United States Department of the Interior

TAKE PRIDE IN AMERICA

BUREAU OF LAND MANAGEMENT
Ely District Office
HC 33 Box 33500
Ely, Nevada 89301-9408

IN REPLY REFER TO:

IN REPLY REFER TO:
4710 (NV-042)

Dear Reader:

Through a letter mailed to you about a month ago, you were informed that the Ely Field Office was planning to remove excess wild horses from the Monte Cristo/Sand Springs Complex Herd Management Areas. The purpose of the gather is to achieve AML and to continue research using the fertility control vaccine. The gather is set to begin on or about January 19, 1998.

Since the notification letter was mailed, we have had an opportunity to use the population model developed by Dr. Stephen Jenkins of the University of Nevada, Reno to predict and compare the results of several different management strategies on the Monte Cristo/Sand Springs complex. The results of the computer simulations are explained and summarized in the attached paper. If you have any questions, please contact Shane DeForest at (775) 289-1866.

Sincerely,

James Perkins
Assistant Field Manager
Renewable Resources
Ely Field Office

1 Enclosure
1. Population Model Simulations

RECEIVED
JAN 28 1999
DEPT OF ADMINISTRATION
DIRECTOR'S OFFICE

MONTE CRISTO/SAND SPRINGS COMPLEX

HERD MANAGEMENT AREAS

POPULATION MODEL SIMULATIONS

Prepared by
Shane DeForest
Ely Field Office
Wild Horse and Burro Specialist

January 7, 1999

1. **Introduction**

The Ely Field Offices will be gathering wild horses from the Monte Cristo and Sand Springs Complex Herd Management Areas (HMAs) beginning on or about January 19, 1999. The complex includes the Monte Cristo (NV 402), Sand Springs East (NV405), and Sand Springs West (NV630) HMA's. The appropriate management level (AML) for the complex is 542 horses (236 Monte Cristo, 257 Sand Springs East, and 49 Sand Springs West). The most recent census' placed the current population at over 1,500 (696 Monte Cristo, 724 Sand Springs East, 82 Sand Springs West) animals.

Two of the three HMAs in this complex (Monte Cristo and Sand Springs east) have been selected to contribute to continuing population level fertility control research. The current research was designed to study the effect of immunocontraception on a population scale using three different isolated populations of mares. This treatment project is the final group of horses for this aspect of the research program for 1998/1999.

Field research into the performance of this type of vaccine was begun in the Antelope/Antelope Valley HMAs in 1992, and has included the Nevada Wild Horse Range in 1996, and the Kamma Mountains, Antelope, and Antelope Valley HMAs in 1998. The 1998 formulation of the immunocontraceptive vaccine that will be used on this final group of horses was developed using information obtained from previous years research .

The Development of an effective multi-year fertility control vaccine could be used to regulate the level of wild horse population growth reducing the number of horses that would need to be gathered nationally each year. A second potential benefit of developing a successful immunocontraceptive vaccine could be realized through cost savings associated with a decrease in the frequency of return gathers to conduct herd maintenance by removing excess wild horses. The research is being conducted by John W. Turner, Jr., Ph.D., Jay F. Kirkpatrick, Ph.D., and Irwin K. Liu, Ph.D.

2. **Project Objectives**

a. **Objectives of the Fertility Control Study**

<u>Research Team</u>

The continuation of the 1998 treatments into the Sand Springs/Monte Cristo complex is the third and final step of the current fertility control research using the one shot, one year vaccine. The study design for this aspect of the fertility control research involved the use of three separate and isolated populations of wild horses. The fertility control drug is to be administered to two populations of wild horses; a third population will not be treated and will serve as a control. The effectiveness of the immunocontraceptive vaccine in limiting population growth will be determined by foal counts in each population over the next three years. The goal of the field study is to treat as many mares as possible in each treated population in order to determine what effect the treatment would have on limiting the growth of the herd.

Bureau of Land Management's Wild Horse Management Study

The BLM will be conducting its own evaluation of the management potential of the immunocontraceptive vaccine. The objectives of the BLM, with respect to this phase in the field studies, is to establish baseline information to determine what effects various levels of treatment will have on population growth on both the short and long term. A second facet of the BLM evaluation will be to determine, through modeling, if lower, more manageable growth rates can be achieved through immunocontraceptive use. Finally, BLM hopes to evaluate the utility of administering the contraceptive using darts and compressed air guns during the 1998 gather. BLM intends to determine if those objectives are met through monitoring population growth and evaluating the 1998 process by conclusion of the calendar year 2000.

b. Objectives of Population Modeling

In an attempt to predict the effect of the gather and the implementation of fertility control on a large number of animals, two computer simulations were run using the wild horse population model developed by Dr. Stephen Jenkins of the University of Nevada, Reno. The first simulation was based on a selective removal of horses five years of age and younger and no fertility control measures implemented on the horses released back to the range. The second simulation was based on a selective removal of horses five years and younger and fertility control measures implemented on horses age six and older prior to their release back to the range.

The population model uses data on survival and reproductive rates of wild horses to predict population growth. The model uses a random process to simulate unpredictable future variation in survival and fecundity, reflecting the fact that future environmental conditions that may affect wild horse populations cannot be known in advance. The model uses a series of trials to project a range of possible population sizes after a given number of years, which is more realistic than predicting a single, specific population size.

2. Procedures

Gather Methods/Fertility Control

The BLM will gather approximately 85 to 90 percent of the total population of wild horses inhabiting the Monte Cristo HMA and approximately 70% of the Sand Springs East HMA. Horses will be gathered via helicopter trapping. After trapping, horses will be sorted according to age and sex. All mares in the Monte Cristo and Sand Springs East HMAs that are six years of age and older (approximately 220 to 230), will be treated with a revised immunocontraceptive vaccine which includes three doses of porcine zona pellucidae (PZP) and two doses of adjuvant (enhances response of body to PZP). All treatments will consist of a single injection. This vaccine will render the mare infertile for one breeding season. Treatment will be administered as a single 1 cc. injection by pneumatic blow dart while each mare is in a squeeze stockchute. Of these mares, approximately 100 to 150 will be used as the core study group and may be permanently marked for tracking purposes during the monitoring phase of the study. If permanent marking is opted for, the mark will consist of a single four inch letter or number which will be freeze branded to the upper left hip.

Wild horses that are under six years of age will also be gathered and most will be removed from the range and placed in BLM's national Wild Horse and Burro Adoption Program. Horses placed into the adoption program will not be treated with the immunocontraceptive vaccine. If young horses are released back onto the herd area, they will be vaccinated.

Population Model

The basic parameters required by the model are initial population size, age-specific survival rate, age-specific fecundity (reproductive) rates for females, and sex ratio at birth. The initial population size was determined using the most recent census figures. The model was allowed to compute an age distribution for a "normal" population. This data was assumed to be accurate due to the fact that neither HMA had experienced significant gathers, and the gather in Sand Springs East had been a gate cut, meaning that all ages were removed to a target number.

Age-specific survival data are lacking for the Monte Cristo and Sand Springs East HMA horses. The initial survival rates used were those from the Garfield Flat, Nevada area, where a long-term study, which began in 1992, is in place. The model values for the foaling rate were used due to a lack of site specific data. These values varied by age from a low of 0.41 for ages 3 through 5 to a high of 0.55 for ages 6 through 10. The sex ratio at birth was assumed to be 50-50.

The model uses coefficients of variation, which are indices of year-to-year variation in adult mortality, foal mortality and foaling rate, to simulate unpredictable variation in environmental conditions. Estimating these coefficients requires long-term demographic data, which are unavailable for the study area. Therefore, the program default values were used.

The model was run under two sets of conditions: one using no fertility control and the other assuming a one year fertility drug was used that was 95 percent effective. Other initial conditions for the simulation included a 10 year management period, 85% of horses are gathered (15% are able to elude capture), all horses 0-5 years of age that are captured are removed and no horses six years or older are removed, gathers occurred when the population exceeded 567 and numbers were reduced to 419 (the range of AML for the area). This ensures a gather will take place the first year, as the population currently exceeds 567. For both simulations, 50 individual trials were run (20 trials is the default). Each trial with the model will give a different pattern of population growth; some trials may include mostly "good" years, others may include a series of several "bad" years in succession. This approach to modeling population growth uses repeated trials to project a range of possible population sizes after a given number of years, which is more realistic than predicting a single, specific population size (Jenkins, Wild Horse Population Model, Version 3.1, User's Guide). Table 1 depicts the initial population parameters for the Sand Springs/Monte Cristo Complex.

For a detailed description of the model, see the User's Guide, Wild Horse Population Model, Version 3.1 (Jenkins 1996), available upon request.

Table 1.

INITIAL POPULATION PARAMETERS					
Age	**Initial**		**Survival**		**Fecundity**
	Females	Males	Females	Males	
0	151	121	.976	.917	.000
1	67	37	.977	.972	.000
2	95	109	.997	.972	.410
3	105	56	.976	.991	.410
4	67	46	.975	.991	.410
5	47	22	.973	.991	.550
6	53	37	.972	.991	.550
7	63	54	.971	.990	.550
8	37	30	.969	.990	.550
9	26	17	.967	.987	.550
10	27	20	.965	.988	.550
11	11	9	.962	.986	.470
12	14	21	.959	.984	.470
13	13	13	.955	.981	.470
14	5	0	.951	.978	.470
15	7	4	.950	.973	.470
16	0	0	.940	.967	.470

17	0	0	.934	.959	.470
18	1	7	.927	.948	.470
19	0	0	.919	.933	.470
20	12	14	.909	.914	.470
21	0	0	.898	.889	.470
22	0	0	.886	.857	.470
23	0	0	.872	.816	.470
24	0	0	.856	.764	.470
25	0	0	.000	.000	.470
Total	**805**	**617**	-	-	-

4. **Results of Population Modeling**

Before discussing the results of the population model, it is important to understand that population modeling has some drawbacks. The most important of these according to Jenkins is that results may be taken too seriously as predictions of what will happen to a particular population in the future. What we are really doing with the Wild Horse Population Model when we try to project population growth is saying: **If** a set of assumptions about survival, reproduction, environmental variability, and management actions hold true, **then** we expect the population to grow at a certain rate determined by the model. In other words, the results of this model, like those of any model, depend on its assumptions, and the user must always keep those assumptions in mind when interpreting the results. The most appropriate and effective way to use the model is for comparison of population growth under various conditions. The model is specifically designed for comparing fertility control and removal as management strategies (Jenkins, Wild Horse Population Model, Version 3.1, Users Guide).

The model was run for a ten year period (1998-2008) for both simulation using the assumptions listed on page 3. The model indicated that there would be an average of 131 foals produced in the year 2008 with fertility control and an average of 125 foals produced without fertility control. This is a 9.5% increase in foal production in 2008 using fertility control, but foal production of the treated group returns to an average of 135 in the year 2001, which is slightly above normal.

The model indicates that by the end of the 10 year period, the overall population with fertility control implemented once every 3 years (assuming that fertility control is used during every scheduled gather) would be around 573 total animals verses around 587 total animals if no fertility control is implemented, but animals age 5 and under are removed from the range once every 3 years (Tables 3 and 4, Age Distribution by Year, Initial vs. Final Age Distribution - with and without fertility control). The mean population growth rate per year with fertility control was projected to be 16.8% with fertility control and 20.4% without fertility control over the 10 year period (Table 5, Average Growth Rate per Year). The fertility control project would not have a significant impact on the sex ratio of the horses. The projected sex ratio in 1998 without fertility control was 57% female/43% male and at the end of 10 years it was projected to be 50% female/50% male. The sex ratio with fertility control was 56% female/44% male in 1998 and 50% female/50% male in 2008.

Table 2.

INITIAL vs. FINAL AGE DISTRIBUTION
(0-5 Year Olds Removed, Gather every 3 Years with Fertility Control, Years 1998-2008)

Age	Initial		Most Typical		Least Typical	
	Females	Males	Females	Males	Females	Males
0	155	120	67	64	30	34
1	67	37	13	13	43	38
2	95	109	0	2	20	31
3	105	56	13	10	28	28
4	67	46	2	3	18	10
5	47	22	0	1	7	0
6	53	37	0	0	1	26
7	62	54	1	0	5	6
8	37	30	1	1	2	4
9	26	17	3	1	9	8
10	27	20	4	4	2	4
11	11	9	1	0	0	0
12	14	21	2	4	1	2
13	13	13	14	9	7	6
14	5	0	6	8	2	4
15	7	4	4	4	2	2
16	0	0	39	31	15	25
17	0	0	37	42	21	33
18	1	7	22	24	15	16
19	0	0	13	13	3	7
20	12	14	20	16	7	12
21	0	0	5	5	0	2

22	0	0	9	9	1	8
23	0	0	8	5	1	2
24	0	0	2	0	1	0
25	0	0	2	1	0	0
Total	**805**	**617**	**288**	**270**	**254**	**309**

Table 3.

INITIAL vs. FINAL AGE DISTRIBUTION (0-5 Year Olds Removed, Gather every 3 Years with no Fertility Control, Years 1998-2008)						
Age	**Initial**		**Most Typical**		**Least Typical**	
	Females	Males	Females	Males	Females	Males
0	155	121	65	60	43	34
1	67	37	12	12	31	25
2	95	109	9	9	12	38
3	105	56	6	6	12	15
4	67	46	1	2	7	9
5	47	22	2	1	7	5
6	52	37	1	1	9	9
7	62	54	4	2	3	0
8	37	30	3	2	5	10
9	26	17	5	2	4	7
10	27	20	4	3	1	3
11	11	9	1	1	1	1
12	14	21	2	3	1	3
13	13	13	12	6	11	7
14	5	0	12	9	5	5
15	7	4	3	4	3	1
16	0	0	41	32	26	29
17	0	0	46	50	18	48
18	1	7	23	24	13	24
19	0	0	16	12	5	12
20	12	14	18	18	8	12
21	0	0	8	6	1	7

22	0	0	8	13	1	7
23	0	0	4	8	0	5
24	0	0	2	0	0	0
25	0	0	2	1	0	0
total	**803**	**617**	**310**	**287**	**227**	**316**

Table 4.

AVERAGE GROWTH RATE PER YEAR (%)		
Trial	**With Fertility Control**	**No Fertility Control**
1	14.4	21.8
2	17.3	22.8
3	15.6	16
4	17.5	23.5
5	18.8	22.4
6	21.0	20.5
7	14.8	22.3
8	18	23.4
9	8.8	21.1
10	19.2	18.9
11	12.8	23.8
12	15.8	17.7
13	15.2	18.1
14	19.4	21
15	18.1	19.8
16	15.4	19
17	14.8	19.8
18	17.8	25.4
19	8.1	21.2
20	17.6	24.7
MEAN	16.8	20.4
MINIMUM	8.1	10.0

MAXIMUM	21.0	25.4
LO LIMIT	16.0	19.6(95% confidence limits)
HI LIMIT	17.7	21.2% (95% confidence limits)

5. Summary

Implementation of fertility control measures should have a significant impact on foal birth rates in the year 2000. However, 1999 Birth rates will be normal to above normal, and survival of this generation would be expected to be higher. In suceeding years after 2000, birth rates should return to normal to above normal and the phenomenon of higher survival, higher birth rates, and greater recruitement would be expected to continue for several years. This rebounding phenomenon would occur due to several factors including less competition for forage as a result of gathers, and higher body condition ratings for both mares and foals after each effective fertility control treatment ends.

On the long term, the impacts of fertility control on the overall horse populations in both HMAs appears to be nominal as compared to no fertility control in the Sand Springs and Monte Cristo HMAs (Table 5). The overall growth rate at the end of ten years is lower when fertility control is implemented, but rebounds to above normal levels after the contraceptive effects are no longer active. The difference in horse numbers at the end of ten years appears to be not more than 39 animals.

Table 5. Impacts of Different Management Strategies

Management Strategy	Population Crash	Lowest Population Level within 95%confidence level	Mean Lowest Population Level	Year AML First Reached	Growth Rate
0-5 removed; no fertility control	No	565	587	2008	20.4%
0-5 year olds removed; fertility control implemented	No	535	573	2008	16.8%

Both management scenarios investigated here resulted in more horses in the 16 to 25 year age category as a consequence of regular large scale removal of 85 to 90% of the younger age classes under the selective removal policy. The dramatic skewing of the population following each gather is offset somewhat by the actual capture rate of 85-90% of the population. This occurance ensures that 5-10% of adoption eligible

horses evade capture in a given gather providing for some level of recruitement regardless of management efforts.
The computer model indicated that AML would not be reached within the evaluation period, however, it did indicate that the numbers could be reduced to within the upper range of the AML (within 15% of the AML), by 2008.

Other impacts of fertility control verses no fertility control can be seen in Table 6. This table shows the overall number of horses gathered, removed and treated during a ten year period with and without fertility control. As can be seen from the table, fertility control results in fewer foals being conceived which results in fewer horses gathered, removed and treated with the immunocontraceptive vaccine. It is here that the real value of achieving a multiyear vaccine could be realized.

Table 6. Number of Horses Gathered, Removed and Treated Over Ten Year Period

Management Strategy	Mean Number of Horses Gathered	Mean Number of Horses Removed	Mean Number of Mares Treated
0-5 Year Olds Removed, No Fertility Control Implemented	3831	2278	0
0-5 Year Olds Removed, Fertility Control Implemented	3524	1983	769

With the current one shot-one year vaccine, and regular interval gathers when AML is exceeded, the cost savings achieved with immunocontraceptive use are as follows:

	Horses gathered	Horses Shipped	Vaccinated
W/fertility control	3524	1983	769
W/out fert. control	3831	2278	0
difference Horses /vaccinated	307	295	769

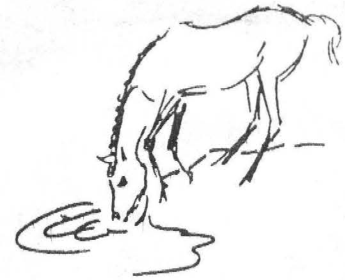
Dollar savings	+ (300.00 per horse to capture)	307 X 300.00 = 92,100.00
	+ (440.00 per horse to adopt)	295 X 440.00 = 129,800.00
	- (60.00 per horse to vaccinate)	769 X 60.00 = 46,140.00
	Totals (savings)	175,760.00

Ultimately, a vaccine which is effective for two or three breeding season and eliminates the need for frequent gather operations and fewer vaccination sessions would result in a realization of even higher savings. Money saved in gather and processing costs could be spent on habitat and resource management.

1-26-99

WHOA

WILD HORSE ORGANIZED ASSISTANCE
P.O. BOX 555
RENO, NEVADA 89504
(702) 851-4817



. . . a note from

Dawn Y. Lappin

Mr. James Perkins, Asst. Field Manager
Bureau of Land Management
HC 33, Box 33500
Ely, NV 89301-9408

Dear Mr. Perkins:

Thank you for the copy of the Monte Cristo/Sand Springs Complex HMA's Population Model Simulations. We appreciate being advised as to how the District came to the conclusions regarding how the vaccine would work with the current populations.

We support the continued field application of the vaccine for purposes of limiting the reproduction in the herds. So long as this vaccine is reversible, the affects of this vaccine in limiting production will be invaluable in the near future. We urge caution only where herds are small, their exact movements are unknown. Monte Cristo was one of the first areas I worked, with permittees, to try and bring about some resolution of the problems.

Again, we appreciate Mr. DeForest's efforts in behalf of the wild horses.

Dawn

P.S. Please note I have included the labels from <u>two</u> mailings so that you might remove the extra.

Most sincerely,

Dawn Y. Lappin (Mrs.)
Director