

RESOURCE NOTES

NO. 26

DATE 07/20/00

Density Dependence in Population Dynamics of Feral Horses

*By: Stephen H. Jenkins, Ph.D.
Department of Biology/314
University of Nevada*

*The fourth in a series of 13,
Session 1*

Background

Populations of wild horses on rangelands in the western U.S. have the capacity for rates of increase as high as 20 to 25% per year. For this reason, intensive and expensive management is often necessary to reduce populations periodically to appropriate management levels. The effects of density on population dynamics of wild horses are not presently known although, in other species, negative density dependence can contribute to population stability. Negative density dependence implies that birth rate decreases or death rate increases as the density of a population increases. Several mechanisms may contribute to these processes, including competition for food, disease or parasitism, social factors, and possibly predation. Demonstrating the existence of density dependence in populations of wild horses doesn't preclude the need for active management, but may influence optimal decisions about management.

Discussion

Two general methods can be used to test for density dependence in population dynamics: experimental manipulations and statistical analyses of density estimates for unmanipulated populations. Choquenot (1991) showed experimentally that juvenile survival, and hence rate of population growth, depended on density for feral donkeys in Australia. However, this experiment was unreplicated, and rigorous experimental studies of the population dynamics of large, wide-ranging mammals such as wild horses and burros are difficult in general.

Therefore, I used time-series analysis of data for seven populations of wild horses in the western U.S. to look for evidence of density dependence. Data for two of these populations came from intensive ground surveys of known individuals (Berger, 1986 and L. Coates-Markle, personal communication). The remaining data came from aerial censuses. Despite the large amount of effort expended by BLM in censusing populations of wild horses, few available data sets meet the assumptions necessary for rigorous statistical tests of the hypothesis of density dependence. These assumptions are that the population should be relatively closed to immigration and emigration, that there should be a series of counts in the same season of successive years without intervening removals, that counts should

not be gross underestimates because of poor sighting conditions, and that there should not be illegal gathers and removals during the sampling period.

There were 5 to 21 years of usable data for the seven populations analyzed. I found negative relationships between growth rate and population size for all seven cases, although only one was statistically significant at the conventional 5% level. However, I used a form of meta-analysis (Rice, 1990) to calculate that the overall probability of getting the complete set of results purely by chance was only 0.001. If these seven populations are representative of others in the western U.S., this is strong evidence of negative density dependence in wild horses.

Conclusion

If the negative density dependence found in this study is strong enough in comparison to other factors that impact population dynamics, such as severe winters or droughts that cause density-independent mortality, then unmanaged populations of wild horses might eventually stabilize at their ecological carrying capacities. However, obvious degradation of habitat might occur at these population levels; i.e., appropriate management levels for horses may be substantially lower than ecological carrying capacities. Nevertheless, this analysis of density dependence implies that appropriate management levels should be

WILD HORSE AND
BURRO PROGRAM



carefully justified by sound scientific research, in order to forestall the potential argument that populations should simply be allowed to stabilize on their own.

Negative density dependence also implies that population growth rate increases as density decreases. This means that small populations may be able to recover more rapidly than expected based on their performance at higher densities. BLM should continue to monitor populations with aerial censuses; whenever possible, these censuses should be done in the same season of two or more successive years without intervening

removals in order to establish more clearly the details of density dependence so that more accurate population models can be developed. In addition, we need to collect specific data on the effects of density on survival and reproduction. The improved models resulting from these data will contribute to better prediction of potential effects of alternative management plans.

Sources

Berger, Joel. 1986. Wild horses of the Great Basin: social competition and population size. Chicago: University of Chicago Press, 326 p.

Choquenot, D. 1991. Density-dependent Growth, Body Condition & Demography in Feral Donkeys: Testing the food hypothesis. Ecology vol. 72(3): 805-813.

Rice, 1990: Biometrics 46:303-308.

Contact

Stephen H. Jenkins, Ph.D.
Department of Biology/314
University of Nevada
Reno, NV 89557
phone 775-784-6078
fax 775-784-1302
e-mail: jenkins@med.unr.edu



RESOURCE NOTES are intended to be early announcements of technical and informational topics for Bureau of Land Management personnel and some of their customers. Information in this RESOURCE NOTE is based on the opinion and experience of the author and has not been peer-reviewed. Conclusions and opinions expressed herein do not necessarily represent those of BLM. Use of trade names does not imply U.S. Government endorsement of commercial products.

If you have received a copy of or found out about RESOURCE NOTES in an indirect way and would like to be included in future mailings, please send the following:

NAME, TITLE, MAILING ADDRESS and a list of the two or three subject areas that you are most interested in or that most directly relate to your job. Send this information to Phil Dittbener, BLM, RS-140, P.O. Box 25047, Denver, CO. 80225-0047 or phil_dittbener@blm.gov or FAX 303-236-3508.

If you would like to prepare a RESOURCE NOTE for distribution, or you have an idea and author in mind for a good RESOURCE NOTE, please contact Phil Dittbener at 303-236-1833, FAX 303-236-3508 or phil_dittbener@blm.gov with the topic and the name of writer, including an address, phone number, and e-mail address.

Thank you for your interest in RESOURCE NOTES.



National Science &
Technology Center



Bureau of Land Management