## Appendix C. Calico Mountains Complex Population Modeling

### Objectives of Population Modeling

Some of the questions this modeling helps to answer:

- What effect does fertility control have on the population **growth rate**?
- What effects do the different alternatives have on the **average population size**?
- Do any of the action alternatives **"crash"** the wild horse population in this HMA?

### Population Data, Criteria, and Parameters

Age-sex distribution data was compiled from the 2004 Calico Mountains HMA capture data records (620 animals) and rescaled to the current population estimate of 3,095 head for the Calico Mountain Complex. This HMA population is expected to be representative of all HMAs in this Complex. The rescaled age-sex distribution was then used to represent the Calico Complex age-sex structure. The Garfield data set supplied with the WinEquus population model was used for survival probabilities and foaling rates. These data were collected by M. Ashley and S. Jenkins at Garfield Flat, Nevada between 1993 and 1999. Marked individuals were followed for a total of 708 animal-years to generate these probabilities.

Simulations (100 for each alternative) were run with applicable management options selected for a time period of ten years. Population parameters were set to keep the population size between the low AML of 572 and the high AML of 952 by each alternative. Other parameters included: minimum gather cycle of three years, foals included in the AML, "no" gather for fertility control regardless of population size, and "yes" continue gather to treat females.

- Alternative 1, the Proposed Action modeled the affects of removal, fertility treatment, and releasing more studs to maintain a sex ratio of approximately 40% female and 60% male in the post gather population.
    - Under a 80% gather efficiency scenario
    - Under a 90% gather efficiency scenario
- Alternative 2, modeled affects of removal actions only.
- Alternative 3, No Action modeled the growth of wild horse populations with no management actions.

### Population Modeling Results & Discussion

Out of 100 trials (or samples) in each Alternative simulation, the model tabulated minimum, average, and maximum population sizes over a gather period of ten years. Results for each Alternative, including both the 80% and the 90% gather efficiencies applicable to the Proposed Action are summarized in Table 1 below.

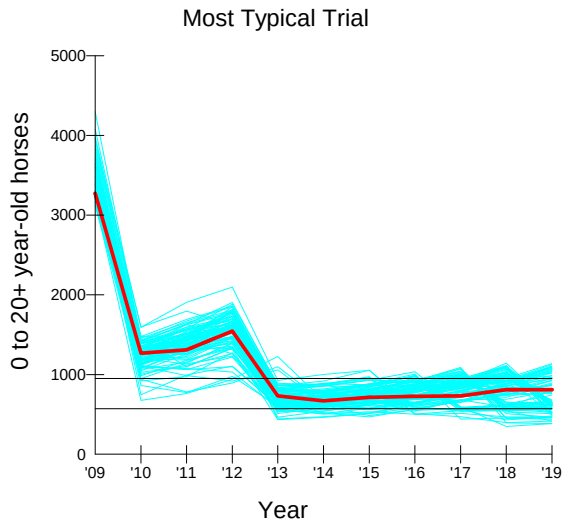
The Proposed Action at 90% gather efficiency minimizes the number of horses removed over a ten year period, thus this alternative provides the greatest long-term cost savings as fewer horses would be put into short and/or long-term holding. It also minimizes management of the herds with an expected gather cycle of about every five years. However, the annual growth rate of 1-6% would is too low to be sustainable over time. The Proposed Action at 80% gather efficiency results in an acceptable annual growth rate over time, lengthens the gather cycle up to two years and reduces the average population size and number of animals removed as compared to Alternative 2 or removal actions only.

**Table 1. WinEquus Modeling Results by Alternative.**

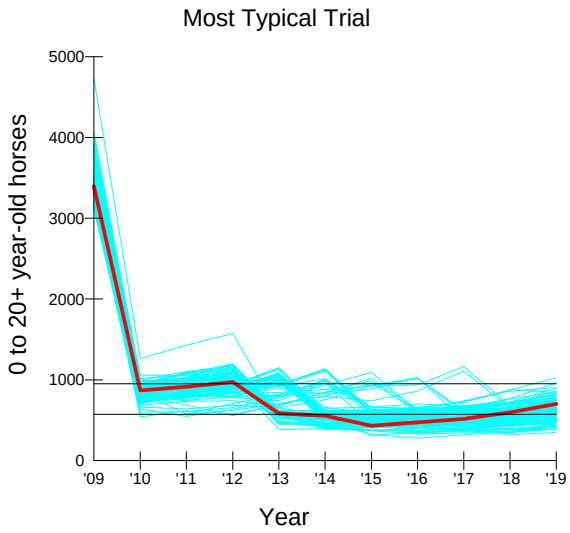
| Alternative | Annual Growth Rate | Ave Population Size | Gather Cycle (over a 10 year period) | # Animals Removed (Average) (over a 10 year period) |
|---|---|---|---|---|
| Proposed Action (80% gather effic) | 5-10 % | 1,167 | every 3-4 years | 3,334 |
| Proposed Action (90% gather effic) | 1-6 % | 934 | about every 5 years | 2,782 |
| Alternative 2 | 14-21% | 1,329 | every 2-3 years | 4,456 |
| No Action | 18-23 % | 10,682 | N/A | 0 |

The low and high range AML (572 to 952 animals) is indicated on the graphs below by the parallal black lines. The red line indicates the **"most typical"** result (out of 100 modeling runs) for each alternative based on the applied management tools (removals, fertility control, sex ratio adjustment) over a period of ten years or numerous gather cycles. The corresponding blue lines display the **range** of expected results (out of 100 modeling runs) for each alternative. A drop in the line represents a decrease in the population due to a gather and associated management actions while a rise in the line represents population growth.

The Proposed Action which utilizes repeated fertility control treatments on release mares and adjusts the males sex ratio from about 50% to 60% over a period of ten years decreases the annual growth rate and expands the gather cycle while keeping the population size within the established AML range (572-952) over a ten year period as displayed in Graphs 1 and 2 below. However, at 80% gather efficiency, low AML is unlikely to be achieved as compared to the 90% gather efficiency after the proposed December 2009 gather, but is achievable with subsequent gathers. Graph 2 further indicates a 90% gather efficiency may not be necessary in subsequent gathers as 80% seems adequate (Graph 1) to maintain the population within the AML range. Gathers at 90% gather efficiency are highly unlikely to actually occur in this Complex due to the large scale of the habitat and wild horse movements. Gather efficiency would be expected to decrease as the overall population size decreases and as animals learn to avoid capture once released.

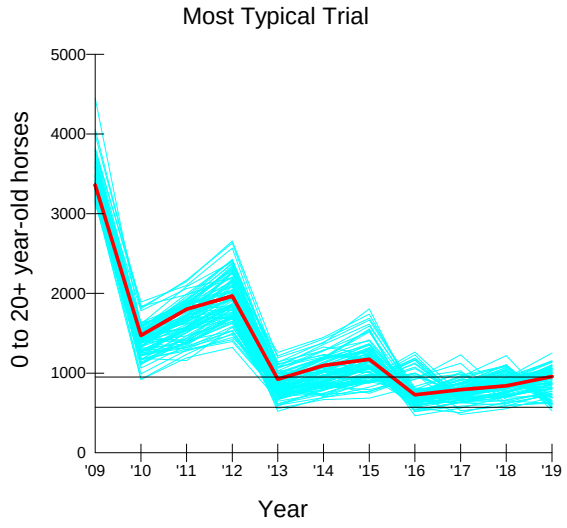



**Graph 1.** Proposed Action, 80% gather efficiency.

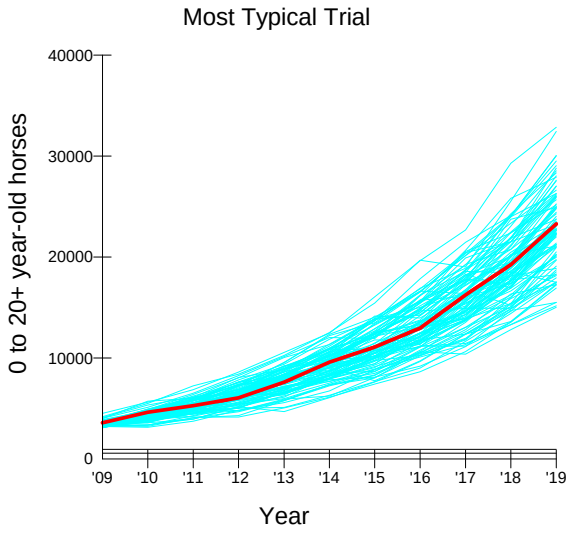



**Graph 2.** Proposed Action, 90% gather efficiency.

Alternative 2 results displayed in Graph 3 indicate that removals only at 80% gather efficiency would not be successful at achieving the low range AML at least not until the third scheduled gather. The No Action results are for comparison as the model does not account for limits of habitat capacities. At some point wild horse populations would exceed habitat thresholds (run out of forage, water, and space) and a population crash would likely occur.




**Graph 3.** Alternative 2. Removal Only.




**Graph 4.** Alternative 3. No Action.

**Summary**

Based on the modeling results and discussion above. The Proposed Action at the 90% gather efficiency is most likely to achieve a population at the low range AML with the proposed December 2009 gather. Continuation of the applied management tools (removals, fertility

control and adjustment to a 60% male sex ratio) per the Proposed Action at the 80% gather efficiency during subsequent gathers would insure annual growth rates are sustainable over time. The Proposed Action at 80% gather efficiency would result in the need for two gathers to occur before the low AML range is achieved. Either Proposed Action results are more desirable than Alternative 2 as the total number of animals removed are reduced and the gather cycle is lengthened. None of the alternatives indicate that a crash is likely to occur to the populations at least through the next two gathers cycles. However, future gather efficiencies would need to be monitored and adjusted as applicable given updated modeling parameters. It is also important to remember that these scenarios are based on modeling results and not on actual field results. Population modeling is used as a tool to help plan appropriate management actions.