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Information Memorandum No. 83-353
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To: All Field Officials

From: Director

Subject: Summary of Wild Horse and Burro Research

Enclosed is a summary of all wild horse and burro research sponsored by the Bureau of Land Management (BLM), including that done in association with the National Academy of Sciences.

Final reports of all individual research projects will be made available to State Directors in the near future.

[Handwritten Signature]

Chief, Division of Wild
Horses and Burros

1 Enclosure:

Encl. 1 - Summary of BLM-Sponsored Research on Wild
Horses and Burros (13 pp)

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Summary of Bureau of Land Management-Sponsored Research on Wild
Horses and Burros

1. Age-Specific Pregnancy Rates in Challis Wild Horses: 1980

Principal Investigator: Dr. U. S. Seal, Veterans Administration
Hospital, Minneapolis, Minnesota
Period of Study: 1980
Funds Expended: None

Summary and Conclusions:

From an estimated population of 617 wild horses in the Challis Planning Unit, Salmon District, Idaho, 303 were gathered in October 1980. The gather was designed to produce a random sample of individuals within the herd. Of the animals gathered, 167 were female. Of these, 30 were foals and were not studied further. Blood samples were drawn from the 137 females and analyzed to estimate reproductive parameters to characterize the herd. Analysis was based on blood content of progesterone, pregnant mare serum gonadotropin, and estradiol. Based on the analysis, animals in the sample were categorized as follows:

<u>Age Class</u>	<u>Sample Size</u>	<u>Average Weight</u>		<u>Percent Pregnant</u>	<u>Percent Lactating</u>	<u>Percent Survival</u>
		<u>Anestrous</u>	<u>Pregnant</u>			
1	10	564		0	0	--
2	28	606	726	36	0	--
3	12	709	793	67	25	69
4	21	799	872	57	43	64
5	8		895	71	86	151
6	9		876	89	67	94
7	13		943	85	85	96
8	9		934	78	67	79
9	6		1,022	83	50	64
10-12	15		918	93	73	88
15-30	6		924	100	100	108 ?

Percent survival was calculated as the ratio of percent lactating in any age class to the percent pregnant in the previous age class.

It was concluded that the results from hormone assay should be confirmed by firm physical evidence of pregnancy, such as through rectal palpation. Given such verification, the serum assays offer substantially more information than can be obtained from physical examination.

2. The Effects of Various Removal Strategies on Feral Horse Populations

Principal Investigator: Dr. Michael L. Wolfe, Utah State University
Period of Study: 1980
Funds Expended: \$4,000

Summary and Conclusions:

Using a computerized model of a modified Leslie matrix, a series of population simulations was run to study the effects of age-specific and sex-specific removals on wild horse herd growth rates. A computer program (EQUUS II) was developed and delivered for use in modeling. The author stated four general conclusions:

- a. Given the highly polygamous nature of horses, selective removal of males is not a viable strategy to limit their rate of increase.
- b. Fertility control among females cannot be considered a permanent solution to population limitation. Unless all females in a population are treated, including immature animals, recruitment into the reproductive age segment will negate the effects of control measures.
- c. Survival rate, fecundity, and age at first breeding are the primary determinants of the rate of change in size of populations.
- d. Reliable information on reproductive performance and/or recruitment are the most important requisite data for determining rates of increase in feral horse populations.

3. The Burros of the Chemehuevi and Bill Williams Mountains, Havasu Resource Area

Principal Investigator: Dr. Robert D. Ohmart, Arizona State University
Period of Study: 1974-1977
Funds Expended: \$81,785

Summary and Conclusions:

A sample of 53 burros was marked with permanent collars, 27 in the Chemehuevi Mountains and 26 in the Bill Williams Mountains, Havasu Resource Area, Colorado River Valley, California-Arizona. Population size, habitat relationships, and seasonal movement of burros were studied, as well as interspecific relationships with desert bighorn sheep.

Using the ratio of marked to total burros observed in an aerial census, population size was estimated at 497 animals. Foals accounted for 20 percent of observations, yearlings for 17 percent, and adults for 63 percent. Sex ratio was reported to be 54F/46M. Late April through mid-May was recommended as the optimum season for census, as animals begin to congregate at water sources.

Water and food availability appeared to be the primary factors affecting movement patterns in burros. A critical threshold air temperature of 95°F was found to cause a strong shift in animal distribution towards (to within 3 kilometers of) water. Competition for forage between burros and bighorn sheep was demonstrated on one of the study areas. There was moderate overlap in diets. Forage yearlong for burros was 61 percent shrubs, 30 percent forbs, and 4 percent grasses (5 percent unknown). On common habitat areas, overlap in distribution was 10 percent in winter, 85 percent in spring, and 65 percent in summer and fall. No conclusion was drawn on competitive superiority.

The only stable social group among burros was the jenny and her foal, which remained together for about 1 year. Home ranges for burros averaged about 12 square miles with no discernable difference between sexes. Territoriality was observed in only one animal, an adult male. Foaling occurred year-round, and resulted in 2 foals/3 years per average jenny. Life spans appeared to be 11 to 12 years in jennies, 12 to 14 years in jacks.

Competition on one of the areas (Bill Williams Mountains) was significant, based on diet overlap, distribution overlap, and habitat alteration by burros. The author recommended elimination of the burro population from this area to favor bighorn sheep.

4. Investigations of Reproductive and Chemical Fertility Control in Wild Horses

Principal Investigator: Dr. Jay Kirkpatrick, Eastern Montana
College

Period of Study: 1978-1981

Funds Expended: \$162,300

Summary and Conclusions:

Two antifertility agents were tested under field conditions for their effectiveness in suppressing reproduction in bands of wild horses through treatment of dominant stallions. Microencapsulated testosterone propionate was administered to 10 wild stallions in the Challis herd, Salmon District, Idaho, and a synthetic estrogen, Quinestrol, was administered to 3 stallions in the Juntura herd, Vale District, Oregon.

Effectiveness of the treatments was determined by counting the number of foals born in bands led by drug-treated stallions, compared to production in control bands. Foal counts for control bands averaged 0.371 foals/mare; in treated bands, foal numbers averaged 0.066/mare. Seven of eight control bands produced foals whereas two of seven treated bands produced foals. No births were attributed to breeding by subdominant stallions. Sperm counts among treated stallions were 36 percent lower than among untreated stallions.

The following conclusions were stated:

a. Male-focused chemical fertility control in feral horse populations is feasible.

b. Controlled-release microencapsulated testosterone propionate and the synthetic estrogen Quinestrol offer the best hope (among drugs tested) for reduced fertility resulting from a single administration.

c. Testosterone cypionate has potential as a fertility inhibitor but must be delivered repeatedly at 1-month intervals.

d. All three of these drugs are reversible in their action and must be delivered annually.

e. None of these drugs affects the behavior, libido, or herding instinct of the stallions.

f. Delivery of these drugs from a helicopter is feasible.

g. Social structure of the feral horse bands remains sufficiently stable, particularly during the breeding season, to have no adverse effects upon male-focused fertility control.

h. Elimination scent-marking behavior is a reliable end point with which to measure changes in reproductive behavior.

5. Wild Horse Telemetry Study

Principal Investigator: Howard Baldwin, Sensory Systems Laboratory, Inc.

Period of Study: 1979-1981

Funds Expended: \$10,000

Summary and Conclusions:

Several methods were investigated to attach telemetric devices to wild horses to aid in long term study of the marked animals.

Ear-mounted transmitters were found to be unsatisfactory for use in monitoring wild horses; all models and methods of attachment caused excessive irritation to the animal and resulted in malfunction due to rubbing.

Neck collars were the most successful carrier tested. A leather collar with adjustable latch under the neck was recommended.

6. Evaluation of Chemical Restraint Methods for Potential Use in Wild, Free-Roaming Horses

Principal Investigator: Dr. Ronald Borchard, Washington State University

Period of Study: 1978-1981

Funds Expended: \$140,000

Summary and Conclusions:

Several skeletal muscle relaxants and sedative analgesics were tested for their utility in capturing and restraining unapproachable horses. It was concluded that many drugs are effective when delivered intravenously, but are not absorbed from muscle tissue at rates adequate for efficient field capture work.

Of the drugs tested, succinylcholine chloride was the most effective under a variety of conditions (corrals, open field use) and for a variety of purposes (capture, field immobilization for study). Caution was advised in using succinylcholine chloride soon after animals have undergone stress, as might accompany trapping, gathering, or extended transport, as the effect could be life threatening hypoxia, hypercapnia, and acidosis.

7. Habitat Use and Spatial Interactions of Cattle, Wild Horses, Mule Deer, and California Bighorn Sheep in the Owyhee Breaks of Southern Oregon

Principal Investigator: Robert J. Raleigh, Eastern Oregon Agricultural Research Center

Period of Study: 1978-1983

Funds Expended: \$75,000

Summary and Conclusions:

Habitat use patterns, dietary similarities, and spatial interactions of wild horses, California bighorn sheep, mule deer, and domestic cattle were studied on the Three Fingers Wild Horse Management Area and adjacent lands in southeastern Oregon. During the study, the wild horse herd numbered between 132 and 171 animals.

Size and stability of home ranges were determined for 14 bands and 10 individual stallions. Home ranges for bands averaged 28.3 square kilometers and for individual stallions, 25.8 square kilometers. No seasonal shifts in home ranges were detected.

Daily animal activity patterns were studied through observations of animals during daylight hours. Feeding activity occupied 68 percent of horse time, 68 percent of bighorn sheep time, 57 percent of cattle time, and 74 percent of deer time. Resting accounted for 18 percent of horse time, 38 percent of cattle time, 23 percent of bighorn sheep time, and 18 percent of deer time. The remainder of the daylight time for each species was spent primarily for drinking and traveling.

Drinking behavior was studied most intensively for horses. Horse use of waters peaked in early morning and late afternoon, was done by band, and lasted 6.3 minutes per animal and 16.1 minutes per band on the average. The average distance from observed animals to a water source was not significantly different across seasons for any species, but was significantly different among species, horses exhibiting the greatest distance and cattle the lowest. Distribution of individuals of all species except bighorn sheep was affected by slope. Cattle and horses preferred areas with little (0-19 percent) slope, and their use of available habitat was limited by 19 percent and 29 percent slope, respectively. Deer favored areas of less than 40 percent slope, while bighorn sheep ranged freely on slopes up to 100 percent (the maximum studied).

Interspecific spatial overlap varied from little (horses-bighorn sheep) to extensive (horses-cattle). No correlations were evident concerning active avoidance of one species by another. Application of a similarity index to use of available plant communities by the animal species studied produced nearly identical values (73 to 74 percent) for horse, deer, and cattle combinations.

8. Food Consumption Rates and Nutrition of Horses and Cattle

Principal Investigator: Dr. Larry R. Rittenhouse, Colorado State University

Period of Study: 1980-1982

Funds Expended: \$184,000

Summary and Conclusions:

Rate of forage intake and its nutritional value for domestic horses and cattle were studied on a 1,000-acre pasture near Durango, Montrose District, Colorado. Botanical composition of diets was studied through fecal analysis. Both cows and mares were found to select heavily in favor of grasses, relative to percent representation of grasses in the available forage. Diet similarity indices during the summer study period averaged 0.840, indicating a high overlap in forages selected. Similarity in diets selected by lactating versus nonlactating animals was high (0.90) throughout all seasons. Initial estimates of dry matter intake indicated that mares consumed about 20 percent more forage than cows per pound of body weight. Lactating animals of both species consumed more forage than nonlactating animals, 20 percent more in mares and 16 percent in cows.

Analysis of intake based on body weight indicated that body weight had little influence on forage intake rates in horses, within adult weight ranges. Rate of ingestion in horses is likely a function of other variables.

Apparent dry matter digestibility in cows was about 10 percentage points higher than in mares. Physiological status of the animal (lactating vs. nonlactating) has no apparent effect on digestibility in either species. Apparent crude protein digestibility was greater for mares than for cows, even though crude protein content of the two diets was similar.

Mares exhibited the ability to graze forage plants more closely to the ground than cows, which may imply a competitive advantage of horses over cattle when forage is limited. It also implies that horses are much more likely than cattle to severely impact range resources when proper stocking rates are exceeded.

Field observations of horses and cattle grazing freely (unconfined) indicated a high degree of spatial and temporal overlap in habitat use. Horses were observed to travel further and use a larger portion of the study area than cattle. There is evidence that horses provide greater competition to cattle than cattle do to horses, even though cattle consume a more diverse diet. Forage allocative decisions should consider potential competition for resources in both time and space.

9. Wild Horse Habitat Preference and Use

Principal Investigator: Dr. R. H. Denniston, University of Wyoming
Period of Study: 1980-1982
Funds Expended: \$283,000

Summary and Conclusions:

Habitat use by wild horses, domestic cattle, and pronghorn antelope was surveyed on the Red Desert of southwestern Wyoming. One hundred one-square-kilometer plots were located and corner-marked on a random stratified basis in the Red Desert. Plots were surveyed on a regular basis by land and air. Data collected for each plot during surveys included the numbers of wild horses, cattle, and pronghorn antelope on the plot, distance to the nearest water source, snow availability, and wind speed. Vegetation types and a topography index were also determined for each plot. Results from 41 surveys (30 ground, 11 air) conducted over a period of 19 months indicated that habitat variables accounted for at least 60 percent of the variance in ungulate distribution. There were significant differences in habitat use among horses, cattle, and pronghorn antelope. These differences were probably based mostly on plot distances to water and animal location differences within the study area rather than diet differences.

Major use pattern conclusions were:

a. Horses and antelope were better able to utilize areas further from water sources than cattle during the fall and winter study periods, partly because of their ability to ingest snow.

b. Horses and antelope were more similar to each other with regard to distribution in all seasons than they were to cattle.

c. Plots used by cattle during certain seasons had higher proportions of greasewood, low sagebrush-grass, and rabbitbrush vegetation types than did plots used by horses and antelope.

There was a potential for competition between horses and cattle in the study area. The greatest potential was during late spring and summer when water was scarce. Since pronghorn antelope are thought to have largely different diets than horses and cattle, the potential for competition was not as strong between pronghorn antelope and either horses or cattle.

10. An Initial Study of Wild Horse and Burro Demography: Determination of Pregnancy and Lactation Rates in Various Herds

Principal Investigator: Dr. Michael L. Wolfe, Utah State University
Period of Study: 1981-1982
Funds Expended: \$40,000

Summary and Conclusions:

Blood serum concentrations of reproductive hormones were used to estimate pregnancy rates in wild horses and burros removed from public lands in herd reduction gathers. Samples included 225 horses from Wyoming, 255 from Nevada, and 78 from Oregon; and 165 burros from California. Levels of progesterone, pregnant mare's serum gonadotropin (PMSG), and estradiol-17B were determined by radio immunoassay procedures. Based on comparison with the results of pregnancy diagnosis from rectal palpations on 124 animals, critical endocrine concentrations were established as criteria for pregnancy determination.

Results were reported as follows:

a. Endocrine concentrations sufficient to indicate pregnancy in horses and burros are:

Progesterone: 0.05 ng/ml; and/or

PMSG: 3.0 µg/ml; and/or

Estradiol-17B: 300 pg/ml.

b. The mean incidences of pregnancy among mares from herds in Nevada, Oregon, and Wyoming were 58.4 percent, 69.2 percent, and 85.3 percent, respectively. Pregnancy among the California burros was 79.4 percent.

c. Rectal palpation is a reliable method for determining pregnancy from the 30th day of pregnancy on. Accuracy is thought to be 90 to 95 percent.

d. Pregnancy determination through hormone diagnosis was found to be 80 to 85 percent accurate.

e. Rates of pregnancy were found to be positively correlated with variations in body weight and animal condition.

f. Pregnancy rates were not significantly different between lactating and nonlactating mares or jennies.

g. Apparent pregnancy rates (determined from blood assays) among yearling mares and jennies were significantly higher than previously reported: Wyoming mares, 80.9 percent; Nevada mares, 43.2 percent; California jennies, 42.9 percent.

11. Vegetation Utilization, Diets, and Estimated Dietary Quality of Horses and Cattle Grazing in the Red Desert of Westcentral Wyoming

Principal Investigator: Dr. Michael A. Smith, University of Wyoming

Period of Study: 1980-1982

Funds Expended: \$407,000

Summary and Conclusions:

Forage use patterns and diets of horses and cattle grazing in the big sagebrush-grass vegetation type were studied in relation to the availability of preferred forage plants. Replications were designed to study grazing by horses alone, cattle alone, and horses and cattle together under several stocking rates. Methods for handling wild or feral horses were also studied.

Conclusions were stated for each phase of the study:

a. Animal Behavior.

(1) Horses utilized virtually all areas of the study pasture during both summer and winter seasons. Cattle used all parts of the pasture during summer, but concentrated during winter in areas of broken topography which provided cover.

(2) Horses and cattle rarely grazed in close proximity to one another. However, no specific behavioral interaction with respect to distribution was discerned.

(3) Horses spent the majority of the daylight hours foraging during both summer and winter. Cattle tended to concentrate grazing activity in summer in early morning and evening, but grazed daylong in winter. Both species grazed at night. Time spent grazing increased as forage availability decreased.

(4) Cattle distribution became more disperse as forage availability decreased. Horses, on the other hand, maintained band integrity throughout the year across levels of forage availability.

b. Food Preference and Dietary Overlap.

(1) Horses and cattle displayed a high degree of dietary overlap on the study area, ranging from 54 percent in early summer to about 91 percent by winter.

(2) No conclusions on exploitative competition for forages between cattle and horses could be drawn, due to the confinement of the animals in the grazing treatments. However, the likelihood of such competition on common-use areas was stated to be high.

(3) Horses were primarily grazers throughout the summer season, grasses and sedges constituting 70 percent of diets, shrubs constituting 25 percent of these diets, and forbs 5 percent. Cattle summer diets were 45 percent graminoids, 35 percent shrubs, and 20 percent forbs. Preferred graminoids were junegrass, Sandberg bluegrass, bottlebrush squirreltail, and needleleaf sedge, all of which were selected at levels higher than their relative abundance.

(4) Winter diets were composed as follows: grasses and sedges, 66 percent of cattle diets and 60 percent of horse diets; shrubs, 34 percent of cattle diets and 40 percent of horse diets; and forbs, no use observed. Preferred shrubs were winterfat, shadscale, four-wing saltbush, and Nuttall saltbush.

c. Dietary Quality and Nutrition.

The diets chosen by cattle were higher in nutritive value than those selected by horses, both in summer and in winter. Horse diets appeared to contain less than maintenance levels of crude protein during part or all of both summer and winter seasons.

d. Forage Utilization.

(1) Utilization levels, when adjusted to a metabolic body weight basis for comparison, were highest for horses alone, intermediate for common horse-cattle use, and lowest for cattle alone. This tends to support a higher animal unit equivalency for horses, although no quantification was made.

(2) Needleleaf sedge was highly preferred by both horses and cattle at all stocking rates and combinations during summer, followed by perennial grasses.

(3) Winterfat was highly preferred by both horses and cattle on winter treatments, across stocking rates.

(4) Trampling damage to herbaceous vegetation (grasses, forbs, sedges) was a highly significant component of utilization in summer, varying inversely with distance to water sources.

e. Animal Handling Facilities and Techniques.

(1) Conventional livestock handling facilities are not suitable for initial handling of wild horses. Cattle crowding alleys are too wide to handle them safely, and traditional livestock corrals are not high or strong enough to confine these animals. Corral fences should be high enough and solid to obstruct the horses' vision.

(2) Crowding alleys should be a maximum of 36 inches wide and divided by solid sliding gates at 10 feet intervals. A heavy-duty bucking chute facilitates haltering and handling of wild horses.

(3) Heavy-duty nylon strap halters with welded tie-rings should be used when haltering mature wild horses. A snubbing post makes handling safer and easier.

(4) If field pasture design includes an alley between pastures, it should be at least 35 feet wide so that horses can avoid contact with the fence.

(5) A New Zealand-type electric fence proved safe and effective in controlling feral horses. Horses should be conditioned to an electric fence before being released into electrically fenced pastures.

(6) Pasture gates should be 18 feet wide and wings should be built to make openings visible. Wood lath snow fence is inexpensive and satisfactory for building gate wings and temporary corral divisions.

(7) For weighing horses, a bucking chute can be mounted to a beam-type platform scale. A rubber mat should be placed on the floor to prevent slipping.

(8) When studying confined animals, only one stallion should be in a pasture group. New horses should not be added to established bands without a 4- to 6-week adjustment period prior to field use. If only mares are being studied, field observations may be more difficult because the animals are not prone to band into one tight group. Domestic horses add a calming influence when pastured with wild or feral horses, and aid in herding.

12. Census Methods for Wild Horses and Burros

Principal Investigator: Dr. Donald B. Siniff, University of Minnesota

Period of Study: 1980-1983

Funds Expended: \$283,000

Summary and Conclusions:

Various methods for estimating numbers of wild horses and burros were evaluated, together with environmental and other factors which may affect census accuracy. Methods were tested on herds in pinyon-juniper cover and low shrub cover, as well as in flat terrain versus rolling and dissected topography. Environmental variables studied were extent of snow cover and cloud cover. Method-related variables addressed were marking techniques and strategies, types of aircraft, observer experience, and sampling design. Animal-related variables were group size, seasonal behavior, distribution patterns, and movement.

Results were incorporated into a Census Handbook that outlined suggested procedures for conducting census and analyzing the results. Conclusions are summarized as follows:

a. Past census efforts by BLM and the Forest Service which relied on complete counting of herds have been inaccurate by amounts ranging from 7 to 60 percent, depending on terrain, cover type, and species observed.

b. Accurate estimation of animal numbers over large areas will depend upon aerial survey and requires calibration of an index using either marked animals or animal removal.

c. For use in simple aerial counting, a Piper Supercub plane is recommended. The extra expense of a helicopter is not justified in terms of increased accuracy.

d. The results of a census can be significantly affected by several variables (observer experience, presence of marked animals, snow and/or cloud cover, band size, etc.) which can be adjusted for to some extent in census design. In updating a previous census, consistency in methods is required.

13. Adult Mare and Foal Survival Rates

Principal Investigator: Dr. Donald B. Siniff, University of
Minnesota

Period of Study: 1981-1983

Funds Expended: \$70,000

Summary and Conclusions:

Samples of wild horses on the Pah Rah and Pine Nut Mountain Herd Areas in Nevada were marked with color-tagged and radio transmitter-equipped collars between 1980 and 1981. Periodic aerial observation of these animals continued through 1982 to estimate rates of mortality and foaling.

Foaling rates on the 2 herd areas were 53 percent and 64 percent in 1981 and 30 percent and 69 percent in 1982. Foal mortality rates were 15 percent and 33 percent in 1981 and 10 percent and 2 percent in 1982. On the Pah Rah area, 45 percent of mares foaled both years of the study, 34 percent foaled 1 year, and 21 percent did not foal either year. On the Pine Nut herd area, the corresponding rates were 10 percent, 62 percent, and 28 percent, respectively.

Changes in range condition across years (defined in terms of gross forage production) appeared to cause corresponding changes in foaling success.

14. Wild and Free-Roaming Horses and Burros

Investigator: National Academy of Sciences, Board on Agriculture
and Renewable Resources, Committee on Wild and Free-Roaming
Horses and Burros. Frederic H. Wagner, Chairman

Period of Study: 1979-1983

Funds Expended: \$280,000

Summary and Conclusions:

The committee published a Phase I report in 1981 containing current knowledge and recommended research on wild horses and burros. It published a final report in October 1982 which synthesized the results of completed research on wild horses and burros and made management-related recommendations to the agencies. The reports have been provided to all field offices.