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United States Department of the Interior

NATIONAL PARK SERVICE
Water Resources Division - PEB
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Denver, CO 80225

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Memorandum

To: Superintendent, Cumberland Island National Seashore

Through: Bill Jackson, Acting Chief, Water Resources Division (WRD); Mark Flora, Chief, Planning and Evaluation Branch, Water Resources Division (WRD)

From: Kevin Noon, PhD, Wetland Scientist, WRD
Mike Martin, Hydrologist, WRD

Subject: Position Paper: Wetland Impacts from Feral Horses, Cumberland Island National Shoreline

During the week of March 29, 2004, Mike Martin and Kevin Noon (Water Resource Division, NPS) visited Cumberland Island National Shoreline to provide technical assistance regarding several topics including evaluate numerous disturbed wetland areas across the island and identify and prioritize opportunities to restore altered wetlands.

During our review of wetland conditions on the Island, park staff requested that we evaluate the adverse impacts on the wetlands resulting from the maintenance of the 250-head herd of feral horses.

Attached is a position paper that evaluates the adverse impacts to wetlands from the maintenance of the feral horse population on Cumberland Island.

If you have any questions regarding this report please call Kevin Noon at (303) 969-2815 or Mike Martin (970) 225 3509.

cc: (by e-mail only)

2380 - Jackson, Flora, J. Wagner, M. Martin, K. Noon, Vana-Miller, Hennessy (file)

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Position Paper
WETLAND IMPACTS FROM FERAL HORSES
CUMBERLAND ISLAND NATIONAL SHORELINE

Kevin F. Noon, PhD, Wetland Scientist, NPS Water Resources Division

Mike Martin, Hydrologist, NPS Water Resources Division

We offer the following position paper evaluating the adverse impacts to wetlands from the maintenance of the feral horse population on Cumberland Island. Our evaluation is based on literature review, park staff input, and field observations.

Summary and Recommendations

Adverse effects are particularly acute in wetlands, where horses tend to congregate most of the year, attracted by water, shade, cooler temperatures, and an abundance of high quality forage. The horses have been observed, by park staff, using the wetlands primarily in the spring, fall, and winter months and using open areas where the bugs and heat are tolerable, during the summer months.

Horse grazing, trampling, and defecating cause adverse impacts in the wetlands on CUIS. Annual horse-count data estimates show that the current horse population on Cumberland Island is approximately 250. This population deposits from 3.3 to 4.1 million pounds of waste on the island per year (USEPA 2001, Fry 1973). This equates to 24,900 pounds per year of nitrogen and 9,467 pounds per year of phosphorus deposited on the island (NRCS 1999). In addition to reduced water quality, some of the impacts include hydric soil compaction, increased erosion, trampled vegetation, soil biomass damage, consumption of native plant species, and increased opportunities for non-native plant species colonization.

Maintenance of the feral horse herd causes unacceptable impacts to the park's wetland resources, values, and purposes whose effects cannot be satisfactorily mitigated.

We recommend that the following options in order of preference:

1. Remove the horse population from the island
2. Maintain a small number of horses in a confined area for visitor enjoyment. This would essentially be a maintained group of horses that would require health care and management, including supplemental feeding
3. Fence to exclude grazing in all of the dune areas adjacent to wetlands, and to exclude grazing from wetland areas including a surrounding 150-foot buffer area

(All three recommendations were also made in 1975, in the Control of Problem Animals section of the *Ecology of Cumberland Island* report by Hillestad et.al.)

Current NPS management policies suggest that the first recommendation is most appropriate. The horses can be defined as exotic species according to section 4.4.1.3, Definition of Native and Exotic Species, *National Park Service Management Policies 2001* (NPS D1416 document). As such, numerous sections of the policies document, and some sections of the NPS *Procedural Manual #77-1: Wetland Protection*, identify actions to be taken to rectify various adverse conditions and strategies for managing the feral horse population on CUIS. Relevant excerpts from both documents are included at the end of this paper.

We feel that all of the mandates listed at the end of this paper support our recommendation, especially one particular mandate, i.e., Section 8.6.8 Domestic and Feral Livestock, *National Park Service Management Policies 2001* (NPS D1416 document) which states that: “No live-stock use or activity, regardless of how authorized, will be allowed that would cause unacceptable impacts to a park’s resources, values, or purposes. In particular, livestock use that depletes or degrades non-renewable resources, or whose effects cannot be satisfactorily mitigated, will not be allowed.”

Discussion

Adverse Impacts from Trampling

Horse Trampling produces mechanical pressure on wetland soils, grasses, and other hydrophytic herbaceous cover, and results in adverse effects. Horse trampling modifies hydric (wetland) soil characteristics, soil formation, and geomorphology which in turn affect hydrologic and erosion processes. Malleable wetland soils are more susceptible to the adverse effects of trampling than dry ones. The major geomorphic alterations created by trampling are 1. Increased roughness of the surface, 2. Increased bulk density, and 3. Decreased porosity and infiltration. Compaction that reduces surface permeability is ultimately the greatest factor in determining changes in plant survival, soil weathering, and soil genesis.

Horse trampling detaches soils particles, directly affects patterns of wetland soil weathering, and plays an indirect role in altering the processes of soil formation. The consumption of wetland vegetation exposes soils to weathering which increases the amount of suspended sediment and nutrients entering the wetland water column. Grazing horses can also reduce water quality by stirring up the wetland sediments. Horse manure sediments, and sediments stirred up by trampling, become suspended in the water column this can modify the color, clarity, and temperature of wetland waters and adversely affect aquatic ecosystems. Sediments can smother submerged aquatic plants and reduce light penetration, impacting on photosynthesis. Impaired photosynthesis reduces the capacity of the aquatic ecosystem to support plant life and fish. Excess sediment can smother animal life on wetland substrates, suffocate fish and other vertebrate eggs, and interfere with fish gill functioning.

Horse trampling disturbance of biomass including soil-dwelling organisms affects soil properties as well. Organisms that live in the sub-surface and normally contribute to soil

formation are disturbed or destroyed by trampling and compaction near the surface. These soil-dwelling organisms, including earthworms, tend to increase both the porosity and permeability of the soil, alter the structure of the soil, and change the soil's capacity to support wetland plants. Studies have revealed that most (90 percent) of these organisms and their larvae are found within 10 cm of the surface -- the portion of the soil most affected by grazing and compaction (Trimble and Mendel 1995). When infiltration is diminished through compaction, many of these organisms can be destroyed and plant roots may be denied the water and air they need to survive (Trimble and Mendel 1995, Kauffman 2004). In addition, cattle egrets were observed following the horses grazing in the wetlands. Cattle egrets typically follow grazing animals and benefit from the grazing process: They consume vertebrates and invertebrates stirred up or exposed by the horse grazing activity.

Adverse Impacts from Herbivory

Plants are eaten by the horses, and crushed or broken by horse hoofs. Grazed wetlands have less vegetation and litter cover than ungrazed wetlands. These activities result in the removal of natural vegetation and the alteration of plant-community composition. A significant number of wetland plants were observed, during an initial site evaluation, as sheered by grazing. Horses without sufficient or good-quality forage from surrounding dunes or uplands will feed selectively on their preferred plants within the wetlands. The observations were made in March, during the wet season and most rigorous growing period. Herbivory also causes a corresponding decline in the root biomass of wetland vegetation. Sheering new plant growth and decreasing root biomass dramatically reduces the ability of those species to survive, produce seed, or reproduce vegetatively.

Horse grazing of woody plant seedlings in the wetlands and surrounding areas can reduce recruitment of large woody debris in the system. Trees and shrubs provide food and canopy structure for birds and other wildlife. Woody debris, as it falls in the wetland, provides organic matter and twig and limb surface area critical to the proliferation of aquatic organisms. Re-establishment of wetland shrubs and trees rarely occurs if grazing pressure is not reduced.

Depressing the vigor of native plant species, along with denuding soil surfaces, facilitates the colonization of invasive exotic weeds. Spence et. al. (1996) reported that horses and other livestock contribute to the transport and invasion of non-native species by:

- Transporting weed seeds into uninfested sites on their coats and feet and in their guts
- Preferentially grazing wetland native plant species over weed species
- Creating patches of bare, disturbed soils that act as weed germination beds
- Destroying microbiotic crusts that stabilize soils and inhibit weed seed germination
- Creating patches of nitrogen-rich soils (through defecation), which favor nitrogen-loving weed species or species not adapted to the normal wetland soil conditions
- Reducing concentrations of soil mycorrhizae required by most native species
- Accelerating soil erosion that buries weed seeds and facilitates their germination

Grazing by the horses on CUIS is the primary cause of sand dune devegetation (Hillestad, et. al. 1975). Once vegetation is removed the dunes deflate and migrate into adjacent ecosystems including the wetlands (Leatherman 1988). The adverse impact is accelerated loss of wetland habitat, indirectly created by grazing on existing dune areas.

According to Hillestad, et. al. (1975) “extirpation of feral animals from Cumberland will improve habitat conditions for white-tailed deer. An increase in deer population should be expected.”

Adverse Impacts from Effluent Input

The average horse produces from 36 to 45 pounds of waste (urine and feces) each day. This equates to the deposition of from 3.3 to 4.1 million pounds of waste deposited on the island per year by the herd of 250 (USEPA 2001, Fry 1973). The horses on the island are smaller than most domestic horses and may produce less organic matter than what the authors predict. Regardless, the organic matter distribution from the horses is significant. The organic matter in defecated effluent consumes oxygen as it breaks down, starving plant and animal life in the waters of oxygen (increasing biochemical oxygen demand). The organic material can also cause excessive growth of bacterial and fungal slimes, which can raise the pH of water and kill sensitive plants and animals.

The total pounds per year of nitrogen deposited on the island by a herd of 250 horses is 24,900 and the total pounds per year of phosphorus is 9,467 (NRCS 1999). There is a strong significant positive correlation between the time spent grazing in a vegetation type and the amount of defecations in that vegetation type. Horses congregating in the wetlands deposit manure and urine in concentrated areas: The horses defecate concentrations of nutrients where they graze. The sheered condition of the plant species suggests that the horses spend a significant amount of time grazing within the wetlands. Grazing in wetlands is more attractive in early spring and late fall, and winter. From April through September they tend to graze more in open areas, out on the dunes and estuaries, where ocean breezes help reduce the effects of heat and bugs.

Grazing causes adverse nutrient loading of wetland soil and waters. In its ammonia form, nitrogen is highly toxic to fish and aquatic animals, even at low concentrations. Ammonia also consumes large quantities of oxygen, depleting oxygen levels in the waterway, potentially suffocating oxygen-breathing organisms within the wetlands. Nutrient loading also increases water temperatures, adversely affecting fish and invertebrates (Woltering 2002).

Inorganic nutrients such as nitrogen and phosphorus can increase plant growth and cause algal blooms in water bodies, including estuarine environments. Small regular, concentrated, additions of N and P from horse excrement encourages metaphyton to develop (McDougal 1994). Large mats of metaphyton, composed of filamentous green algae, were observed in Retta

Lake (see Photo). An overabundance of these algal blooms alters habitat conditions (primarily oxygen reduction) to less favorable for most plants, invertebrates, fish, reptiles, and amphibians.

Direct discharge of effluent into waterways, and its effects, can be offensive to park visitors. Effluent discharge can result in reduced amenity values and adverse affect on peoples' relationship with the wetlands. Nutrients are also a serious health problem when considering



water quality and human interaction (Kearsley 2004). Horse waste contains many pollutants that can contaminate surface and ground waters used as drinking water sources. Micro-organisms in the effluent can make water unsafe for drinking or recreational use. Solids from horse waste increase turbidity and adversely affect the taste and odor of waters. Probably the greatest human health

Horses Grazing in the Retta Lake Wetland

concern associated with horse wastes is pathogens. Many pathogens found in horse waste can infect humans if ingested. Organisms like *Cryptosporidium* , *Giardia lamblia* , and *Salmonella* can induce symptoms ranging from skin sores to chest pain. *E.coli* causes diarrhea and abdominal gas and has been the source of disease outbreaks in several States. Particularly virulent strains of *E.coli* can cause serious illness and even death. *Cryptosporidium* is of particular concern because it is highly resistant to disinfection with chlorine. This protozoan causes gastrointestinal illness that lasts 2 to 10 days in healthy individuals but can be fatal in people with weakened immune systems.

Relevant NPS Policy

National Park Service Management Policies 2001

The following excerpts identify policies and management actions relative to the continued maintenance of the feral horse population on CUIS.

4.1.5 Restoration of Natural Systems

The Service will use the best available technology, within available resources, to restore the biological and physical components of these systems, accelerating both their recovery and the recovery of landscape and biological-community structure and function. Efforts may include, for example:

- Removal of exotic species;
- Removal of contaminants and non-historic structures or facilities;
- Restoration of abandoned mineral lands, abandoned or unauthorized roads, areas over-grazed by domestic animals, or disrupted natural waterways and/or shoreline processes;
- Restoration of native plants and animals.

4.4 Biological Resource Management

4.4.1 General Principles for Managing Biological Resources

The National Park Service will maintain as parts of the natural ecosystems of parks all native plants and animals. The term “plants and animals” refers to all five of the commonly recognized kingdoms of living things and includes such groups as flowering plants, ferns, mosses, lichens, algae, fungi, bacteria, mammals, birds, reptiles, amphibians, fishes, insects, worms, crustaceans, and microscopic plants or animals. The Service will achieve this maintenance by:

- Preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- Restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- Minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them.

8.6.8 Domestic and Feral Livestock

8.6.8.1 General

The NPS will allow livestock use only when the use is consistent with the criteria listed in section 8.2, and the use is either:

- Specifically authorized by a park’s enabling legislation;
- Required under a reserved right of use arising from the acquisition of a tract of land;
- Required in order to maintain a historic scene; or
- Conducted as a necessary and an integral part of a recreational activity appropriate to a park.

Where livestock use (including cattle, sheep, goats, horses, mules, burros, reindeer, llamas, and alpacas) occurs in parks, it will be categorized as (1) livestock operations, (2) recreational stock, (3) trespass animals, or (4)

feral herds. No live-stock use or activity, regardless of how authorized, will be allowed that would cause unacceptable impacts to a park's resources, values, or purposes. In particular, livestock use that depletes or degrades non-renewable resources, or whose effects cannot be satisfactorily mitigated, will not be allowed.

4.4.1.3 Definition of Native and Exotic Species

"Native species" are defined as all species that have occurred or now occur as a result of natural processes on lands designated as units of the national park system. Native species in a place are evolving in concert with each other. "Exotic species" are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as non-native, alien, or invasive species. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place.

4.4.4 Management of Exotic Species

Exotic species will not be allowed to displace native species if displacement can be prevented.

4.4.4.2 Removal of Exotic Species Already Present

All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed—up to and including eradication—if (1) control is prudent and feasible, and (2) the exotic species:

- Interferes with natural processes and the perpetuation of natural features, native species or natural habitats; or
- Disrupts the genetic integrity of native species; or
- Disrupts the accurate presentation of a cultural landscape; or
- Damages cultural resources; or
- Significantly hampers the management of park or adjacent lands; or
- Poses a public health hazard as advised by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Program); or
- Creates a hazard to public safety.

High priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controllable.

4.6 Water Resource Management

4.6.3 Water Quality

The pollution of surface waters and groundwaters by both point and non-point sources can impair the natural functioning of aquatic and terrestrial ecosystems, and diminish the utility of park waters for visitor use and enjoyment. The Service will determine the quality of park surface and ground-water resources and avoid, whenever possible, the pollution of park waters by human activities occurring within and outside of parks. The Service will:

- Take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations; and

4.6.5 Wetlands

When natural wetland characteristics or functions have been degraded or lost due to previous or on-going human actions, the Service will, to the extent practicable, restore them to pre-disturbance conditions.

6. Wilderness Preservation and Management

6.1 General Statement

The National Park Service will manage wilderness areas for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness. Management will include the protection of these areas, the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness. The public purpose of wilderness in the national parks includes the preservation of wilderness character and wilderness resources in an unimpaired condition, as well as for the purposes of recreational, scenic, scientific, education, conservation, and historical use.

6.3.7 Natural Resources Management

The principle of non-degradation will be applied to wilderness management, and each wilderness area's condition will be measured and assessed against its own unimpaired standard. Natural processes will be allowed, insofar as possible, to shape and control wilderness ecosystems. Management should seek to sustain the natural distribution, numbers, population composition, and interaction of indigenous species. Management intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries.

NPS Procedural Manual #77-1: Wetland Protection.

The following excerpts identify actions to be taken regarding various adverse conditions or management strategies relative to the continued maintenance of the feral horse population on CUIS.

2.2 Policies, Requirements, and Standards

G. Where natural wetland characteristics or functions have been degraded or lost due to previous or ongoing human activities, the NPS will, to the extent appropriate and practicable, restore them to pre-disturbance conditions.

H. Where appropriate and practicable, the NPS will not simply protect, but will seek to enhance natural wetland values by using them for educational, recreational, scientific, and similar purposes that do not disrupt natural wetland functions.

4.1 Applicability

B. Activities Subject to Executive Order 11990

Examples of activities with the potential to have adverse impacts on wetlands include drainage, water diversion, pumping, flooding, dredging, channelizing, filling, nutrient enrichment, diking, impounding, placing of structures or other facilities, livestock grazing, and other activities that degrade natural wetland processes, functions, or values.

Examples of wetland degradation include modifying flow, circulation, hydroperiod, or other aspects of the hydrologic regime; degrading natural biotic communities and processes including native plant and animal communities, habitat quality, floral and faunal productivity, and natural biodiversity; and degrading social/cultural values such as aesthetics, education, historical values, archeological resources, recreation, and scientific research.

5.5 Restoring Wetlands Degraded by Human Activities

Where natural wetland functions have been degraded or lost due to previous or ongoing human activities (e.g., drainage facilities, structures, agriculture), NPS General Management Plans, Resource Management Plans, Development Concept Plans, or similar planning documents must outline actions to reestablish environments in which wetland ecological processes can function as they did prior to disturbance, to the extent practicable. Highest priority should be placed on removing such damaging facilities, structures, or activities and restoring pre-existing wetland habitats and processes. Where removing such facilities or activities is not practicable, the NPS should seek ways to minimize and, to the extent possible, reverse the adverse impacts.

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