

Island Horses' Genetic Diversity Evaluated

By Susan Bratton, Robin Goodloe
and Robert Warren

Unlike most species of feral animals in NPS areas, free ranging horses have been considered a potential historic resource. For the barrier islands along the Atlantic coast, tales of Spanish mounts washed ashore from shipwrecks dominate the popular literature on the origins of the isolated herds. The management of island equids has long been controversial. The horses themselves are very popular with park visitors. Feral equids can, however, become campground pests or endanger people who expect them to behave like pets. The larger populations, such as that on Cumberland Island, GA, heavily utilize native marsh and inter-dune vegetation, which can encourage local soil erosion via grazing and trampling. Maintenance of "historic" horses may thus conflict with other natural resources management objectives.

In 1986 and 1987, a research team from U/GA, Athens, collected blood samples from feral horses on Cumberland Island National Seashore, and Cape Lookout National Seashore (Shackleford Banks), NC, by immobilizing adult animals with etorphine hydrochloride and xylazine hydrochloride. (Initial attempts at immobilization resulted in two deaths due to capture

myopathy. This problem was corrected by administering sodium bicarbonate – physiological solution intravenously to animals while they were immobilized.) The team also collected blood from ponies on Cape Hatteras National Seashore (Ocracoke Island) and from Chincoteague National Wildlife Refuge on the southern end of Assateague Island when the animals were corralled for annual veterinary care. Samples were sent to the laboratory of Dr. E. Gus Cothran in the Department of Veterinary Science, University of Kentucky, where standard starch gel and polyacrylamide gel electrophoresis were used to assess genetic variability at 10 enzyme or protein loci. In addition, red cell alloantigens at six blood group loci were detected using standard immunological procedures. These types of analyses had already been performed for many breeds of domestic horses, so genetic resemblance between populations could be easily determined.

The study looked first at measures of genetic diversity including heterozygosity and the number of alleles per locus. All 16 loci analyzed were polymorphic in at least one of the populations, and 10 were polymorphic for all of them. The samples from Assateague Island had the greatest degree of polymorphism. The four island horse populations tended to share the same

predominant or fixed allele at each locus and these, in general, corresponded to the predominant allele in domestic horses. All alleles identified had already been reported for domestic horses, implying the barrier island herds did not possess any unique genetic material found only in feral populations.

The results also provided little evidence of inbreeding. No significant deficiency in mean multilocus heterozygosity was apparent, although the mean number of alleles per locus in some feral herds was slightly lower than the mainland breeds. This, however, may have been the result of small sample sizes. The Assateague Island sample produced 74 of the 95 alleles known to occur at the loci analyzed, which suggests the Assateague Island herd is quite genetically diverse and harbors a high proportion of all domestic horse alleles.

The greatest genetic similarity among the island populations was between the Assateague Island and Cumberland Island populations, although there is no historic evidence to suggest they arose from common stock. When compared to domestic breeds, Cumberland Island horses were similar to Tennessee Walkers, while Assateague Island ponies were similar to Belgian workhorses and Shetland ponies. Since individuals of the latter breed were introduced into the Assateague Island population in the early 1900s, the similarity is not surprising. Comparison to other breeds suggests the island horses do not represent a unique gene pool from a common ancestral strain, nor are they more similar to one another than they are to various domestic horse breeds.

From a managerial perspective, the data indicate there is little reason to treat the barrier island horses as a unique or valuable genetic resource and little evidence that any of the herds represent a specific historic Spanish bloodline. This conclusion is supported by park records and oral history.

Efforts to outbreed and improve the coloration in the Assateague Island herd resulted in the introduction of Shetland ponies in the early 1900s. More recently, two Spanish barb stallions and 40 western mustangs were released on the island. On Hatteras Island there have been similar infusions of Thoroughbred, Arabian, Quarter Horse and Spanish mustang blood. The original Cumberland Island stock included saddle horses, circus horses, and western mustangs released in the 1920s as well as more recent arrivals, such as an Appaloosa stallion, whose progeny may still be seen in the wilderness area. The horses on Shackleford Banks probably derive primarily from stock brought to the island after the 1899 hurricane, and may be a mix of Hatteras Island animals, Quarter Horses, Tennessee Walkers and other breeds.

Although free range horses and ponies have been present on some of these islands since the colonial period, the present genetic composition of the herds does not appear to derive solely from relict early Spanish or English releases, but rather is the product of breeding activities conducted over the years by island residents. The Cape Hatteras horses, in fact, have a close genetic resemblance to Standardbred horses, a breed that developed in the United States in the late 17th and early 18th century. It would, in fact, be difficult to select the herd that is the most historic. All have recent genetic additions, and at least two (Shackleford Banks and Cumberland Island) may derive primarily from post-1900 introductions.

If feral equids remain on the coastal barrier islands
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Lincoln Boyhood Vegetation (Continued from page 22)

green dragon, both species having toxic calcium oxalate (a deterrent to hogs), and poison ivy and the fact that the Lincolns had hogs. The forest showed no evidence for selective cutting of the overstory. Unlike the surrounding communities that were pastured in the 19th century, this stand lacked rank growth of Japanese honeysuckle. The other remnant was a small pin oak and bitternut hickory flatwoods at the western edge of the park. This remnant forest and xeric west-facing successional forests were similar in composition to presumed presettlement stands.

By the turn of the century, all the land surrounding the old growth forest was used for pasture. During the late 1920s or early 1930s a large portion of LIBO was reforested by the Civilian Conservation Corps. Plans indicated the intent of planting a wide variety of species; however the existing stand composition has low species diversity and fails to represent a natural community for this region. The overstory is a mixture of tulip tree and red or sugar maple. Sugar maple and tulip tree were introduced to the area at this time. The majority of the other forest types failed to compare with natural communities due to the predominance of shade tolerant and fire intolerant mesic species (such as red and sugar maple), the absence of oaks and hickories, the lack of herbaceous cover, and the ubiquity of Japanese honeysuckle.

Critical Management Issues

Critical management issues identified included the abundance of Japanese honeysuckle, vegetation inertia in abandoned homesites caused by exotic perennial lawn grasses, absence of oaks and hickories in the majority of the planted forests, the invasion of sugar maple and to a lesser extent tulip-tree into the old growth forest and the low abundance or absence of spring ephemeral herbs. Prescribed burning in some sections of the park may eliminate the invasion of shade tolerant and of fire sensitive tree species.

Management experiments to eliminate Japanese honeysuckle demonstrated that efforts may be most successful under a forested canopy where prolific growth is

absent. Use of glyphosate may also eliminate the few herbs present in these anthropogenic communities, unless it is applied in the fall after herb die back. Trial plantings of spring ephemeral herbs indicated that ground cover restoration is possible. Glyphosate was shown to reduce the cover of exotic perennial grasses in old lawns and allow invasion of successional herbs. Although the herbicide fails to kill all of the grasses, a somewhat natural successional process has been initiated.

Oak trees (black, white and pin) that were planted in the old field showed deer browse, which may be why old field succession has been so slow. During the final sampling, seedlings of shingle oak were found and the presence of these was taken as a positive sign for natural establishment of large-seeded tree species.

Restoration priorities were based on a quasi quantitative numerical ranking system divided into the following categories: ecological significance, historical significance, relative restoration cost, urgency for and practicality of restoration. Although all categories were given equal weights, they could be weighted to give certain categories greater importance. Stands given high priority include the upland old growth forest and the bottomland forest.

Forest restoration to approximate the presettlement vegetation at Lincoln Boyhood will require a long-term concerted effort of management. Restoration will require innovation, creativity, and monitoring. Failures may be expected. Those attempting to achieve the vision of an approximate oak-hickory forest should not be discouraged by failures and setbacks. All such efforts will contribute to our knowledge of community restoration.

Copies of the 106-page report may be obtained from the Superintendent, Lincoln Boyhood National Memorial, Lincoln City, IN 47552.

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(the decision presently is made on a park-by-park basis), it would be desirable to maintain the populations at as small a size as possible to prevent vegetation damage. If the population is too small, however, and is isolated from other potential sources of new genetic material, in-breeding will result, which in turn reduces population viability. Estimates based on present sex ratios and harem composition for Cumberland Island predict that to maintain an effective population size of 50 animals, the total pre-foaling population must number about 80 animals. A study of feral impacts on salt marsh, conducted by the University of Georgia CPSU, suggested a vegetation carrying capacity of 45 to 75 animals. Adjusting for differences in harem size, a similar projection for Assateague Island National Seashore suggests a herd of about 100 animals is sufficient.

Regulated breeding and continued reintroduction of stock have maintained genetic diversity in the pony population at Cape Hatteras National Seashore, which stands currently at fewer than 30 animals. Further introductions probably will be necessary, and probably should be conducted with other island ponies. The same type of strategy would be appropriate for Assateague Island. Animals should, if possible, be from other island habitats and from populations with differing gene frequencies. Since the horses of Cumberland Island and Shackleford Banks are of relatively

recent and very diverse origin, the use of mainland stock for outbreeding would be appropriate, and was a management technique utilized by island residents prior to park designation.

Genetic evaluation should be conducted prior to determining management strategies for feral animal species (or cultivated plants) assumed to be of historic significance. Genetic data may be used to determine the probable history of a population, its relationship to other populations, and the degree of in-breeding it may already have experienced. Genetic evaluation also adds scientific objectivity to potentially emotional issues such as the management of feral equids. Many techniques, such as electrophoresis, previously used only by a few progressive researchers now are widely employed and comparative data bases may already exist for domestic breeds or cultivars. These methods also are applicable to projects concerning endangered species with very limited or isolated populations and may be valuable in the course of population recovery or reintroduction projects.

The final report from this project has been submitted to the *Journal of Wildlife Management* for review. Further information is available from Robin Goodloe at the University of Georgia, Athens.

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