and the impact their proposed management plan will have on the viability and
8 long-term survival of the horses. BLM personnel, including rangeland specialist,
9 sat across from me at a conference table, and acknowledged that certain analyses
10 were based on insufficient data and, in some instances, that supporting data did not
11 exist.
12

13 19. From the Montana BLM State Director to the Billings office field
14 manager and personnel – all have told me they intended to move forward with their
15 plan despite knowing it is based on assessments that are not valid.
16

17 20. Dr. Boone Kauffman, a renowned range specialist/ecologist with
18 extensive research experience domestically and internationally, was hired by The
19 Cloud Foundation to review my analyses of the BLM's rangeland health
20 assessments, assess the BLM's rangeland health assessments, the BLM's
21 Environmental Assessment, and the associated data received via the FOIA process.
22 I am including the assessment report he provided to The Cloud Foundation (a true
23 and correct copy is attached as **Exhibit A**), his biography (a true and correct copy
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1 is attached as **Exhibit B**), and an invoice that documents that he was a paid, expert
2 consultant (a true and correct copy is attached as **Exhibit C**).

3
4 21. Key notations from Dr. Boone Kauffmans's report regarding the
5 analyses that I completed: The reviews by the Cloud Foundation volunteers
6 (Phyllis Wray), represents a significant effort and were well done. They did an
7 excellent job pointing out many discrepancies and omissions in the EA. In general,
8 this analysis of the AIM and the FOIA data was very informative, and legitimate
9 concerns were uncovered. Based upon analysis in the FOIA data compared to the
10 AIM report it appears that the BLM made several conclusions that cannot be
11 supported by their relatively sparse data set. Data in the report (EA) are
12 misrepresented. The BLM has not adequately in a scientifically defensible manner
13 "Reevaluated the AML to determine the number of horses that may be maintained
14 on the PMWHR while ensuring a thriving natural ecological balance, preserving
15 multiple use relationships, and making progress towards Standards for Rangeland
16 Health." An adequate and scientifically defensible residual production assessment
17 is a really important variable that should be collected in the PMWHR. The BLM
18 has done a shoddy and incomplete job only spending 2 days on this analysis, and
19 only sampling 6 (7) sites for only one year. They failed to provide the data as
20 requested in the FOIA. Again, a production assessment would be critical data to
21 truly ascertain carrying capacity. This highlights discrepancies between the EA
22 Appendix B and the data in the FOIA. Also of importance is the lack of replication
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1 in the dataset. This only represents results from one site. It is really impossible to
2 draw conclusions for the entire area with such a paucity of data.

3 22. My knowledge and data related to horse numbers and demographics
4 comes from direct observations and documentation for my consistent, monthly
5 visits to the Range over the past ten years and information obtained from the
6 Mustang Center in Lovell, Wyoming. The Pryor Mountain Wild Mustang Center
7 has been documenting and keeping precise records of the Pryor horses for decades.
8 Up until recently the BLM and the Mustang Center had an MOU and the BLM
9 relied heavily on Center's documentation and records in the management of the
10 horses. The Mustang Center is known to possess the most valid and
11 comprehensive data about the Pryor Mountain horses. I have served on the
12 Mustang Center's Board of Directors and continue to contribute to the
13 documentation of the horses as a volunteer. The Executive Director shares data
14 with me regarding horse numbers, fertility control records, birth and death
15 documentation. The Center is able to maintain detailed, accurate records because
16 there are many dedicated volunteers, like me, who monitor the horses, the Range
17 conditions, water guzzlers, and fencing. We all contribute to the centralized
18 database that is maintained by the Executive Director. The data and information
19 we gather on a consistent basis is more accurate and superior to what a single wild
20 horse specialist could possibly obtain on his own. I am including data obtained
21 from the Mustang Center related to fertility control. A true and correct copy of the
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1 2026 Pryor Mountain Mare Fertility Control Review is attached as **Exhibit D**.

2 Importantly, this **Exhibit D** chart is generated using data from the BLM's dates of
3 mare fertility control treatment (darting record), and the Mustang Center's
4 research. I contribute data to this chart in the form of analysis documented in the
5 "notes" column. This chart demonstrates that the majority of these documented
6 mares are unable to be bred as most have received six-consecutive treatments of
7 fertility control, a protocol which the BLM itself acknowledges results in the
8 likelihood of an inability to foal. Other mares never foaled despite having been off
9 PZP protocol for up to 16-years and are considered subfertile. These mares should
10 not be considered part of the breeding population.
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14 23. Foal survival and the current breeding population: The number of
15 mares that are capable of reproduction is materially different from simply counting
16 identifiable mares in the herd, or all mares within a particular age class.
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18 24. The BLM's proposed fertility-control, Alternative 2, provides, among
19 other things, that mares ages two and three may be treated with ZonaStat-H. Under
20 their program, one-year-old mares may begin primer treatment when they reach 18
21 months; mares age four and older will not be treated until they have successfully
22 foaled once, with "successfully foaling" defined as a foal surviving to one year of
23 age; and mares that have received six-consecutive treatments will be removed from
24 the fertility control schedule unless they subsequently foal.
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1 25. These provisions demonstrate that fertility-control history and
2 reproductive history must be considered when determining how many mares
3 actually comprise the breeding population.
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5 26. In particular, a mare who has successfully foaled once and therefore
6 qualifies to be returned to fertility control, is no longer being treated as part of the
7 actively reproducing population under the BLM's protocol. Likewise, a mare who
8 has received six-consecutive fertility-control treatments should not simply be
9 counted as a fertile breeding mare merely because she remains physically present
10 on the Range.
11

12 27. The scientific literature concerning repeated PZP treatment supports
13 the importance of considering cumulative treatment history. Nunez et al. reported
14 that five or more consecutive applications of PZP resulted in 100% efficacy in the
15 study population and cited corresponding findings from Assateague involving
16 ovulation failure and decreased urinary estrogen concentrations after repeated
17 treatment. A true and correct copy of the article is attached as **Exhibit E**.
18

19 28. Although some mares may eventually regain fertility after fertility-
20 control treatment ends, my review of the Pryor herd's reproductive records shows
21 that mares frequently do not immediately return to fertility. Some mares have
22 remained non-reproductive for years after treatment has ceased. Inclusive are
23 mares who underwent fertility treatment that stopped by the age of three, but never
24 foaled subsequently, not even during their prime breeding age. My records indicate
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1 that up to 50% of mares who received treatment at the age of two and three, do not
2 foal by the age of four or five. Thus, the delays in returning to fertility impact the
3 total number of breeding mares in any given year. Although biological infertility or
4 sterility cannot be definitively established in a wild population without individual
5 veterinary testing, the reproductive histories of these mares demonstrate
6 subfertility. These mares should not simply be counted as equivalent to actively
7 reproducing mares when assessing the herd's reproductive capacity.

10 29. The BLM has not adequately addressed these distinctions in its
11 analysis of the breeding population.

13 30. Two spreadsheets, “2026 Pryor Mountain Mare Fertility Control
14 Review, **Exhibit D**, and “Fertility Control Efficacy for Five Pryor Mares,” (a true
15 and correct copy is attached as **Exhibit F**), summarize my analysis of BLM darting
16 records and information maintained by the Mustang Center.

18 31. Based on those records, in 2026 approximately:

19 a. 31 mares had successfully foaled once and therefore met the BLM's
20 stated criterion for placement on a fertility-control schedule;

22 b. 35 mares had received six consecutive fertility-control treatments;

23 c. approximately 10 mares appeared to be subfertile based on their
24 reproductive histories;

26 d. approximately 76 mares therefore were not presently contributing
27 to the actively reproducing population; and
28

1 e. approximately 20 mares remained in the breeding population.

2 32. These numbers are approximate because the BLM's current-year
3 fertility-control records have not been provided to me in complete form.
4
5 Nevertheless, the available records demonstrate that simply counting all mares, or
6 all mares in a particular age category, materially overstates the number of mares
7 actually contributing to reproduction.
8

9 33. The problem is compounded by low foal survival.

10 34. Foal survival and herd demographics: Of the foals I documented as
11 born on the PMWHR in 2023, approximately 35 percent survived to one year of
12 age. Of those born in 2024, approximately 18 percent survived to one year. Of
13 those born in 2025, approximately 39 percent survived to one year. These survival
14 rates are significant because the BLM's fertility-control protocol uses survival to
15 one year as the threshold for determining whether a mare has successfully
16 reproduced. Because so few foals have survived to one year, this protocol means
17 that relatively few young mares are entering the reproducing population while a
18 substantial number of adult mares are being returned to fertility control.
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22 35. In approximately 79 mares over the age of three, approximately 83
23 percent of that group, have satisfied the condition and are or will be returned to
24 fertility control. Several additional mares have, in my observation, ceased
25 conceiving following repeated treatment. In my assessment, based on the data from
26 2026 Pryor Mountain Mare Fertility Control Review, **Exhibit D**, approximately 20
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1 mares in the herd are presently capable of reproducing. Tierra is one of those
2 approximately 20 mares. Appendix F designates Tierra for preferential removal in
3 the five-to-ten age class. I have observed and photographed Tierra and her band on
4 the Range. In my observation, mares on this Range who are taken off fertility
5 control often do not conceive for several years afterward. The effect of returning a
6 mare to treatment is therefore not confined to the year of treatment—it extends into
7 subsequent breeding seasons.
8

10 36. The BLM has not adequately addressed the implications of these low
11 survival rates for the future breeding population or for genetic diversity.
12

13 37. These survivals are far below the rates on which BLM's population
14 projections depend. The BLM's own materials demonstrate that predation can have
15 an extraordinary effect on foal survival on the PMWHR. USGS Appendix N to the
16 EA notes that predation previously resulted in the loss of 96 percent of foal from a
17 single year on the range. The BLM's own genetics contractor identified this
18 exclusion from its model.
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21 38. The demographic consequences are apparent in the surviving young
22 mares. My records indicate that the current surviving young female population
23 includes approximately three three-year-old mares, one two-year-old mare, and
24 four one-year-old mares.
25

26 39. The small number of surviving young mares is important because
27 those animals represent the future reproductive population. Removing young
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1 animals, particularly young mares, while simultaneously suppressing reproduction
2 among adult mares will reduce the number of animals available to contribute to
3 future generations.
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5 40. The BLM's materials also show a decline in the adult population
6 independent of the proposed gather. Appendix F to the Environmental Assessment
7 is expressly keyed to the spring 2024 PMWHR population of 200 adult horses. The
8 Gather Decision recites a spring 2026 census of 187 adult horses. Thus, in the
9 interval between those two counts, and without any gather, the adult population
10 declined by 13 animals. In my observation, natural attrition on this Range from
11 predation, injury, weather, and age has been a substantial and continuing constraint
12 on herd size. The PMWHR encompasses diverse ecosystems and extreme terrain
13 and weather, and the horses are uniquely adapted to it. Natural selection has
14 operated on this herd continuously. Those factors must be considered when
15 projecting the future breeding population, rather than assuming that every mare
16 remaining on the Range will contribute equally to future reproduction.
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21 41. The BLM's calculation of the fertility-control treatment rate does not
22 show the size of the breeding population:
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24 42. I have reviewed the Declaration of Jace Stott, a BLM wild horse
25 specialist. Mr. Stott states that there are 103 mares and that BLM plans to treat 39
26 of them, which he characterizes as a 38 percent treatment rate. A 38 percent
27 treatment rate does not, by itself, establish how many mares will remain capable of
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1 reproducing. It assumes that the remaining mares are equivalent in reproductive
2 capacity, without accounting for prior fertility-control treatment, successful
3 foaling, delayed return to fertility, subfertility, or other reproductive history.
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5 43. Mr. Stott further states that a 38 percent treatment rate “leaves many
6 more mares on the range capable of reproducing” than the 16 mares identified in
7 another declaration. That statement does not account for the reproductive histories
8 of the mares remaining on the Range. The available BLM and Mustang Center data
9 instead indicate that a substantial majority of the mares in the relevant age
10 categories are not presently contributing to the breeding population. Based on my
11 analysis, approximately 20 mares are presently capable of reproducing. Thus, the
12 question is not simply how many mares will receive a fertility-control application.
13 The relevant question is how many mares will remain capable of reproducing after
14 the fertility-control protocol is applied, and how that number will interact with the
15 removal of horses from the Range.
16

17 44. Fertility-control efficacy and treatment timing: Mr. Stott states that
18 PZP has a 90 percent efficacy rate assuming proper treatment practices. I have
19 reviewed BLM fertility-control records together with detailed reproductive records
20 maintained by the Mustang Center for individual Pryor mares.
21

22 45. My review of five mares demonstrates that the effectiveness of
23 fertility control can be affected by the timing and application of treatment. In
24 several instances, treatment occurred after conception had already occurred, or the
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1 timing of treatment did not correspond with the mare's reproductive cycle. These
2 circumstances can result in births that might otherwise be attributed to a failure of
3 the vaccine when the available records indicate that the treatment itself may not
4 have been administered at the appropriate time.

6 46. The same records demonstrate why a mare should not be designated a
7 “non-responder” without examining the timing and circumstances of each
8 treatment. Appendix F identifies mares as non-responders and prioritizes some of
9 them for removal. The Environmental Assessment identifies Greta, Feldspar, and
10 Helenium as non-responders.

13 47. Based on my review of their treatment and foaling records, however,
14 there are instances in which mares identified as non-responders were treated after
15 they had already conceived or were not treated during the years in which they
16 foaled. A designation of non-responsiveness that does not account for treatment
17 timing therefore does not reliably establish that a mare was biologically
18 unresponsive to fertility control.

21 48. Treatment timing is particularly important because fertility control on
22 the PMWHR historically has been administered during periods selected to reduce
23 the likelihood that mares have already conceived.

25 49. I reviewed birth records maintained by the Mustang Center and
26 analyzed the dates of foaling from 2015 through 2025. Approximately 87 percent
27 of the foals born during that eleven-year period were conceived before October of
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1 the preceding year. Treating mares in October therefore presents a substantial
2 likelihood that many mares will already be pregnant when treated. Such treatment
3 may not prevent the ensuing foal crop, while nevertheless affecting the mare's
4 subsequent reproductive capacity.

6 50. On August 12, 2026, the BLM issued a press release stating that it
7 would treat up to 43 mares with fertility control and release them back to the
8 Range. A true and correct copy is attached as **Exhibit G**. On August 27, 2026, I
9 read an August 26, 2026, Montana Ag Network/Q2 News article titled “BLM plans
10 Pryor Mountain horse removal; herd experts warn of overmanagement,” attached
11 hereto as **Exhibit H**. The article reported that BLM plans to treat up to 43 mares
12 with fertility control and release them back to the Range. Mr. Stott subsequently
13 clarified that the number 43 represented the number of applications rather than 43
14 individual mares and stated that the actual number of mares to be treated during the
15 gather would be 39. The BLM's website subsequently listed 63 horses under
16 “planned returned to Range with fertility treatment,” while separately listing the
17 planned removal of 37 horses.

22 51. These varying numbers have made it difficult to determine precisely
23 how many individual mares BLM intends to treat, how many applications will be
24 administered, and which mares will receive those treatments.

26 52. Fertility control on this Range has historically been administered from
27 late winter through early spring and immediately after foaling. Those windows
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1 were selected so that mares would be treated at the point in the reproductive cycle
2 when they are least likely already to be pregnant. Treating mares in the fall differs
3 materially from the schedules used in the past. Mares treated at this time of year
4 are more likely already to be pregnant when treated.
5

6 53. I am also concerned that BLM has not clearly identified which
7 fertility-control product will be used for each mare. If BLM administers GonaCon
8 rather than PZP, the reproductive consequences may differ substantially from those
9 associated with prior PZP treatment. The effect on this herd's remaining
10 reproductive capacity would be substantially greater and longer lasting with
11 GonaCon treatment than past treatment has been. The identity of the product and
12 the individual mares selected for treatment are therefore material to evaluating the
13 effect of the proposed action on the breeding population.
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17 54. The combined effect of fertility control and horse removals: Treating
18 39 mares is not a marginal adjustment in a herd in which, by my assessment,
19 approximately 20 mares remain capable of reproducing. Combined with the Gather
20 Decision's stated intention to prioritize removal of younger animals, it will in my
21 opinion leave the herd without a sufficient reproductive base to sustain itself.
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24 55. The fertility-control program and the proposed removal of 37 horses
25 cannot properly be evaluated as separate actions because both directly affect the
26 size and composition of the future breeding population. Random removal of horses
27 without considering bloodlines, genetic relationships, or DNA data creates a risk
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1 that particular genetic lines will be disproportionately removed from a relatively
2 small population. That risk is magnified when fertility control is simultaneously
3 reducing the number of mares contributing to reproduction.
4

5 56. The problem is particularly acute because the current population
6 contains very few young mares. Removing animals from the one- to four-year age
7 classes would affect precisely the age group that will determine the future breeding
8 population.
9

10 57. In my opinion, the combination of random removals and aggressive
11 fertility control will reduce the breeding population to a level that makes recovery
12 of genetic diversity increasingly difficult. Genetic diversity is not something that
13 can necessarily be restored after it has been lost. The effects of removing particular
14 bloodlines may not be immediately visible in the surviving horses. By the time
15 measurable genetic consequences appear, the underlying loss of genetic material
16 may already have occurred.
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19 58. For this reason, I believe that genetic relationships and bloodline
20 information should be considered before horses are removed from this relatively
21 small and genetically distinct herd.
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24 59. Under the management framework BLM has adopted, mares age four
25 and older are not treated with fertility control until they have produced a foal that
26 has lived to one year of age, after which they are returned to a treatment schedule.
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1 60. I am particularly concerned about the permanent nature of these
2 impacts. Once horses are removed from the Range, a later decision restoring the
3 gather plan would not necessarily restore the same individuals, family bands,
4 reproductive relationships, or genetic combinations that existed before the removal.
5

6 61. Non-responder designations: Appendix F provides that mares
7 identified as non-responders to fertility control will be prioritized for removal, and
8 the Environmental Assessment names Greta, Feldspar, and Helenium as non-
9 responders. I am familiar with and have reviewed the fertility-control treatment
10 records maintained for this herd, which compare the dates on which individual
11 mares were darted against the dates on which they foaled. Based on that
12 comparison, mares that BLM may designate as non-responders were in several
13 instances treated after they had already conceived or were not treated at all in the
14 years in which they foaled. A designation of non-responsiveness drawn without
15 accounting for treatment timing does not, in my opinion, reliably identify a mare
16 who is unresponsive to the vaccine.
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21 62. The BLM's Herd Management Area Plan, AML Recalculation, and
22 Gather Plan, and implementation of its August 10, 2026, Gather Decision will have
23 detrimental and irreversible impacts on the Pryor herd. The critical herd and band
24 dynamics that have ensured the herd's survival will be disrupted, and its genetic
25 diversity will be threatened. As a result, the experiences that I—and countless other
26 visitors—have come to cherish will be severely diminished. Instead of observing a
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1 naturally functioning herd, my future visits will involve watching nearly half of the
2 horses trapped in pens and removed from the Range, closely bonded family bands
3 separated, young foals taken from their mothers, and the profound disruption of the
4 very social structure that has ensured this herd's survival for more than 200 years.
5

6 63. Beyond the immediate impacts of removals, there will be the
7 inevitable loss of genetic diversity resulting from management of the herd at the
8 low end of the revised AML (107) through random removals. Waiting until
9 observed heterozygosity falls below the established threshold before taking action
10 to preserve genetic diversity all but guarantees the loss of irreplaceable genetics.
11 While those losses may not be immediately visible to me or other visitors, they will
12 become painfully apparent as the herd experiences the physiological manifestations
13 of inbreeding.
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16

17 64. On September 23, 2026, when I checked the BLM's Gather Schedule,
18 I found that the Pryor herd was formally placed on the Schedule. The operations
19 are to begin October 1, 2026, and continue through November 15, 2026.
20

21 65. On September 9, 2026, I called the Billings BLM Field Office to ask
22 about the status of a gather. I spoke with Nate Arave, Field Manager. He informed
23 me that he was unable to tell me the date that a gather would commence. He also
24 stated that he was still in the process of obtaining bids for the gather and that even
25 when the bidding process was complete, he was unsure if any of the bids would
26 fall within the budget. I asked if an emergency gather was an option the BLM was
27
28

1 considering, and he said it was not. Arave stated that the BLM would follow
2 through with a scheduled gather (bait and trap) as indicated in the Gather Plan DR.

3 66. I am concerned that the BLM will move forward with removing
4 approximately 40 horses while Appeals are pending. The Appeals address
5 significant misrepresentations and misinformation included in the HMAP, AML
6 ReCalculation, and Gather Plan. The removal of 40 horses will cause irreparable
7 harm. Once they are removed, they will not be returned. Horses that I have
8 known, photographed, and documented for many years.

9 67. Randomly removing 40 horses from this small herd without using
10 bloodline data or DNA will result in the loss of genetic diversity. The impact of
11 the loss of critical genetics due to random removals will not be immediately
12 evident, however the damage will have occurred. The irreparable damage from the
13 loss of genetics will become visible over time as the herd reaches a genetic
14 collapse. I will be aware of the invisible, but inevitable mutations that will occur
15 from inbreeding. It will be devastating to watch this herd die off from the lack of
16 genetic diversity or become a non-reproducing herd because of aggressive fertility
17 control.

18 68. An additional concern is information that was presented in a recent
19 press release and in the media. Both the press release from the BLM and news
20 articles said that 43 mares would be treated with fertility control during the gather
21 process. It has since been clarified by the wild horse specialist that the number 43

1 represents the total number of applications and not horses. I am concerned about
2 the lack of transparency regarding the change in fertility control protocol, the type
3 of fertility control that will be used, and what mares will be treated. In addition,
4 the BLM has never defined the criteria for determining a mare a 'non-responder';
5 despite the fact that the BLM has stated 'non-responders' may be removed from
6 the Range or treated with GonaCon, a fertility control that may result in sterility.
7

8
9 69. To be sure, the greatest issue of concern related to the fertility control
10 application is the timing. Information from the Science and Conservation Center
11 responsible for the development and distribution of PZP states that optimum
12 application should occur one to two months prior to the known estrus cycle of the
13 species being treated. I completed an analysis of detailed documentation from
14 Pryor Mountain Wild Mustang Center that includes the most accurate dates of
15 births. The analysis shows that from 2015 to 2025, 87% of the foals born during
16 that eleven-year period were conceived the previous year before the month of
17 October. Treating mares this late in the year is a departure from past PZP
18 application, and does not follow the protocol established by the developers of PZP.
19 Treating mares with fertility control in October will result in many mares that are
20 already pregnant being treated. This approach will result in ineffective population
21 control, a large foal crop next year, and it also calls into question the prudent use of
22 taxpayer dollars.
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1 70. The BLM stated that they will use a bait/trap for the upcoming gather.
2 There are no indications that the BLM is preparing for a bait/trap gather as they
3 have in the past. The location that was used for the 2015 for a bait/trap and the
4 planned 2018 bait/trap was near the pond in a high elevation location. Corral
5 panels were set up weeks in advance to allow the horses to become accustomed to
6 their presence and increase the chances for successful baiting and trapping. As of
7 today, September 25, 2026, there are no panels erected at the site historically used.
8 One week before the bait/trap is to commence there are no signs on the Range that
9 the BLM will be following their past protocol.
10

11
12
13 71. My observations and those of others who visit the Range on a daily or
14 weekly basis indicate a significant departure from past bait/trap events. Those of
15 us who closely monitor the horses and the Range have observed activity that
16 indicates that the BLM will not be adhering to the bait/trap process that was stated
17 in the Gather Plan Decision Record. On September 9, 2026, Liz Lumsden,
18 documented unusual helicopter activity on the Range that indicated either a
19 preliminary surveillance of terrain in anticipation of using a helicopter to run
20 horses down the mountain to the low elevation BLM Administrative site or to
21 conduct a census. However, BLM has not provided an updated census which they
22 committed to prior to the Gather.
23
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25

26 72. Additional evidence that the BLM will be departing from past
27 bait/trap protocol and implementing a helicopter roundup is that the Billings BLM
28

1 has always completed the bait/trap without using a contractor. The Billings Field
2 Manager told me he was in the process of obtaining bids, which indicates a
3 departure from past bait/trap protocol.
4

5 73. I, and others, have documented significant structural alterations and
6 additional fencing at the BLM's Administrative site, Britton Springs. These
7 observations, in addition to the lack of preparation at the typical location for a
8 bait/trap, indicate the very strong likelihood that the BLM will use a helicopter to
9 drive the horses down the mountain to low elevation where Britton Springs is
10 located.
11
12

13 74. The use of a helicopter to drive the horses from a high elevation of
14 8,700' to 3,400' over extremely rugged terrain will result in injuries and potential
15 deaths, as has occurred in past helicopter roundups on Pryor Mountain. There are
16 many old horses and very young foals that will be at greatest risk. I have
17 witnessed helicopter roundups and have seen the trauma, the injuries that result in
18 death/euthanasia. The thought of these horses that I've come to know and who
19 know me, being terrorized is beyond distressing.
20
21

22 75. Injury to my interests: The horses I observe, photograph, and
23 document are among those BLM has designated for removal, including Tierra. If
24 the gather proceeds, my future visits will be to a herd from which those individual
25 animals have been permanently taken, in which the family bands I have followed
26 have been broken up, and in which reproduction has been further suppressed.
27
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1 Those losses cannot be undone by a later ruling in this appeal. Because of my
2 decade of observing, studying, photographing, and documenting the Pryor
3 Mountain herd, my contributions to TCF's technical analyses and advocacy, and
4 my continuing intention to return to the Pryor Mountain Wild Horse Range, the
5 August 10, 2026, Gather Decision, and the September 24, 2026 Emergency Gather
6 decision, directly threaten my recreational, aesthetic, educational, scientific, and
7 conservation interests, as well as those of TCF and its members who have devoted
8 years to studying and preserving this unique herd.
9

10
11 76. Several years ago, I was asked to participate in the PBS *Nature*
12 documentary *American Horses* because of my experience and knowledge of the
13 Pryor herd. My final words in that documentary were:
14

15
16 “These are truly a different type of horse, a very valuable horse; their
17 genetics need to be carried forward. Because, if we lose what we have
18 here on this mountain, we won't ever get it back.”
19

20
21 77. Those words remain my opinion today.

22 78. An order preventing this emergency gather would prevent or lessen
23 the personal injuries I have described.
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1 I declare under the penalty of perjury pursuant to 28 USC § 1746 that the
2 foregoing is true and correct. Executed this 30th day of September 2026 in
3 Montana.
4

5 /s/ Phyllis Wray

6 Phyllis Wray
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Exhibit A

A Review of the EA (appendix 2) and documents, notes, and spreadsheets from the AIM analysis and reviews – Pryor Mountain Wildhorse Range (PMWHR)

J Boone Kauffman

Illahee Sciences International

October 2025

Overall Summary of review

The BLM has conducted vegetation analyses over the past few decades, but the effort has been disjointed and incomplete (the Environmental Analysis – Appendix 2, hereafter referred to as the EA). Further, critical data to determine ecological carrying capacity (or AMLs) has not been conducted. Most notably there is a paucity of quantitative data of forage productivity, availability, and utilization. These disjointed and incomplete analyses were used to compose the EA (Appendix 2). The reviews and analyses provided by the Cloud Foundation correctly exposed many of the shortcomings.

Even though limited in extent, the plant species composition of the AIM plots reported in the EA seem to be adequate and there are legitimate concerns about the composition and current ecological state of the Range. There are many important resource values of the PMWHR that deserve attention including the need for optimal wild horse management, optimal habitat conditions for wild horses, and sustaining populations of other habitats for wildlife and rare and endangered species. However, data ascertaining the ecological carrying capacity or sustainable stocking rate of the PMWHR is lacking. There are little data on which habitats are most preferred by horses as well as the current forage productivity of the PMWHR. Most notable are data lacking on the quantity of forage available for horses and this is particularly true for the winter months when an ecological “bottleneck” can occur.

The reviews by the Cloud Foundation volunteers represents a significant effort and were well done. They did an excellent job pointing out many discrepancies and omissions in the EA.

Other documents reviewed

USDI BLM 2023. Pryor Mountain Rangeland Health Assessment. 67p
https://eplanning.blm.gov/public_projects/1502632/200347237/20123284/251023264/Appendix%20B_Rangleand%20Health%20Assessment.pdf

Singer, F.J. & K.A. Schoenecker, compilers. 2000. Managers’ summary – Ecological studies of the Pryor Mountain Wild Horse Range, 1992-1997. U.S. Geological Survey, Midcontinent Ecological Science Center, Fort Collins, CO. 131 pp

Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems 2nd Edition Volume I: Core Methods AIM and methods manuals.

Document: ANALYSIS OF RANGELAND HEALTH ASSESSMENT METHODOLOGIES and AML RE-EVALUATIONS

The BLM states they have data on 61 AIM points across the PMWHR. However, these data were collected over a 11-year period which makes combining them problematic without some reference to annual climate and animal use during this and period.

This table is quite informative as most years there were only a few AIM plots collected.

The frequency and distribution of AIM data collection is shown below:

YEAR	# OF AIM SITES KEY SITE-NPS	# OF AIM SITES KEY SITE-BRITTON SP.	# OF AIM SITES KEY SITE-PENN'S	# OF AIM SITES KEY SITE-BTR	# OF AIM SITES KEY SITE-SYKES	TOTAL # OF AIM SITES FOR YEAR/S
2015	0	2	0	0	0	2
2016	0	0	0	0	1	1
2017	0	0	2	0	1	3
2018	0	3	0	0	1	4
2019	0	0	0	0	0	0
2020	0	4	4	3	5	16
2021*	3	3	2	1	5	14
TOTAL AIM						
USED FOR AML	3	12	8	4	13	40
2022	6	2	6	4	3	21
TOTAL AIM						
2015-2022	9	14	14	8	16	61

They are correct in questioning forage production at the Penns site as it appears that production is greater than 250 lbs/ac. Further this is limited in that there were only 6 plots collected at this site. The range and total mean forage production would be helpful.

Further, as no forage production data were collected in 2015-2021 we really do not know what current production and therefore forage availability is. I am not aware of a correlation developed between composition of key forage species and forage production (lbs/ac).

The summary is quite comprehensive and alarming.

Conclusions –

In general, this analysis of the AIM and the FOIA data was very informative, and legitimate concerns were uncovered.

Based upon analysis in the FOIA data compared to the AIM report it appears that the BLM made several conclusions that cannot be supported by their relatively sparse data set. Data in the report (EA) are misrepresented.

The sample size of each key site for the 2021-2022 sampling is pretty limited (N= 5-9 data points/key site).

The BLM Wild Horse and Burro Handbook, Appendix 3, p. 68: state that a minimum of three to five years of monitoring data is preferred. This is true but it is also true that BLM natural resource specialists' programs are woefully underfunded thus preventing adequate monitoring of the public lands they are charged with managing.

For a better quantification of vegetation change it is good to revisit permanent plots (or vegetation stands) over a number of years. The handbook also suggests there is a value in repeated measures on the same plots' areas over multiple years.

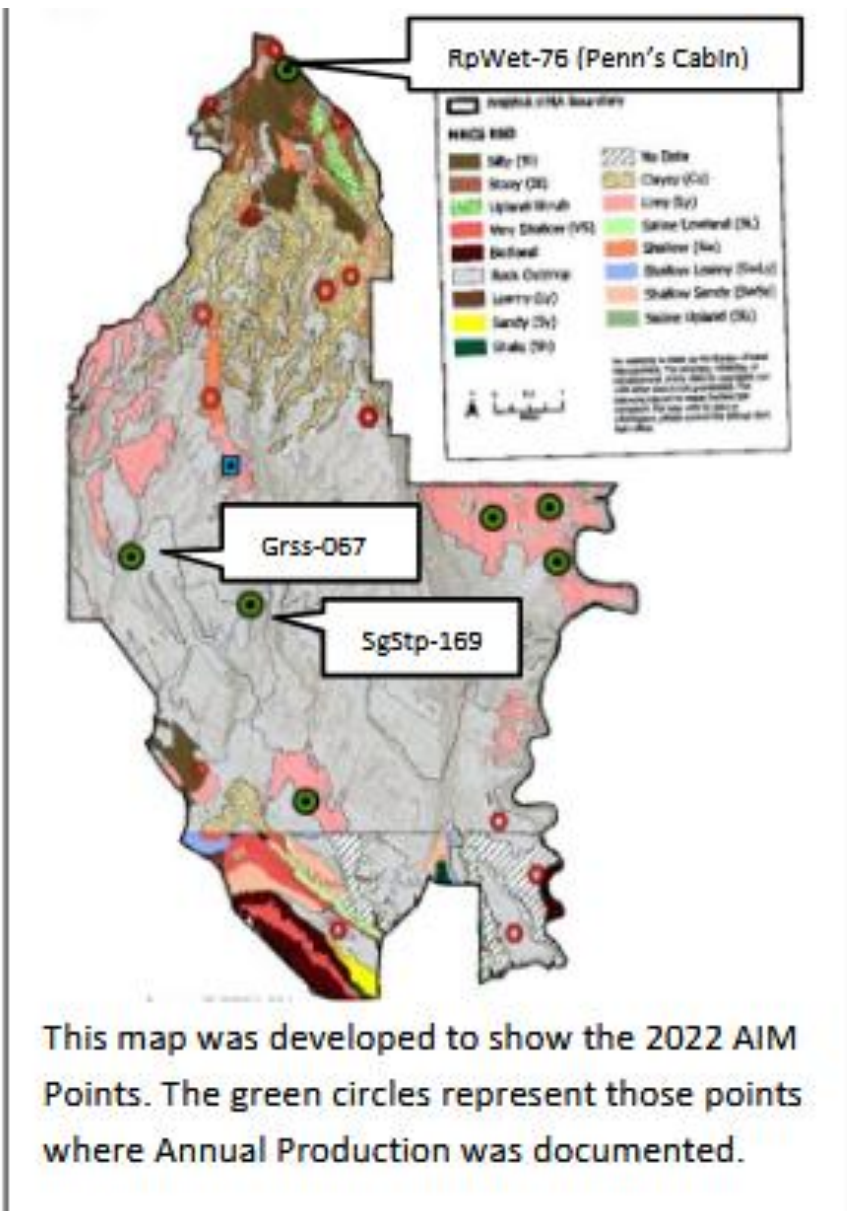
It is important to sample during a drought year as this might be the years where carrying capacity is best expressed. In wet years, the range can support a density of animals that may suffer from starvation and disease during above average precipitation years. In short, it would be more alarming if the 2 data collection years was above average precipitation years.

Document: The AIM database (FOIA)

The AIM database could be really valuable in comparing this work with any additional field sampling that we do. This includes all of the species composition and species richness data of the sampled AIM plots. The database (in Excel) covers only years 2016-2022.

Document: Analysis of EA & FOIA data (as received by PMWMC May/August 2023)

This highlights discrepancies between the EA Appendix B and the data in the FOIA. Also of importance is the lack of replication in the dataset. This only represents results from one site. It is really impossible to draw conclusions for the entire area with such a paucity of data.



The results are really concerning as these are really low values of residual vegetation.

The BLM stated that: "The BLM collected utilization data on November 16-17, 2021, at six key areas commonly used as winter range and calculated pounds per acre using following the Harvest Method". The sites sampled in the EA were: National Park Service (3,183 acres), Turkey Flats (1,443 acres), Burnt Timber, including areas known as Cheyenne Flats and Forest Service (2,725 acres), and Sykes Ridge (424 acres). But the FOIA listed 7 sites. A single estimate for areas this large is not a sufficient basis from which to based AMLs. Further collections do not entail a utilization study but one of residual plant mass in the Autumn. This is an important distinction. Pens Cabin was not included in the EA. Is Pens Cabin used by horses in the winter?

In order to obtain the winter carrying capacity of the PMWHR it would be more desirable to collect standing crop biomass (forage availability) in the late fall and early winter as was done by the BLM. But six sites are nowhere near an adequate sample size to ascertain this carrying capacity in the large land areas listed above. I would estimate that this sample size is an order of magnitude too small to obtain an adequate measure of winter forage availability (a sample of 50-70 sites). The sheet of paper of residual forage production makes no sense compared to the table in the EA.

2. Interpreting indicators of rangeland health (IIRH) - rangeland health assessment methodology

The reviewers did an admirable job pointing out discrepancies and shortcomings of the IIRH (table). I would caution criticism of the indicators of range health which can vary by climate and precipitation influences. These are the conditions that really determine carrying capacity of the wild horse range. What I would examine is what data were used to make these determinations. I think that it is not possible to ascertain winter conditions from 1 or 2 sampling days of 6 (7) sites.

Again, it is important to determine these factors during drought years as these are the years that ultimately determine the carrying capacity.

Also, what must be recognized is that litter production (Indicator 14) is certainly affected by the quantity of forage removed by grazing animals as well as climatic conditions.

Annual production (Indicator 15) was not really quantified by the BLM.

Reproduction (Indicator 17) can also be affected by the level of grazing as well as climatic factors.

All of the criteria could be best quantified by grazed/ungrazed comparisons (exclosures or utilization cages). Sampling should take place in plots that vary in their distance to water. It is interesting to note that BLM never adds distance to water in their site selected on data results.

In their analysis of Indicators of Range Health, It is alarming that the BLM omitted forage production of Penns; cabin as it is contradictory to their analysis of this site. They provide no explanation of this omission.

What is also of interest is who actually conducted the IIRH as I don't think the AIM field crews did this analysis. Did the BLM specialist who conducted this analysis actually visit the site? Why didn't they compare vegetation data with other studies who have conducted detailed vegetation analyses in the past (for example see Singer and Schoenecker 2020).

An adequate and scientifically defensible residual production assessment is a really important variable that should be collected in the PMWHR. The BLM has done a shoddy and incomplete job only spending 2 days on this analysis, and only sampling 6 (7) sites for only one year. They failed to provide the data as requested in the FOIA. Again, a production assessment would be critical data to truly ascertain carrying capacity.

Document: **ANALYSIS of rangeland health assessment methodologies and AML recalculations**

Much of this a repeat of the previous document.

The fact that the IIRH was collected in a drought year is, in itself, not a fatal flaw in the analysis. These sorts of collections should be done during drought years as these are the times when forage might be more limiting for horses, when overuse would most likely occur, and when animal suffering due to a lack of forage availability is most likely. However, this analysis could be conducted in other years to examine the degree of resilience of the plant communities and to what extent some of the key indicators are affected by animals' vs annual weather.

Document : AML-RMP Sequence

This document is a good review of how BLM has not met court decisions.

Notably is: *"MD WH-4: AMLs will be adjusted as needed to ensure a thriving natural ecological balance through monitoring and data collection including but not limited to: forage utilization, trend, ecological condition, precipitation data, rangeland health assessments, population inventory, climate or habitat changes, and range availability."* Many of these requirements are not in the EA. Most notably a quantitative assessment of forage utilization.

The overall interpretations by the Cloud Foundation of these court decisions seem pretty spot-on to me. The BLM has not adequately in a scientifically defensible manner "Re-evaluated the AML to determine the number of horses that may be maintained on the PMWHR while ensuring a thriving natural ecological balance, preserving multiple use relationships, and making progress towards Standards for Rangeland Health."

Document: ANALYSIS OF RANGELAND HEALTH ASSESSMENT METHODOLOGIES and AML RECALCULATIONS

Residual production is an important health assessment and variable that is truly needed to determine sustainable AMLs on the PMWHR. My biggest concern is incomplete and poor effort put in by the BLM. Data were only collected data over a period of 2 days (for one year)

and in only 6 (7) different sites. It would not be adequate to make informed decisions as important as an “emergency removal.”

It is important not to confuse peak standing crop from residual forage (winter conditions. Both are critical for determining sustainable ecological carrying capacity and have not been adequately measured on the Range.

It is important to note that determining annual production of each plant species and species composition by weight determined as stipulated by the Technical Reference is really difficult and time consuming.

Document Range Indicators – spreadsheet providing no interpretable information

Documents: Spreadsheets of data used in the AIM – Information in this spreadsheet are largely repeated in the EA.

Exhibit B

**J Boone Kauffman
Illahee Sciences International
Biography 2025**

I am the lead scientist/co-owner of Illahee Sciences International LLC, which is a small research consulting business focusing on the interactions of land use, biological diversity, and climate change. We provide research and consulting services for many non-government organizations, foundations, and government agencies, including The Nature Conservancy, Center for International Forestry Research, the US State Department, United Nations, the Intergovernmental Panel on Climate Change (IPCC), and USAID.

I am also a full Professor (retired) in the Department of Fisheries, Wildlife, and Conservation Sciences at Oregon State University. I have been affiliated with Oregon State University from 1986–2003 and 2011–2025. From 2003–2010, I was a research ecologist/biologist with the USDA Forest Service Pacific Southwest and Northern Research Stations.

I have a B.S. in Range Management from Texas Tech University (1978), a M.S. in Rangeland Resources from Oregon State University (1982), and a Ph.D. in Forest Ecology from the University of California, Berkeley (1986).

My research, technology transfer, consulting and teaching efforts center on understanding dynamic interactions of land use, climate change and their influences on ecosystem services. This includes leading projects in riparian, wetland, tropical forest, mangrove, and rangeland settings associated with vegetation ecology, biodiversity, biogeochemistry, restoration, climate change, fire ecology, and sustainable management. I have conducted research in over 20 countries of the world and in 12 Western US states. At Oregon State University I advised a total of 32 graduate students and 6 post-doctoral researchers at Oregon State University. This includes 23 MS students and 9 Ph.D. Students.

I have published over 270 scientific publications and book chapters, most of which relate to the impacts of land use on ecosystem structure and function as well as the restoration of native ecosystems. Regarding the ecology and land use of temperate western US ecosystems here are some publications that are pertinent:

Kauffman J.B., Cummings D.L., Beschta R.L., and W.J. Ripple. 2025. Where the buffalo roam: Ungulate influences on quaking aspen and willow communities in the Greater Yellowstone ecosystem. *Ecosphere*. 16:e70410 (DOI: 10.1002/ecs2.70410).

Kauffman, J.B., Souza, F.M., Costa, R.F., da Silva A.E.B., Ferriera T.O., Magonigal, J.P., Ritonga R., Gangga, A., Novita, N., Pacheco C.F.O., Bernardino A.F. 2024. Conversion of tropical forests to water buffalo pastures in lower Amazonia: Carbon losses and social carbon costs *Ecosphere* 15(12): e70055. <https://doi.org/10.1002/ecs2.70055>

Kauffman JB, Beschta RL, Lacy PM, Liverman M (2023) Forum: Climate, ecological, and social costs of livestock grazing on western public lands. *Environmental Management* 72:699–704
<https://doi.org/10.1007/s00267-023-01853-6>.

Ripple, W.J., Wolf, C., Phillips, M.K., Beschta, R.L., Vucetich, J., Kauffman, J.B., Law, B.E., Wirsing, A.J., Lambert, J.E., Leslie, E., Vynne, C., Dinerstein, E., Noss, R., Wuerthner, G., DellaSala, D.A., Bruskotter, J.T., Nelson, M.P., Crist, E., Darimont, C. Ashe D.M. 2022. Rewilding the American West. Bioscience.

Kauffman JB, Coleman G, Otting N, Lytjen D, Nagy D, Beschta RL (2022) Riparian vegetation composition and diversity shows resilience following cessation of livestock grazing in northeastern Oregon, USA. *PLoS ONE* 17(1): e0250136. <https://doi.org/10.1371/journal.pone.025013>

Kauffman JB, Beschta RL, Lacy PM, Liverman M. 2022. Livestock on public lands of the western USA accentuate effects of climate change: Implications for mitigation and adaptation. *Environmental Management*, <https://doi.org/10.1007/s00267-022-01633-8>.

Ellsworth, L. M., J. B. Kauffman, S. A. Reis, D. Sapsis, and K. Moseley. 2020. Repeated fire altered succession and increased fire behavior in basin big sagebrush–native perennial grasslands. *Ecosphere* 11(5): e03124. [10.1002/ecs2.3124](https://doi.org/10.1002/ecs2.3124)

Reis, S., L.M. Ellsworth, J.B. Kauffman, and D. Wroblewski. 2018. Reduced fuel loads 17 years after fire lead to lower potential fire behavior in Wyoming big sagebrush ecosystems. *Ecosphere*. DOI [10.1007/s10021-018-0268-7](https://doi.org/10.1007/s10021-018-0268-7).

Reis, SA, LM Ellsworth, JB Kauffman, and D Wroblewski. 2019. Long-term effects of fire on vegetation structure and predicted fire behavior in Wyoming Big Sagebrush ecosystems. *Ecosystems*. 22(2): 257–265.

Kauffman, J.B., M. Mahrt, L.A Mahrt, and W.D. Edge. 2001. Wildlife of riparian habitats. pp 361-388 In: Johnson, D.A. and T.A. O'Neill

(eds.): Wildlife-Habitat relationships in Oregon and Washington: Oregon State University Press, Corvallis, OR.

Kauffman, J.B. and D.A. Pyke. 2001. Range ecology, global livestock influences. pp 33-52 In: Levin, S. A. (ed.). Encyclopedia of Biological Diversity, Volume 5. Academic Press. San Diego, CA.

Kauffman, J.B., P. Bayley, H. Li, P. McDowell, and R.L. Beschta. 2002. Research/Evaluate Restoration of NE Oregon Streams: Effects of livestock exclosures (corridor fencing) on riparian vegetation, stream geomorphic features, and fish populations. Final report to the US Bonneville Power Administration, Portland, OR 97p.

Kauffman J.B., A.S. Thorpe, and E.N.J. Brookshire. 2004. Livestock exclusion and belowground ecosystem responses in riparian meadows of Eastern Oregon. *Ecological Applications* 16:1671-167.

Kauffman, J.B., N. Otting, D. Lytjen, and R.L. Beschta. 1996. Ecological principles and approaches to riparian restoration in the Western United States. In: Healing the Rivers. Pacific Rivers Council Eugene, OR.

Beschta, R.L., J.B. Kauffman, D.S. Dobkin, and L.M. Ellsworth. 2014. Long-term livestock grazing alters aspen age structure in the northwestern Great Basin. *Forest Ecology and Management*. 329:30-36.

Wroblesky, D.W. and J.B. Kauffman 2003. Initial effects of prescribed fire on morphology, abundance, and phenology of forbs in big sagebrush communities in southeastern Oregon. *Restoration Ecology*. 11:82-9

Ellsworth, L.M. and J.B. Kauffman. 2017. Plant community response to prescribed fire varies by pre-fire condition and season of burn in mountain big sagebrush ecosystems. *Journal of Arid Environments*. <https://doi.org/10.1016/j.jaridenv.2017.04.012>

Ellsworth, L.M., D. Wrobleski, J.B. Kauffman, and S.A. Reis. 2016. Ecosystem resilience is evident 17 years after fire in Wyoming big sagebrush ecosystems. *Ecosphere* 7(12): e01618. [10.1002/ecs2.1618](https://doi.org/10.1002/ecs2.1618).

Ellsworth, L.M. and J.B. Kauffman. 2013. Seedbank responses to spring and fall prescribed fire in mountain big sagebrush ecosystems of differing ecological condition at Lava Beds National Monument, California. *Journal of Arid Environments*. 96:1-8.

Exhibit C

INVOICE 1 (2025) to the Cloud Foundation
ILLAHEE SCEINCES INTERNATIONAL LLC
J Boone Kauffman PhD
1440 NW LINCOLN AVE
CORVALLIS, OREGON USA 97330

Project: Review of the written analyses from Phyllis Wray, The Pryor Mountain EA, related literature, and the FOIA documents that the Pryor Wild Mustang Center received.

Billing includes 5 hours of review at \$112.00/hour (Non-profit/Environmental rate)

Invoice number: 07 - 2025.

Total: This Invoice: \$560.00

J Boone Kauffman
Lead Scientist
7 November 2025

Bank Account Details:

Oregon State Credit Union

PO Box 306 Corvallis, OR 97339

Phone: 800-732-0173 | Routing number #323274270 | NMLS #472475

Account Name: Illahee Sciences checking.

Account number 3797980099

Exhibit D

2026 Pryor Mountain Mare Fertility Control Review

Scope and limitations: This chart was generated using data from BLM and Pryor Mountain Wild Mustang Center fertility control records and applies the fertility control criteria in Alternative 2 to the mares living on the range in 2026. Treatment histories are confirmed through 2025; foaling records include 2026. "2026 (if treated)" means that the mare would reach six consecutive annual treatments if she received treatment during the early-2026 treatment period; BLM's actual 2026 treatment records have not yet been obtained. Six consecutive treatments represent a management threshold under Alternative 2, and implies that the BLM considers six consecutive treatments to diminish fertility to point where treatment is no longer necessary. Nunez, et. al. state, "If population numbers are managers' primary concern, our data show that giving five or more consecutive applications of PZP will result in 100% efficacy. This is consistent with data from Assateague where mares receiving 5-7 consecutive PZP applications exhibited ovulation failure and decreased urinary estrogen concentrations". Article provided for reference.

Horse	Age in 2026	Number of offspring surviving to age 1.	Consecutive annual treatment years through 2025	Year sixth consecutive annual treatment was reached.	Most recent foal born after sixth consecutive treatment was reached	Treatments after most recent post-threshold foal through 2025	Eligibility for treatment during Oct.–Nov. 2026 gather	Notes
Aztec	26	2	11	2014	No		No	has met 6 consecutive tx threshold per Alt. 2, fertility unlikely
Feldspar	21	7	11	2020	2024	1 after foaling; 2 after conception	Depends on 2026 treatment record and interpretation of treatment sequence	Feldspar received two treatments after Yellowtail's conception, but only one was administered after Yellowtail's birth. Alternative 2 does not specify whether a treatment administered during pregnancy counts toward the required three additional treatments following a subsequent foal.
Icara	18	6	11	2020	2026	N/A—foaled in 2026	Yes	
Brumby	25	1	10	2017	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Adona	26	0	9	2016	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Amethyst	26	1	9	2014	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Bakken	25	2	9	2017	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Gaelic Princess	20	0	9	2020	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Pegasus	11	5	9	2022	2026	N/A—foaled in 2026	Yes	
Sequoyah	27	0	8	2015	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Baileys	25	0	8	2017	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Beulah	25	0	8	2017	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Heritage	19	0	8	2022	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Bacardi	25	1	7	2017	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Celt	24	1	7	2018	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Fiasco	21	2	7	2020	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Greta	20	7	7	2021	2024	1 after foaling; 2 after conception	Depends on 2026 treatment record and interpretation of treatment sequence	Greta received two treatments after Yvonne's conception, but only one was administered after Yvonne's birth. Alternative 2 does not specify whether a treatment administered during pregnancy counts toward the required three additional treatments following a subsequent foal.
Juniper	17	1	7	2024	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Dove	23	1	6	2019	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Demure	23	2	6	2019	2021	3	No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Gabrielle	20	2	6	2021	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Graciana	20	1	6	2025	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Kitalpha	16	3	6	2025	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
La Brava	15	4	6	2025	2025	0	Yes	
Limerick	15	0	6	2025	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
La Nina	13	4	6	2025	2026	N/A—foaled in 2026	Yes	
Nimbus	13	2	6	2025	2025	0	Depends on interpretation of treatment sequence	Zuela was conceived on approximately 7/24/2024, before Nimbus's sixth consecutive treatment on 12/31/2024, but was born afterward. Alternative 2 does not specify whether a foal conceived before the sixth treatment triggers the requirement for three additional treatments.
Nova	13	3	6	2025	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Outlaw Lady	12	1	6	2024	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Quillan	10	1	6	2023	No		No	has met 6 consecutive tx threshold per Alt 2, fertility unlikely
Firestorm	21	2	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Fool's Gold	21	1	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Galadriel	20	1	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Hataalii	19	3	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Helenium	19	4	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Hera	19	2	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Hailstorm	19	1	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Norma Jean	13	1	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Quintana	10	1	5	2026 (if treated)	No		Depends on confirmation of 2026 treatment	If not tx in Sp. of 2026, would be eligible for tx Fall of 2026, fertility unlikely
Rosarita	30	2	4				Uncertain—age 30	30 year old mare - fertility unlikely
Halcyon	19	3	4				Yes	
Halo of the Sun	19	0	3				No	19 year old - has never foaled - fertility in question
Jasmine	17	2	3				Yes	
Ketchikan	16	1	3				Yes	
Maia	14	2	3				Yes	
Morgana	14	6	3				Yes	
Noble	13	2	3				Yes	
Petra	11	2	3				Yes	
Pilar	11	3	3				Yes	
Quahneah	10	3	3				Yes	
Ventura	5	1	3				Yes	
Valentina	5	0	3				No	5 year old - has never foaled
Venus	5	0	3				No	5 year old - has never foaled

Vesper	5	0	3			No	5 year old - has never foaled
Victoria	5	0	3			No	Foal - 2026
Vintage	5	0	3			No	Foal - 2026
Virginia City Sue	5	0	3			No	Has foaled, did not survive to the age of 1
Vivianna	5	0	3			No	Has foaled, did not survive to the age of 1
Half Moon	19	1	2			Yes	
Jacinta	17	5	2			Yes	
Jewel	17	3	2			Yes	
Moenkopi	14	1	2			Yes	
Naara	13	0	2			No	13 year old - has never foaled - fertility in question
Niobrara	13	1	2			Yes	
Violet	5	0	2			No	has foaled, did not survive to the age of 1
Wildfire	4	0	2			No	4 year old - has never foaled
Wildrose	4	0	2			No	has foaled, did not survive to the age of 1
Willa	4	0	2			No	Foal - 2026
Wind River	4	0	2			No	4 year old - has never foaled
Petite Colour	11	2	1			Yes	
Prima	11	0	1			No	11 year old - has never foaled - fertility in question
Phantom	11	1	1			Yes	
Kohl	16	1	0			Yes	
Manualita	14	0	0			No	14 year old - has never foaled - fertility in question
Nirvana	13	0	0			No	13 year old - has never foaled - fertility in question
Niyaha	13	1	0			Yes	
Orielle	12	0	0			No	12 year old - has never foaled - fertility in question
Prospera	11	4	0			Yes	
Quintasket	10	2	0			Yes	
Ruby	9	0	0			No	9 year old - has never foaled - ID's by BLM for removal (hernia)
Reverie	9	1	0			Yes	
Sophia	8	0	0			No	Foal - 2026
Silver Bow	8	1	0			Yes	
Taiga	7	0	0			No	7 year old - has never foaled
Talulah	7	0	0			No	Foal - 2026
Tierra	7	0	0			No	7 year old - has never foaled
Titania	7	1	0			Yes	
Ukulele Lil	6	0	0			No	Foal - 2026
Ula	6	0	0			No	Foal - 2026
Uma	6	2	0			Yes	
Unity	6	0	0			No	Has foaled, none survived to the age of 1
Ursula	6	0	0			No	6 year old - has never foaled
Umatilla	6	1	0			Yes	
Uushawate	6	1	0			Yes	
Vaquera	5	0	0			No	5 year old - has never foaled
Willow	4	0				No	4 year old - only foal did not survive to the age of 1
Xacara	3					Yes	
Ximena	3					Yes	
Xyris Montana	3					Yes	
Yara	2					Yes	
Zani	1					Yes	
Zen	1					Yes	
Zena	1					Yes	
Zsa Zsa	1					Yes	

Exhibit E

Immunocontraception in Wild Horses (*Equus caballus*) Extends Reproductive Cycling Beyond the Normal Breeding Season

Cassandra M. V. Nuñez*, James S. Adelman, Daniel I. Rubenstein

Department of Ecology and Evolutionary Biology, Princeton University, Princeton, New Jersey, United States of America

Abstract

Background: Although the physiological effects of immunocontraceptive treatment with porcine zona pellucida (PZP) have been well studied, little is known about PZP's effects on the scheduling of reproductive cycling. Recent behavioral research has suggested that recipients of PZP extend the receptive breeding period into what is normally the non-breeding season.

Methodology/Principal Findings: To determine if this is the case, we compiled foaling data from wild horses (*Equus caballus*) living on Shackleford Banks, North Carolina for 4 years pre- and 8 years post-contraception management with PZP (pre-contraception, n=65 births from 45 mares; post-contraception, n=97 births from 46 mares). Gestation lasts approximately 11–12 months in wild horses, placing conception at approximately 11.5 months prior to birth. Since the contraception program began in January 2000, foaling has occurred over a significantly broader range than it had before the contraception program. Foaling in PZP recipients (n=45 births from 27 mares) has consistently occurred over a broader range than has foaling in non-recipients (n=52 births from 19 mares). In addition, current recipients of PZP foaled later in the year than did prior recipient and non-recipient mares. Females receiving more consecutive PZP applications gave birth later in the season than did females receiving fewer applications. Finally, the efficacy of PZP declined with increasing consecutive applications before reaching 100% after five consecutive applications.

Conclusions/Significance: For a gregarious species such as the horse, the extension of reproductive cycling into the fall months has important social consequences, including decreased group stability and the extension of male reproductive behavior. In addition, reproductive cycling into the fall months could have long-term effects on foal survivorship. Managers should consider these factors before enacting immunocontraceptive programs in new populations. We suggest minor alterations to management strategies to help alleviate such unintended effects in new populations.

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* E-mail: cmvnunez@princeton.edu

Introduction

The extirpation of predator species has resulted in the expansion of free-ranging ungulate populations in North America [1], necessitating their regulation. Immunocontraceptive management has become increasingly popular as culling programs are seldom well-received by the general public. In females, the most common form of immunocontraception, porcine zona pellucida (PZP), stimulates the production of antibodies that bind sperm receptors on the egg's surface, thereby preventing sperm attachment and fertilization [2].

In recent decades, the wild horse (*Equus caballus*) has become a model for evaluating the effects of PZP, thanks chiefly to the seminal nine-year study of contracepted mares on Assateague Island National Seashore [3]. Subsequent research on this population has shown that PZP has little to no effect on recipient physiology or behavior [4,5,6]. For example, in Assateague horses, PZP has no effect on the duration of individual estrous cycles [6],

and researchers have reported only minor ovulation failure and depressed urinary oestrogen concentrations with repeated applications [4]. However, behavioral research on the horses of Shackleford Banks, North Carolina, and other wild ungulate species suggests that PZP affects the reproductive physiology of recipient animals [7,8,9]. In each of these studies, females treated with PZP extended reproductive behaviors into the non-breeding season. While these results are consistent with an extension of ovulatory cycling into the post-breeding season when most females are normally anovulatory [10,11], this possibility has not yet been tested.

Mares are seasonally polyestrous and extended estrous periods have been documented [11]. Tropical species, for example, are less strictly seasonal, and in some cases, reproduce throughout the year [12,13]. In addition, variability in the cycling schedules and receptivity of individual mares [14], and the performance of estrous behavior and copulatory activities during the non-breeding season [15] have been documented in temperate species. Such

variation in ovulatory scheduling and receptivity suggest that the seasonality of reproductive behavior in *Equus caballus* females is characterized by a substantial degree of plasticity. As the physiological state of contracepted animals has been significantly altered, the possibility of prolonged extended cycling is even more feasible.

In wild horse societies, the harem is the core social group, consisting of usually one, but sometimes two or three harem male(s), one to several female(s), and their offspring [16,17,18,19,20,21]. Harem males will sometimes fight to acquire mares from other groups, but stallions almost always retain their mares [18,19,20,22]. In temperate environments, food availability is lower during the fall and winter months and free-ranging horses will alter their activity to maximize food intake and reduce energetic costs [23,24]. Mares are typically anovulatory at this time and sexual behavior in males is largely absent [11,14].

On Shackleford Banks, increased reproductive behavior in the post-breeding season by mares has resulted in increased male attentiveness [9]. Such behavior (by males) has been shown to restrict the movement of females, thus reducing their grazing efficiency [21,25]. The occurrence of this behavior during a time of year when animals typically increase group spread to acquire adequate forage [19,24], represents a change in behavior fundamental to the animals' survival [26,27]. Offspring conceived during the post-breeding season are likely subject to decreased resource availability as lower quality forage can affect mares' ability to produce sufficient milk [27]. Finally, regardless of the timing of titer decline post-treatment [9,28,58], when anti-PZP antibody titers decrease during the fall months [28,29], extended reproductive cycling among recipient mares will increase their chances of conception, thereby lowering the vaccine's overall efficacy. Determining whether PZP recipients are likely to extend reproductive cycling is therefore of great importance if managers are to limit animal numbers while still maintaining functional, healthy populations.

Here we use the birth dates of foals to estimate dates of conception for PZP recipient and non-recipient mares on Shackleford Banks, North Carolina. Gestation length in wild horses is 11–12 months [30]. Therefore, dates of conception can be reliably estimated as approximately 11.5 months prior to birth. Breeding normally occurs from March through August, with most births occurring in April and May [11]. Given the extension of reproductive behavior in PZP-treated mares [9], we hypothesize that PZP recipients will extend cycling into the non-breeding season more often than will non-recipients. Therefore, when PZP recipients conceive and give birth, they will do so later on average and over a wider range of months than will non-recipients.

Methods

Study area

This study was conducted on Shackleford Banks, a barrier island located approximately 3 km off the coast of North Carolina, USA. The island was 15 km in length, and varied between 0.5 and 3 km in width. The horse population on Shackleford Banks has been co-managed by the National Park Service and the Foundation for Shackleford Horses since 1996.

Study subjects

The reproductive units of Shackleford horses are typical of feral equids. They are coherent harem groups of one, or sometimes two or three stallion(s), one to several mare(s) and their offspring [18]. Predominantly, the harem groups are not territorial and animals

move within overlapping home ranges, although this has not always been the case [18].

Management

PZP Contraception. In January 2000, the National Park Service began the application of PZP for the purposes of immunocontraception. The National Park Service administers PZP in the spring (late February through April) each year. Mares receive their initial treatment at 1.5–2 years of age. Each injection includes 100 micrograms of PZP with an adjuvant (combined at the darting site). Initial doses include Freund's Complete Adjuvant, Modified, Mycobacterium butyricum (Calbiochem #344289). All succeeding doses include Freund's Incomplete Adjuvant (Sigma #F5506). In a given year, an average of 63% of all reproductive mares are inoculated with the vaccine (range = 37–88%). The authors of the present study are not and have never been in charge of making management decisions regarding this herd.

Gathers and Removals. The National Park Service began their management of the Shackleford Banks population prior to the use of PZP, performing five gathers between November 1996 and January 2000. During these gathers the majority of the population was rounded up and individuals testing positive for equine infectious anemia were removed and either euthanized or quarantined. As such forms of management could conceivably influence reproductive cycling, we analyzed foaling dates before and after gathers (but before contraception management) using a linear mixed effects model (see Statistical Analyses).

From January 2000 – January 2008, 38 foals (conceived due to contraception failure or administration scheduling) were removed from the island for the purpose of population control. The majority of removals (92%) were conducted in the January following the foals' birth.

Foaling Data

We recorded foaling data before contraception management (1995–1997) during a study of mother-infant behavior [31]. We obtained foaling data for 2000 and post-contraception years (2001–2008) from the National Park Service at Cape Lookout National Seashore, North Carolina. Although PZP was first administered in 2000, foals born in this year were conceived before contraception management. As such, we considered 2000 a pre-contraception year.

We identified individual horses by color, sex, age, physical condition, and other distinguishing markings including freeze brands. We monitored pregnant mares 2–3 times per week to ensure accurate estimation of foaling date. Births are not commonly witnessed, as mares will generally give birth away from their harem group [31]. This does not significantly affect the determination of birth dates because typically, mares return to their groups within hours (depending on the length of the foaling process and the mares' and foals' condition afterward). In the event that we did not locate mares for more than one week, the birth dates of new foals were estimated by comparing the condition of the foals' coat, mane and tail hair, and locomotor ability to that of foals for which the exact age was known. Using these methods, we were able to estimate birthdays within a range of 1–2 days to 1 week. Focal animals in this study were observed from a minimum of 15 m away at all times. The observers did not obstruct or manipulate the animals' natural behavior in any way. As such, approval for this study by a review board or ethics committee was unnecessary.

We designated births as coming from current recipient, prior recipient, or non-recipient mares. Current recipients received PZP

treatment the year they conceived (the year previous to foaling). Prior recipients received PZP treatment at some point earlier in their lifetime, but not the year of conception. Non-recipients had never received PZP at the time of conception.

Physical Condition

Physical condition is an important factor to consider when monitoring reproductive behaviors. Animals in better condition will have more resources to allocate to mating behavior and physiology than will animals in poorer condition. We assessed mare condition via rump scoring. We determined rump scores examining the curvature of the line between the tailbone and the point of the hip. Scores were based on a scale from 1 to 5; a score of 1 being the poorest [32].

Weather Data

We collected all climatology data from the Morehead City WNW Station at 34° 44'N; 76° 44'W, approximately 8 km from the study site. We obtained all data from the National Climate Data Center (2009) [33].

Statistical Analyses

We analyzed data in R version 2.11.1 (R Core Group, Vienna Austria) and JMP, version 7 (SAS, Cary NC, USA). We used Fligner-Killeen tests to determine if variation in foaling dates differed before and after contraception management and between PZP recipients and non-recipients. This test is more conservative than Fisher's or Bartlett's tests and is less sensitive to outliers and non-normal data [34]. Results from these tests show Bonferroni corrected *P*-values.

We used linear mixed effects models to analyze monthly weather patterns. These statistical models included year as a random effect and the following fixed effects: linear through fourth order polynomial functions of month (to account for nonlinear fluctuations in temperature and rainfall), management regime (before or after contraception management), and two-way interactions with management regime. We selected best fit models using Akaike's Information Criterion adjusted for small sample size (AICc). Because temperature data were temporally autocorrelated, we included an autoregressive moving average correlation structure [35]. For each year of the study, we calculated the mean of the monthly residual values from both the rainfall and temperature models from July through November. We included these terms in the mixed effects models described below to determine if weather affected foaling date.

To test for differences in foaling date with PZP treatment, while controlling for pseudo-replication and unequal variances, we used a linear mixed effects model. The model included mare ID as a random effect and a function allowing different variances across groups (pre-contraception management, post-contraception management non-recipient, post-contraception management current recipient, and post-contraception management prior recipient) [35]. We included mare age as a covariate, as this has been suggested to influence female reproductive behaviors and physiology [36,37]. Additionally, a one-way ANOVA revealed no differences in mare age among treatment groups ($F_{2,84} = 2.03$, $P = 0.14$), suggesting that age did not confound differences among groups. From the above mixed effects model, differences in foaling dates among current, prior, and non-recipients were calculated using an F-test for linear combinations [35].

As gathers could have affected foaling date, we used a linear mixed effects model to test for differences between foaling dates before and after gathers (but before contraception management). After controlling for weather and mare age, mean foaling date did

not differ before and after gathers ($P = 0.63$). Additionally, the range of birth dates did not differ significantly between these groups (SD before gathers = 1.04, SD after gathers = 0.77, $P = 0.36$). Finally, AICc from our analysis of foaling dates (see Results) suggested that combining data before and after gathers yielded a more parsimonious model than did separating those categories (AICc separating pre- and post-gathers = 551.02, AICc combining pre- and post-gathers = 550.60). Consequently these groups were combined as pre-contraception management animals for all analyses.

To determine whether the number of PZP applications (total or consecutive) or the number of years between pregnancies (total or consecutive) influenced foaling date, we ran separate linear mixed effects models using these as predictor variables. Each model used only data from PZP recipients and included mare ID as a random effect. To determine if results from this analysis could be influenced by year, we ran a linear mixed effects model on post-management, non-recipients predicting foaling date by year.

We analyzed PZP efficacy using a generalized linear mixed effects model with a binomial error distribution and mare ID as a random effect [38]. This analyzed the probability of conceiving using age at first PZP application and the number of consecutive PZP applications as fixed effects. All mixed effects models initially included two-way interactions, which were removed if their *P*-values were > 0.10 .

Results

Foaling

After contraception management, foaling occurred over a broader range of months than before contraception management (see Fig. 1, SD pre-contraception = 0.91 months, SD post-contraception = 2.04 months; Fligner-Killeen Test for Homogeneity of Variances: Median Chi Square = 28.10, $P < 0.0001$; pre-contraception: $n = 65$ births from 45 mares over 4 years; post-contraception: $n = 97$ births from 46 mares, over 8 years). In the eight years following contraception management, mares receiving PZP foaled over a broader range of months than did non-recipient mares (see Fig. 1, SD recipients = 2.40 months, SD non-recipients = 1.54 months; Fligner-Killeen Test for Homogeneity of Variances: Median Chi Square = 11.76, $P = 0.001$; recipients: $n = 45$ births from 27 mares; non-recipients: $n = 52$ births from 19 mares).

On average, current PZP recipients gave birth 3.36 months later than did pre-contraception mares, according to our linear mixed effects model, which controlled for heterogeneity of variances, weather influences, and mare age (estimate = 3.36, SE = 0.51, $t = 6.64$, $P < 0.001$; overall model: Likelihood ratio (compared to null model): 40.79, generalized $r^2 = 0.48$, $P < 0.001$). Mares that had received PZP earlier in their lifetime, but not during the year of conception (prior recipients), gave birth 0.90 months later than pre-contraception mares on average (estimate = 0.90, SE = 0.40, $t = 2.27$, $P = 0.03$). Non-recipient mares that never received PZP themselves, but gave birth after the general population was managed with PZP, gave birth 1.01 months later than pre-contraception mares on average (estimate = 1.01, SE = 0.25, $t = 4.04$, $P = 0.001$). This translates into current PZP recipients giving birth 2.34 months later than non-recipient animals and 2.46 months later than prior recipients (F-tests for linear combinations: $F > 16$, $P < 0.001$ for each comparison). Furthermore, birth dates were about 0.38 months later for each degree centigrade above average in the latter half of the breeding season and 0.05 months later for each centimeter of rain above average (temperature residuals July-Nov: estimate = 0.38, SE = 0.13, $t = 2.84$, $P = 0.001$; rainfall residuals July-Nov: esti-

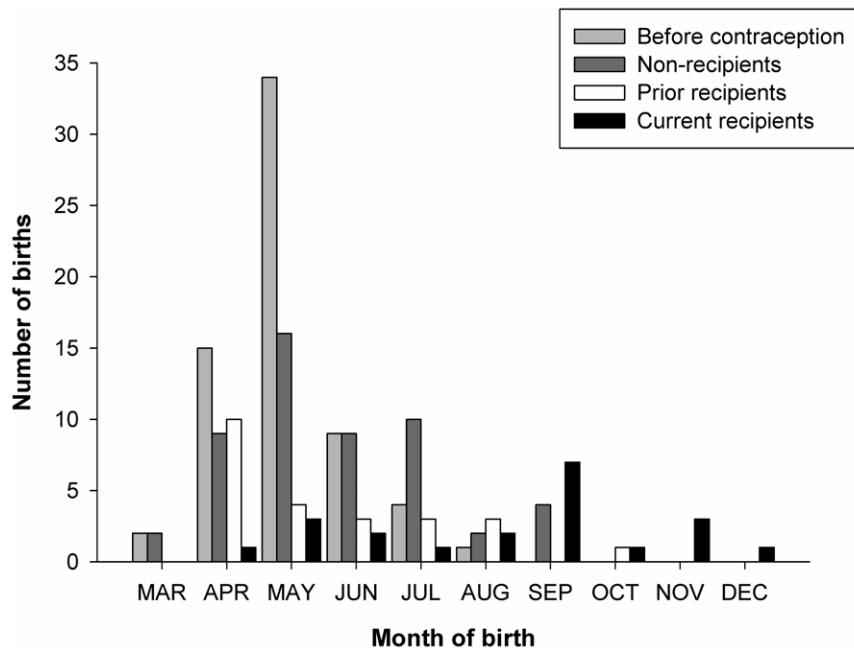


Figure 1. The distribution of births for mares on Shackleford Banks, NC, pre-contraception and post-contraception management. Mares gave birth over a wider range of months after the onset of contraception; this effect was more pronounced in PZP recipients than non-recipients.

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mate = 0.05, SE = 0.03, $t = 1.83$, $P = 0.07$). In general, mares gave birth 0.05 months earlier for every year of age (estimate = -0.05, SE = 0.02, $t = -2.03$, $P = 0.05$).

Among mares treated with PZP, those receiving a higher total number of applications foaled later in the season than did those receiving fewer applications, with each additional application associated with a 0.5 month delay in foaling date (Linear Mixed Effects Model: estimate = 0.55, SE = 0.21, $t = 2.61$, $r^2 = 0.65$, $P = 0.01$, see Fig. 2A). In addition, each consecutive PZP application was associated with a 0.8 month delay in foaling date, on average (Linear Mixed Effects Model: estimate = 0.83, SE = 0.23, $t = 3.64$, $r^2 = 0.65$, $P < 0.0008$, see Fig. 2B). While the consecutive and total number of PZP applications were highly correlated, comparing the AICc between the prior two models suggested that the number of consecutive PZP treatments more accurately predicted month of birth than did the total number of PZP treatments (AICc total = 202.96, AICc consecutive = 196.83). The number of years that mares did not conceive (total or consecutive), however, did not correlate with foaling date (Linear Mixed Effects Model: total years: estimate = 0.31, SE = 0.26, $t = 1.19$, $r^2 = 0.57$, $P = 0.24$; consecutive years: estimate = 0.26, SE = 0.28, $t = 0.92$, $r^2 = 0.44$, $P = 0.36$). It is unlikely that these patterns resulted from a general trend across years, as birth dates among non-recipient animals did not change with calendar year (Linear Mixed Effects Model: $r^2 = 0.17$, estimate = 0.05, SE = 0.09, $t = 0.57$, $P = 0.57$).

Mare Condition

A generalized linear model, which controlled for mare age, showed that among post-contraception animals, recipient mares (both current and prior) were in better physical condition, with rump scores approximately 0.4 points higher than those of non-recipients (overall model (compared to null model): Chi Square = 7.74, $P = 0.05$; PZP treatment: estimate = 0.38, SE = 0.15, Chi Square = 6.13, $P = 0.01$; age: estimate = -0.005,

SE = 0.06, Chi Square = 0.007, $P = 0.93$; PZP treatment $\times$ age: estimate = -0.02, SE = 0.06, Chi Square = 0.13, $P = 0.72$).

Weather

The best fit model of monthly mean temperature showed that overall temperatures were approximately 0.6°C warmer after the onset of contraception management (see Fig. 3A; overall model: Likelihood ratio (compared to null model) = 358.40, $P < 0.0001$, generalized $r^2 = 0.88$; month: estimate = -8.49, SE = -0.97, $t = -8.78$, $P < 0.0001$; month²: estimate = 3.88, SE = 0.29, $t = 13.43$, $P < 0.0001$; month³: estimate = -0.45, SE = 0.03, $t = -13.70$, $P < 0.0001$; month⁴: estimate = 0.015, SE = 0.001, $t = 12.20$, $P < 0.0001$; contraception management (before): estimate = 0.58, SE = 0.27, $t = -2.13$, $P = 0.06$). The best fit model of monthly precipitation showed no overall differences between the periods before and after contraception management, but there were significant interactions between month of the year and the periods before and after contraception (see Fig. 3B; overall model: Likelihood ratio (compared to null model) = 38.43, $P < 0.0001$, generalized $r^2 = 0.20$, $P < 0.0001$; month: estimate = -11.19, SE = 4.96, $t = -2.25$, $P = 0.03$; month²: estimate = 3.66, SE = 1.46, $t = 2.51$, $P = 0.01$; month³: estimate = -0.38, SE = 0.17, $t = -2.27$, $P = 0.02$; month⁴: estimate = -0.01, SE = 0.006, $t = 1.88$, $P = 0.06$; contraception management (before): estimate = 6.99, SE = 4.22, $t = 1.66$, $P = 0.12$; month $\times$ contraception management (before): estimate = -2.97, SE = 1.43, $t = -2.07$, $P = 0.04$; month² $\times$ contraception management (before): estimate = 0.22, SE = 0.11, $t = -2.03$, $P = 0.04$).

PZP Efficacy

We defined PZP efficacy during the year of administration as the number of vaccinated mares that did not become pregnant divided by the total number receiving the vaccine. Across the first four consecutive PZP applications, this efficacy declined from 97% to 87%, returning to 100% after five or more consecutive applications (see Fig. 4). A generalized mixed effects model shows that this pattern

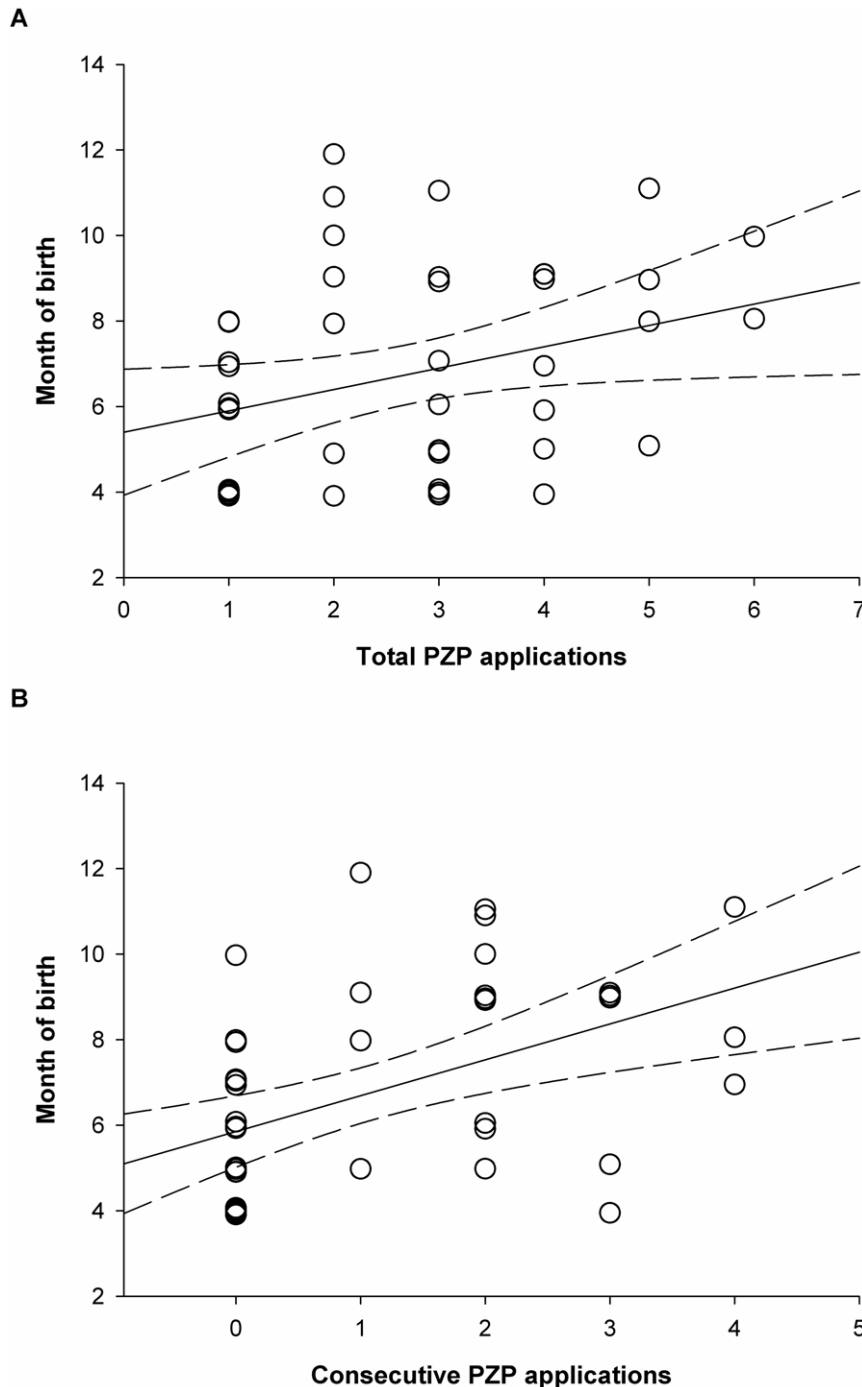


Figure 2. Birth month and number of A) total PZP applications, and B) consecutive PZP applications. In the events of ties, month of birth has been jittered by 0.2 years to allow clear visualization of every individual. Mares receiving more applications of PZP foaled later in the year on average than did mares receiving fewer applications. Although the number of total and consecutive applications is highly correlated, AICc suggests that the number of consecutive applications explains more of the variation in the data.
doi:10.1371/journal.pone.0013635.g002

is significant, even when controlling for mare age (overall model with binomial error distribution: Log Likelihood = -61.79, $P = 0.01$, generalized $r^2 = 0.17$; consecutive PZP applications: estimate = 2.98, SE = 1.20, $z = 2.49$, $P = 0.01$; (consecutive PZP applications) 2 : estimate = -0.51, SE = 0.22, $z = -2.33$, $P = 0.02$; age at first PZP application: estimate = 0.10, SE = 0.05, $z = 1.84$, $P = 0.07$). Prior research has shown that five to seven years of consecutive PZP treatment can be associated with ovulation failure [4]. The present

dataset is consistent with this result, as no mare receiving the vaccine for five or more consecutive years became pregnant.

Discussion

Here we show that PZP recipients exhibited a change in their reproductive schedule: recipient mares gave birth over a broader time period than did non-recipients, with current recipients giving

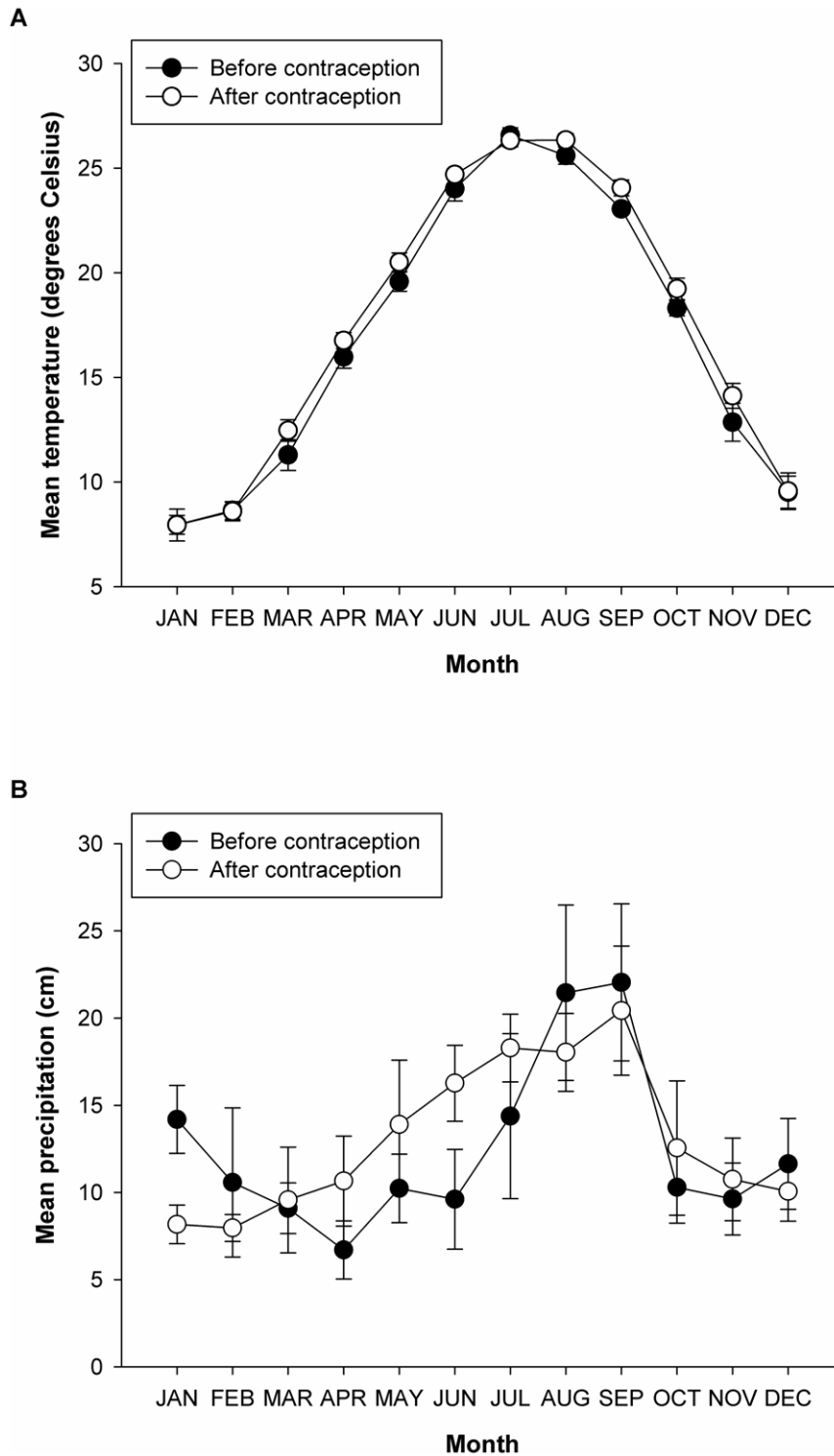


Figure 3. Weather data for six years pre-contraception (1995–2000) and eight years post-contraception (2001–2008) management. Data were collected from Morehead City, North Carolina, approximately 8 km from the study site (Shackleford Banks, North Carolina). Temperatures (A) were marginally warmer post-contraception than they had been pre-contraception. Overall rainfall (B) did not differ before and after contraception, though the seasonal patterns were marginally different pre- and post-contraception. doi:10.1371/journal.pone.0013635.g003

birth later in the year than prior recipient and non-recipient mares. Given that gestation in wild horses lasts approximately 11 to 12 months [30], this change indicates a corresponding change in the schedule of ovulatory cycling. Contraception with porcine

zona pellucida is popular amongst managers specifically because it effectively reduces the odds of conception without the application of exogenous steroids [2]. Long-term studies on Assateague Island have reported that PZP has little to no effect on reproductive

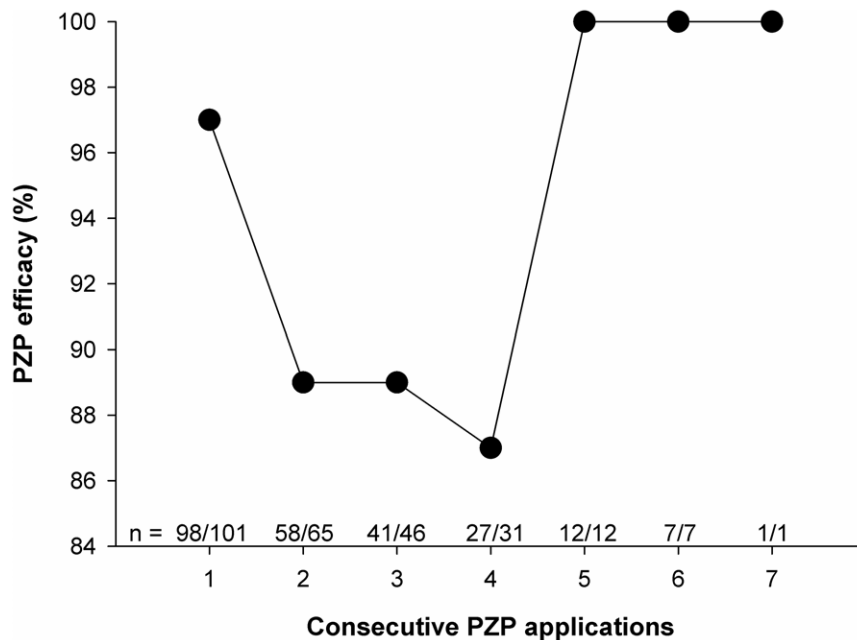


Figure 4. PZP efficacy and number of consecutive PZP applications. PZP efficacy was defined as the number of recipient mares that did not become pregnant divided by the total number of mares receiving the vaccine. Across the first four consecutive applications, PZP efficacy declined, returning to 100% after five or more consecutive applications (5–7 applications have been shown to result in ovulation failure and decreased oestrogen levels [5,40]).

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hormone levels, the schedule of reproductive cycling, or the social behaviors of recipient animals [4]. However, studies in other wild horse populations have shown that recipient mares both initiate and receive more instances of reproductive behavior during both the breeding [39] and non-breeding seasons [9]. This study provides the first evidence that mares treated with PZP can extend ovulatory cycling beyond the normal breeding season. This suggests that populations of wild ungulates can vary in their response to similar contraceptive treatment. Careful consideration of baseline population dynamics should be made prior to treatment in order to fully assess possible PZP effects.

Foaling Date

Mares receiving PZP at any point during their lifetime gave birth over a broader time period than did non-recipient animals. This larger variance among PZP mares is likely driven by the fact that current recipients gave birth later than did recipient (see Results, Fig. 1). Moreover, mares receiving more consecutive applications foaled later in the season than did mares receiving fewer applications. Increases in the average interbirth interval for recipient mares did not seem to be driving this result, as foaling date was not affected by the number of years (cumulative or consecutive) that mares failed to conceive. This discrepancy may be due to high variability in the conception and foaling dates of treated mares. First, it is less likely that an animal vaccinated with PZP will conceive at all, thus reducing sample size. Second, due to contraceptive failure, some treated mares will conceive during the normal breeding season, further increasing variability. Interestingly, prior to the application of PZP, the average month of birth did tend to increase with interbirth interval (Linear Mixed Effects Model: estimate = 0.30, SE = 0.17, $t = 1.82$, $r^2 = 0.06$, $P = 0.07$) [22], demonstrating at least some plasticity in the scheduling of reproductive cycling in Shackleford mares. On Assateague, PZP recipients experience normal reproductive cycling and mate at

rates similar to non-recipients [40]. However, when such behavior fails to result in conception over several years, it follows that individuals extending reproductive cycling will be able to achieve conception later in the year if the contraceptive effects of PZP have decreased sufficiently [28,29].

Because feral horses are highly social, such changes can have cascading effects on other group members and throughout the population. Our research has shown that after contraception management, PZP recipients both attract and initiate more instances of reproductive behavior [9] and are more often the harem male's nearest neighbor during the fall/winter (Nuñez, unpublished data), indicating that group spreads are reduced. Such changes represent an increase in energy expenditure and a potential decrease in nutrient intake during a time of year when sufficient energy reserves are at a premium [27]. Moreover, early foal development in unmanaged populations typically occurs during the spring and summer when resources are plentiful [11,27]. Offspring born in the fall/winter months face nutritional and thermoregulatory challenges not experienced by their counterparts born during the normal foaling season, potentially making developmental benchmarks difficult to achieve [27].

Such predictions are not consistent with data from Assateague Island where mares show increased survival, only minimal physiological side effects, and no behavioral or demographic changes [4,5,6]. In addition, foal survival does not differ between foals born in or out of the normal foaling season [41]. However, on Shackleford Banks, recipient mares change groups more often, elicit and receive more instances of reproductive behavior, and receive more harassment from harem males [9,42]. Given these differences in mare response to PZP management in the two populations, it follows that predictions based on the data from one site are not necessarily applicable to the other.

These population differences may be due to the scheduling of PZP administration at the two sites. When the contraception

program on Assateague began in 1994, the priorities for treatment followed a hierarchical approach based on the previous breeding success of the population, ensuring that all mares were given an opportunity to reproduce [3]. Females for which there was a high priority for treatment included those that had produced at least one surviving offspring. Low priority females included those that were less than four years of age. Females greater than four years old that had not produced surviving offspring did not receive treatment. In addition, the plan stipulated that only mares that had produced at least three surviving offspring or two generations of offspring would receive more than three consecutive years of treatment. Foals were not to be removed as removal increases a mare's reproductive success in the subsequent year [43,44,45]. Finally, it was recognized that this plan was subject to change as the population numbers decreased [46]. In the present study, Shackleford mares were contracepted between 1.5 and 2 years of age and received an average of 3.4 ± 0.2 (mean $\pm$ standard error) consecutive years of contraception, regardless of their productivity. To further control population numbers, foals born to these mares (due to contraception failure or changes in the application schedule), were likely to be removed. This difference in PZP administration and subsequent discrepancy in early life experience may contribute to the behavioral differences between the populations, as the ability to conceive with a harem male is likely critical to establishing lasting harem fidelity [16] and the retention of foals (until at least two years of age) is important to maintaining normal reproductive function [43,44,45].

Possible Mechanisms

Although the effect was more pronounced in recipients of PZP, both recipients and non-recipients showed a wider range of foaling dates after contraception management (after 2001). While relatively rare, such extended periods of estrous have been documented in several equine species. Tropical species, for example, have been observed to reproduce throughout the year [12,13,47]. Similarly, studies of temperate species have shown that individuals can vary significantly in reproductive timing [14] and estrous behaviors during the non-breeding season [15]. Our data show that Shackleford mares exhibit at least some plasticity in their reproductive cycling. This plasticity enables mares to time their reproductive cycling according to ecological, sociological, and physiological cues.

For example, our results show that the reproductive changes exhibited by Shackleford mares correlate with warmer temperatures occurring later in the calendar year, after contraception management. Increases in rainfall late in the breeding season also correlate (albeit weakly) with later births. Both warmer temperatures and increased rainfall could result in higher resource availability [27] and afford females the additional reserves necessary to extend reproductive cycling into what is typically the non-breeding season.

The physical condition of mares may also play an important role in the extension of reproductive cycling. On Shackleford Banks, recipient mares are currently in better physical condition than are non-recipients. This is likely due to the fact that successfully contracepted mares are unconstrained by the costs of pregnancy and lactation [48]. Recipient mares will therefore have more resources to allocate to additional reproductive cycles. This effect of PZP, coupled with warmer temperatures occurring later in the year, may act to increase a mare's chances of conceiving later in the calendar year, if PZP antibody titers are sufficiently low [29].

Additionally, extended cycling in non-recipient mares could be influenced by the physiology and behavior of recipients.

Shackleford males exhibit higher rates of sexual behavior towards recipient females during both breeding and non-breeding seasons [9,42]. These overt social stimuli may entrain some non-recipients to continue reproductive behaviors and cycling into the early fall. Such stimuli are commonly used to induce receptivity in several domestic species including horses [49], pigs [50], and cows [51]. In the wild, courtship signals from conspecifics advance gonadal cycles or maturation in several taxa, including mammals [52,53,54], birds [55], amphibians [56], and reptiles [57]. Given the importance of social cues in the timing of reproduction among such diverse species, this possibility warrants further investigation in Shackleford mares.

Finally, the declining efficacy of PZP with increased consecutive applications is likely a contributing factor to the later foaling dates of recipient mares. Lyda and colleagues' research with captive, wild mares has shown that antibody titers against PZP remain high for up to ten months after initial treatment [28]. In addition, research with both Shackleford and Assateague horses has shown that initial applications of PZP are often effective over multiple years [9,58], suggesting that antibody titers can remain high for longer. However, laboratory research has shown considerable variability in anti-PZP titers [29], as did Lyda and colleagues' work in which half the mares treated with PZP and Freund's Complete Adjuvant fell below contraceptive levels within the ten months of study [28]. Our data show that increasing the number of consecutive applications can reduce the single year efficacy of PZP by roughly 10%, indicating that either antibody titer or reactivity can decrease more rapidly with consecutive applications. Such patterns could result from the induction of immunological tolerance [59], which reduces responsiveness to self-tissues or repeatedly encountered, non-pathogenic antigens [60]. PZP is designed to mimic host tissue and induce an immune response against self tissue: the recipient's own zona pellucida [2]. As such, it seems reasonable that at least some animals would mount tolerance mechanisms to combat this autoimmunity. In addition, the repeated application of a specific antigen generates an antibody response that is increasingly more specific to that particular antigen [29]. The antibodies produced by mares against porcine zona pellucida should, therefore, become less cross reactive with horse zona pellucida over time. Of course, PZP efficacy will vary depending on mare age and timing of inoculation [61]. Regardless, if PZP recipients extend reproductive cycling and behavior into the non-breeding season, any decrease in efficacy that leaves them fertile in the fall/winter will help drive increases in late season conception.

Although the removal of offspring can induce estrous cycling in ungulate species [62], it is unlikely that the removal of foals has influenced foaling date among PZP-treated mares on Shackleford Banks. Thirty-nine foals (conceived due to contraception failure or administration scheduling) have been removed from the island. Approximately 55% of these foals were born to non-recipient animals. The majority of foal removals were conducted in the January following foal births. Given that non-recipient animals did not give birth later than September and most recipient animals gave birth before December, it is unlikely that foal removals in January induced late-season estrus in Shackleford mares. It is equally unlikely that increases in mare condition due to the alleviation of lactation costs resulted in early resumption of estrus the following spring [27]. If that were the case, during the early spring months we would expect to see an increase in the number of foals born to mares subjected to offspring removal. This is not borne out by the data. Still, the removal of foals is ill-advised as it increases mare fecundity the following year [43,44,45].

Management Implications

When the alternative (gather and removal) is considered, PZP is currently managers' most humane and effective option for population control. However, careful study of the animals' demography, physiology, and behavior is necessary prior to and during treatment to ensure that a) the potential effects of PZP can be assessed accurately, and b) within managerial constraints, unintended effects of PZP are ameliorated. Differences in habitat, resource availability, and demography among conspecific populations will undoubtedly affect their physiological and behavioral responses to PZP contraception, and need to be considered. For instance, while Assateague horses show no behavioral and only minor physiological responses to PZP, horses on Shackleford Banks [9,42] and in the western United States [39] alter social and reproductive behaviors in response to PZP. Our data suggest that mare condition and warming trends may present additional complications. Increases in physical condition and changes in average temperature may interact with management regimes, enabling mares to alter their reproductive physiology even further. Moreover, these data emphasize the importance of study during both the breeding and non-breeding seasons. Much of the research showing little to no effect of PZP on feral horse behavior or physiology has been performed exclusively during the breeding season [4,5,10], potentially missing important differences in recipient response.

If population numbers are managers' primary concern, our data show that giving five or more consecutive applications of PZP will result in 100% contraception efficacy. This is consistent with data from Assateague where mares receiving 5–7 consecutive PZP applications exhibited ovulation failure and decreased urinary oestrogen concentrations [5,40]. However, if managers are tasked with the maintenance of natural behaviors and foaling schedules, consecutive PZP applications should be avoided. Research has shown that one application of PZP is often effective over multiple years, exhibiting yearly efficacy declines similar to that of 2–4 consecutive treatments (on Shackleford) [9,58]. Our data show that current recipients gave birth later than both prior recipient and non-recipient animals. However, prior recipients of PZP gave birth on schedules similar to non-recipients, suggesting that breaks between treatments can ameliorate unintended behavioral and

physiological changes in recipient animals. Contraception on such schedules will still maintain lower pregnancy rates, but will allow for the birth of a manageable number of offspring which are also important to the maintenance of normal behaviors [9]. These foals should be allowed to remain in the population for at least two years as earlier removal has been shown to increase a mare's reproductive success in the subsequent year [43,44,45]. Additionally, subadult, dispersing females should be allowed to settle into harems and have at least one foal before receiving contraception [16]. Management regimes such as this would of course necessitate a higher minimum population level. Additional research is needed to determine whether these larger, but still limited population sizes could achieve management goals. If so, this could prove a cost-effective means of controlling animal numbers while maintaining their natural physiology and behavior.

The broader implications of this research are considerable. As this study suggests, the physiological and behavioral effects of PZP are not fully understood. Still, the vaccine is currently administered to many different species including white-tailed deer, *Odocoileus virginianus* [7], elk, *Cervus elaphus* [8], black bears *Ursus americanus* [63], and African elephants, *Loxodonta Africana* [64]. As with conspecific equid populations, habitat, resource, and demographic differences among species will affect their responses to PZP contraception and need to be considered. For social species like the horse, a proper balance between managing population size and maintaining a more natural physiological and behavioral regime is particularly important.

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Author Contributions

Conceived and designed the experiments: CMVN. Performed the experiments: CMVN. Analyzed the data: CMVN JSA. Wrote the paper: CMVN JSA DIR.

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Exhibit F

FERTILITY CONTROL EFFICACY FOR FIVE PRYOR MARES
Data obtained from the BLM and the Pryor Mountain Wild Mustang Center

In Alternative 2: The BLM states: “Mares that are non-responders to ZonaStat-H may be treated with another approved immunocontraceptive or removed from the HMA”.

The BLM has not defined non-responder, nor provided any criteria to be used to determine if a mare is a non-responder. That fact that a mare has been treated with PZP and still foaled is not evidence of being a non-responder. There are many factors that must be considered to make that determination. Specifically, the timing of the treatment and if treatment was administered at all. Proper storage and handling of the vaccine is critical to maintain the viability of the vaccine (temperature ranges, expiration parameters, etc.) An error in storage and handling can cause a vaccine solution can impact potency.

The charts below are fertility control treatment records for five mares currently on PMWHR. The data shows that errors made in application resulted in fertility control failure. A mare that is already pregnant when treated is an application error and does not indicate the mare is a non-responder. The charts also show missed treatments resulted in conception and clearly does not indicate that the mare is a non-responder.

Horse Name(s)	ID	Birth Yr	Treatment Age	Treatment Year	Treatment Status	Treatment Date	Treatment 2 Date	App Date of Breeding	Foaling Yr	Offspring	Efficacy	Timing
Feldspar	200523	2005	1	2006	2006 NT							
Feldspar	200523	2005	2	2007	2007 NT				2008	Iridium-		
Feldspar	200523	2005	3	2008	2008 NT				2009	Jupiter-M		
Feldspar	200523	2005	4	2009	2009 TR	2009 TRp			2010	Krystal-F		
Feldspar	200523	2005	5	2010	2010 TR	2009 TRp2						
Feldspar	200523	2005	6	2011	2011 NT				2012	Mica-M		
Feldspar	200523	2005	7	2012	2012 NT				2013	Nimbus-F		
Feldspar	200523	2005	8	2013	2013 NT			6/17/2013	2014	Ohanze-M		
Feldspar	200523	2005	9	2014	2014 NT			6/20/2014	2015	Cloud's Pride-M		
Feldspar	200523	2005	10	2015	2015 TR	6/2/2015		6/22/2015	2016	Quintana-F	Failed	Likely pregnant when treated
Feldspar	200523	2005	11	2016	2016 TR	2/29/2016					Worked	
Feldspar	200523	2005	12	2017	2017 TR	3/22/2017	4/5/2017	9/22/2017	2018	Sirius	Failed	
Feldspar	200523	2005	13	2018	2018 TR	6/7/2018					Worked	
Feldspar	200523	2005	14	2019	2019 TR	6/25/2019		5/26/2019	2020	Utah-M	Failed	Likely pregnant when treated
Feldspar	200523	2005	15	2020	2020 TR	1/8/2020					Worked	
Feldspar	200523	2005	16	2021	2021 TR	10/15/2020		8/7/2021	2022	Red Wolf	Failed	
Feldspar	200523	2005	17	2022	2022 TR	10/20/2021					Worked	
Feldspar	200523	2005	18	2023	2023 TR	7/6/2023		6/11/2023	2024	Yellowtail	Failed	Likely pregnant when treated
Feldspar	200523	2005	19	2024	2024 TR	1/30/2024					Worked	
Feldspar	200523	2005	20	2025	2025 TR	12/12/2024					Worked	

Horse Name(s)	ID	Birth Yr	Treatment Age	Treatment Year	Treatment Status	Treatment Date	Treatment 2 Date	App Date of Breeding	Foaling Year	Offspring Millicent-F	Efficacy	Timing
Greta	200601	2006	5	2011	2011 NT				2012			
Greta	200601	2006	6	2012	2012 NT				2013	Norma-F		
Greta	200601	2006	7	2013	2013 NT			5/18/2013	2014	Orlando-M		
Greta	200601	2006	8	2014	2014 NT							
Greta	200601	2006	9	2015	2015 NT			5/17/2015	2016	Quaid-M		
Greta	200601	2006	10	2016	2016 TR	3/10/2016	5/5/2016				Worked	
Greta	200601	2006	11	2017	2017 TR	4/6/2017		10/16/2017	2018	Sophia Tex	Failed	
Greta	200601	2006	12	2018	2018 TR	3/12/2018		9/24/2018	2019		Failed	
Greta	200601	2006	13	2019	2019 TR	6/20/2019		9/28/2019	2020	Uma	Failed	
Greta	200601	2006	14	2020	2020 TR	5/6/2020					Worked	
Greta	200601	2006	15	2021	2021 TR	4/8/2021					Worked	
Greta	200601	2006	16	2022	2022 TR	11/17/2021					Worked	
Greta	200601	2006	17	2023	2023 NT			9/23/2023	2024	Yvonne	SHBT	Skipped 2023, Nearly two years between treatment and Breeding
Greta	200601	2006	18	2024	2024 TR	1/31/2024					Worked	
Greta	200601	2006	19	2025	2025 TR	1/1/2025					Worked	
Greta	200601	2006	20	2026	2026TR						Worked	

Horse Name(s)	ID	Birth Yr	Treatment Age	Treatment Year	Treatment Status	Treatment Date	Treatment 2 Date	App Date of Breeding	Foaling Year	Offspring	Foaling Month	Efficacy	Timing
Helenium	200710	2007	1	2008	2008 NT								
Helenium	200710	2007	2	2009	2009 NT								
Helenium	200710	2007	3	2010	2010 NT				2011	Lancaster-m			
Helenium	200710	2007	4	2011	2011 TR	6/5/2011	7/2/2011						
Helenium	200710	2007	5	2012	2012 NT				2013	Noble-F			
Helenium	200710	2007	6	2013	2013 NT			6/24/2013	2014	Outlaw Lady -F	5		
Helenium	200710	2007	7	2014	2014 NT								
Helenium	200710	2007	8	2015	2015 TR	5/19/2015		5/17/2015	2016	Quintasket-F	4	Failed	Likely pregnant when treated
Helenium	200710	2007	9	2016	2016 TR	3/30/2016						Worked	
Helenium	200710	2007	10	2017	2017 TR	4/19/2017						Worked	
Helenium	200710	2007	11	2018	2018 TR	2/22/2018						Worked	
Helenium	200710	2007	12	2019	2019 TR	6/25/2019						Worked	
Helenium	200710	2007	13	2020	2020 NT				2021	Vermillian (dec)	4	SHBT	Should have been treated.
Helenium	200710	2007	14	2021	2021 TR	6/9/2021						Worked	
Helenium	200710	2007	15	2022	2022 TR	10/20/2021		6/8/2022	2023	Xavier	5	Failed	Reversed after 7 months
Helenium	200710	2007	16	2023	2023 TR	10/5/2022						Worked	
Helenium	200710	2007	17	2024	2024 TR	2/5/2024		6/17/2024	2025	Zinnia	5	Failed	Reversed after 4 monthing
Helenium	200710	2007	18	2025	2025 TR	3/7/2025							No foal as of 8/25/2026

Helenium does respond to treatment. She had inconsistency with treatment dates along with one missed treatment year.

Horse Name(s)	ID Numbr	Birth Ye	Treatment Age	Treatment Year	Treatment Status	Treatment Date	Treatment 2 Date	App Date of Breeding	Foaling Year	Offspring	Foaling Month	Offspring DO	Efficacy	Timing
Icara	200801	2008	0	2008	2008 NT									
Icara	200801	2008	1	2009	2009 NT									
Icara	200801	2008	2	2010	2010 NT									
Icara	200801	2008	3	2011	2011 TR	4/23/2011	6/11/2011		2012	Morgana-F				
Icara	200801	2008	4	2012	2012 NT									
Icara	200801	2008	5	2013	2013 NT			5/31/2013	2014	Oglala-M	5	5/1/2014		
Icara	200801	2008	6	2014	2014 NT			5/22/2014	2015	Phantom-F	4	4/22/2015		
Icara	200801	2008	7	2015	2015 TR	6/3/2015							Worked	
Icara	200801	2008	8	2016	2016 TR	3/15/2016		6/19/2016	2017	Raeleah J	5	5/20/2017	Failed	
Icara	200801	2008	9	2017	2017 TR	4/18/2017							Worked	
Icara	200801	2008	10	2018	2018 TR	5/27/2018							Worked	
Icara	200801	2008	11	2019	2019 TR	2/20/2019		9/11/2019	2020	Utopia-M	8	8/11/2020	Failed	Reversed after nearly 7 months.
Icara	200801	2008	12	2020	2020 TR	3/25/2020							Worked	
Icara	200801	2008	13	2021	2021 TR	3/31/2021		8/30/2021	2022	Winoka	7	7/31/2022	Failed	Reversed after 5 months
Icara	200801	2008	14	2022	2022 TR	1/4/2022							Worked	
Icara	200801	2008	15	2023	2023 TR	4/27/2023							Worked	
Icara	200801	2008	16	2024	2024 TR	2/27/2024							Worked	
Icara	200801	2008	17	2025	2025 TR	12/17/2024		5/21/2025	2026	Apollo	4	4/21/2026	Failed	Reversed after 5 months

Treatment was successful 7 of the 11 times.

Horse Name(s)	ID Numbr	Birth Ye	Treatment Age	Treatment Year	Treatment Status	Treatment Date	Treatment 2 Date	Foaling Year	Offspring	Offspring DO	Efficacy	Timing
La Brava	201104	2011	1	2012	2012 NT			2013	Nacer			
La Brava	201104	2011	2	2013	2013 TR	12/6/2012	5/6/2013				Worked	
La Brava	201104	2011	3	2014	2014 TR	4/28/2014		2015	Pilar-F	12/8/2015	Failed	357 days between treatment
La Brava	201104	2011	4	2015	2015 TR	1/22/2015					Worked	
La Brava	201104	2011	5	2016	2016 NT							
La Brava	201104	2011	6	2017	2017 NT			2018	Santiago	7/13/2018		
La Brava	201104	2011	7	2018	2018 NT			2019	Trooper	7/10/2019		
La Brava	201104	2011	8	2019	2019 NT			2020	Ultra Blue-M	7/8/2020		
La Brava	201104	2011	9	2020	2020 TR	5/28/2020					Worked	
La Brava	201104	2011	10	2021	2021 TR	6/9/2021		2022	Wrangler	6/10/2022	Failed	377 days between treatments
La Brava	201104	2011	11	2022	2022 TR	10/6/2021					Worked	119 days between treatments
La Brava	201104	2011	12	2023	2023 TR	10/4/2022		2024	Yucatan	5/27/2024	Failed	363 days between treatments
La Brava	201104	2011	13	2024	2024 TR	3/5/2024		2025	Zelda	11/17/2025	Failed	518 days between treatments
La Brava	201104	2011	14	2025	2025 TR	1/7/2025					8/25/2026	308 days between treatments

La Brava had large gaps in time (>= to a year) between treatments in the failed years.

Exhibit G

Gathers and Fertility Control Operations

The BLM gathers and removes wild horses and burros from public lands to protect the health of the animals and health of our nation's public rangelands. In some locations, the BLM also uses birth control to slow the growth of wild horse herds. Absent management and natural predators, wild horse herds can double in just 4-5 years and quickly outgrow the ability of the land to support them.

Schedule of upcoming wild horse and burro gather actions

All information is tentative and subject to change. For the most current information, [contact the BLM](#).

Herd Management Area or Herd Area	Dates	State	Method	Planned Removals	Planned Returned to the Range with Fertility Treatment	Animal
Sulphur HMA	Oct. 1-14, 2026	Utah	Drive Trap	300	0	Horses
Red Desert Complex (Green Mtn HMA, Crooks Mtn HMA, Antelope Hills HMA, Lost Creek HMA, Stewart Creek HMA)	Oct. 15-Nov. 20, 2026	Wyoming	Drive Trap	931	104	Horses
Pryor Mountains Wild Horse Range	Oct. 1-Nov. 15, 2026	Montana	Bait	37	63	Horses
Cedar Mountain HMA, Swasey HMA	Nov. 1-25, 2026	Utah	Drive Trap	640	0	Horses
Antelope HMA and Antelope Valley						

Herd Management

Maintaining Range and Herd Health

Program Maps

Herd Management Areas

Science and Research

Gathers and Fertility Control Operations

Arizona
California
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Idaho
Montana-Dakotas
Nevada
New Mexico
Oregon-Washington
Utah
Wyoming

Ongoing Gathers

100%

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Exhibit H

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BLM plans Pryor Mountain horse removal; herd experts warn of overmanagement



Photo by: Vanessa Willardson/Q2

Pryor Mountain Wild Horse Range



By: Vanessa Willardson

Posted 6:56 PM, Aug 26, 2026

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The plan also includes treating 43 mares with fertility control and releasing them back to the range. BLM field manager Nate Arave told MTN the horses in the range are running out of resources.

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“The first thing we’re starting to see again is the rangelands deteriorate,” said Arave. “If you don’t have enough food for the horses, they can begin to have deteriorating health themselves, which is not what we want to see long-term.”

Related: [BLM unveils 10-year plan for Pryor Mountain wild horses](#)

BLM estimated the herd population to be 187 this spring. The 10-year goal would put the range at 107 to 120 horses.

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Vanessa Willardson/Q2

“(A) self-sustaining herd requires enough numbers and reproductive capacity to survive on into the next years,” said Nancy Cerroni, the Pryor Mountain Wild Mustang Center director based in Lovell, Wyoming.

Cerroni gives hundreds of wild horse tours to tourists from around the world every year. She worries reducing the herd’s population to 107 could result in too much inbreeding.

“This small population has a finite gene pool. What's up there now is what's up there,” she said.

Cerroni filed an appeal to the Interior Board of Land Appeals this week to halt BLM’s 10-year-plan. This is her second time this summer filing an appeal.



Vanessa Willardson/Q2

Nancy Cerroni

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Other wild horse experts agree with Cerroni that the 10-year plan could pose a danger to the herd's survival.

"One hundred and seven is a ridiculous number," said Ginger Kathrens, founder of The Cloud Foundation. "You start to lose that genetic viability. And then you start to see weirdnesses... any kind of physical weirdness can occur."

"That's not setting up these horses for success or survival," said Kerry Ferguson, executive director of The Cloud Foundation. "That is what we are most concerned about is the future health of this historic and very well-known herd."

BLM plans to remove the horses through bait-and-trap methods. A date has not been set for when removal will start.

The gathered horses will be relocated to holding facilities, where they will be adopted out. You can read more about BLM's adoption program [here](#).

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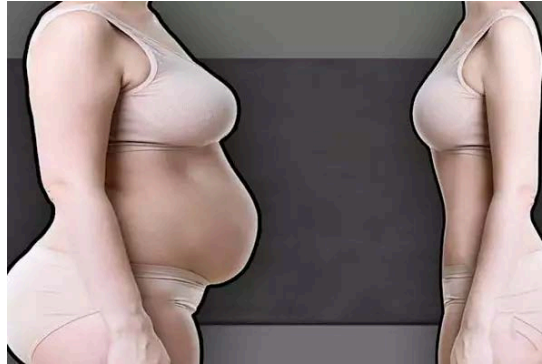
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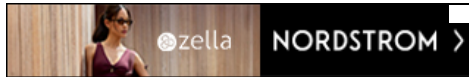
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