

RESOURCE NOTES

NO. 27

DATE 07/20/00

Genetic Variation in Horse Populations

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*The fifth in a series of 13,
Session 2*

Background

One of the major focuses of conservation biology and genetic management of small populations is the preservation of genetic variability. This topic is of particular relevance to the Wild Horse and Burro Program because the majority of wild equid populations managed by the BLM are kept at population sizes that are small enough for the loss of genetic variation to be a real concern. Because a loss of genetic variability can lead to a reduction in fertility or viability of individuals in a population, it is critical that genetic considerations be included in management plans for wild equid populations. An important aspect of utilizing genetic information in management planning is an understanding of what is meant by the term genetic variation and how genetic variability can be measured in horse and burro populations.

Discussion

Genetic variation is the amount of inheritable diversity in a population or an individual. It can be observed as morphological variation in size, conformation or color, but we are actually concerned with variability of genes, whether we can observe an effect of this variation or not. There are several different measures of genetic variation but two of the basic ways it is expressed are heterozygosity, the proportion of genes variable within an individual, and some type of estimate of allelic diversity, such as the total number of genetic types observed within the population. All of these different measures of variation are calculated from data collected from sampling a small set of genetic marker systems in a sample of individuals from a population. Traditionally, the genetic marker systems used to measure genetic variation in horses are a set of blood group and biochemical genetic marker systems that have been developed for parentage verification analysis of domestic horses. The blood group systems are tested by analysis of variation of antigens on the surface of red blood cells using specific antibodies and standard serological techniques. The biochemical genetic systems are serum

or red cell proteins or enzymes detected by electrophoretic methods (relating to a method of separating large molecules such as DNA fragments from a mixture of similar molecules by passing an electric current through a medium containing the mixture - separation depends on each molecules electrical charge and size). Blood group testing requires a fresh blood sample with intact red blood cells. Biochemical genetic testing can utilize frozen blood or other tissues such as a muscle biopsy. At the University of Kentucky, we routinely test seven blood group and ten biochemical genetic systems so that genetic variability measures are based upon data from seventeen genetic loci.

Analysis of genetic variation in populations also is done by use of DNA genetic marker systems. In horses, these DNA systems are primarily a type of genetic marker called microsatellites. Microsatellites are highly variable sections of DNA that can be tested by use of PCR (polymerase chain reaction - a method for amplifying a DNA base sequence) and electrophoretic techniques. Direct testing of DNA can utilize almost any bodily product including hair (if the hair root bulb is

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present) or even feces. The estimates of genetic variation we can get from these techniques perhaps do not accurately correspond to total genomic variation, although that is not certain. However, with a sufficient comparative database, these measures can be used to determine the variation within a population as it compares to other horse populations and can be used to make inferences about the

genetic health of the population at the time of sampling.

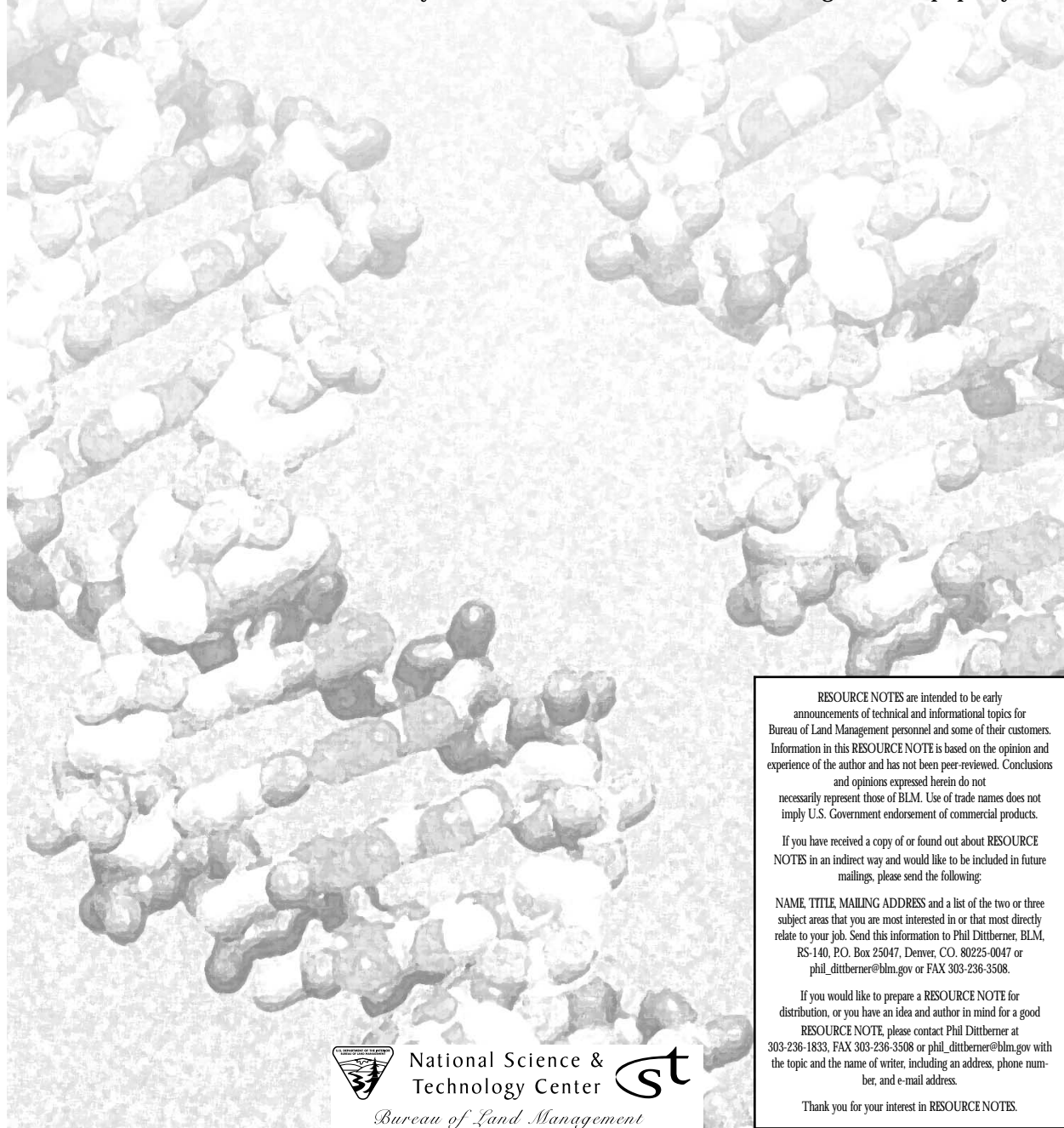
Conclusion

Genetic analysis of wild horse and burro populations can provide valuable information about current levels of genetic variation. This information can then be used to make predictions about how particular management strategies will influence genetic variation in the herd. Thus, genetic analysis can be a useful tool in

the overall management of wild horse and burro populations on public lands.

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