

The Vegetation and
Carrying Capacity of the
Ocracoke Pony Pen
Cape Hatteras National Seashore

CPSU TECHNICAL REPORT 13

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PURPOSE AND CONTENT OF THE REPORT SERIES:

In order to make data and results from managerial studies more easily and quickly available to interested scientists, the US National Park Service Cooperative Unit at the Institute of Ecology has initiated a numbered technical report series. This series produces limited printings of data matrices, bibliographies, review papers and scientific project reports concerning U.S. National Parks and park related problems. The reports are from various sources, not all federally funded, and are intended to supply scientific information rather than deal with park policy. The reports are subject to technical editing and review for scientific accuracy by Institute staff but are not necessarily reviewed by external experts and are not refereed in regard to overall quality or importance to the scientific community.

Abstract

The Ocracoke Pony Pen, Cape Hatteras National Seashore, occupies 52 ha and supports a herd of ponies descending from original free-range Outer Banks stock. The vegetation of the pen included pasture grasses, such as bermuda grass, Cynodon dactylon, and other exotic plant species, but exotic impact was restricted to the area inside the pen. Productivity during the summer ranged from 7 Kg/ha/day to 22 Kg/ha/day, whereas it was 1-4 Kg/ha/day in the winter. The pen can support 24 to 30 ponies during summer and 2 to 13 during the winter.

Introduction

From colonial times to the passage of a law prohibiting free-range grazing, ponies, horses and other livestock roamed the Outer Banks of North Carolina, uninhibited by fences or property boundaries. In the late 1930s, residents of the Banks began to round up their stock and most of the animals were eventually sold. Today, the U.S. National Park Service maintains a small herd of the descendants of the "Banker ponies" in an enclosure on Ocracoke Island, Cape Hatteras National Seashore. This "Pony Pen" is arranged to allow viewing by park visitors and confines the herd to a limited area of salt marsh and interdune "meadow."

Since the pony herd now occupies a limited area, park managers have been concerned both about the impact of the pasture on the native plant communities and about the adequacy of the forage in the pen for the present pony herd. The purpose of this work was:

- 1) to compare floristic composition inside and outside of the pen;
- 2) to establish permanent monitoring plots inside and outside the pen;
- and
- 3) to determine the adequacy of forage production within the pen.

Methods

The Pony Pen occupies approximately 52 Ha (128 acres), and is located about 20 meters west of Highway 12 along a strip of high salt-marsh. A shrub zone runs between the highway and the eastern fence of the pen. The pen is divided by fences into a large northern pasture,

several smaller pastures near the barn and a southwestern pasture. The vegetative composition of the southwestern pasture was predominantly woody and therefore was not sampled for productivity.

Four 3- x 5-meter exclosures were constructed in different pasture types. Within each exclosure, three 1m^2 clip-plots were marked, one clipped every 30-60 days, one clipped at the beginning of the study and at the end, and one clipped only at the end of the study. Vegetation was clipped to within 5 cm (2 inches) of the ground. Clippings were sorted into graminoid and non-graminoid categories, dried and weighed to the nearest 0.1 gm.

A 20-meter transect located about 5 meters from each exclosure was sampled for vegetation percent cover. Percent cover of woody species was estimated within ten 4m^2 areas along alternating sides of the transect line. Herb percent cover was estimated in ten 1m^2 areas located within the woody sample subplots. In addition to the transects paired with exclosures, five pairs of transects were established at various locations around the pen fence. Of these pairs, one transect was located 5-10 m on the outside of the pen, and the other was located 5 m on the inside of the pen. Transect locations were marked with aluminum tags on the fence. Two of these transect pairs sampled the shrub zone along the eastern fence, and the remaining three sampled successively lower saltmarsh along the north and west fences. All transects were sampled in June and August of 1984, except for the shrub zone transects which were sampled only once in June.

The pen was surveyed for a plant species list in April, June and August. Plant specimens were collected and deposited in the park herbarium. A total vascular species list was constructed following Radford et al. (1968).

Results and Discussion

Exotic species established within the Pony Pen included a number of pasture grasses, especially bermuda grass, Cynodon dactylon, and an annual buttercup, Ranunculus sardous. The pasture grasses (listed in the appended species list) were limited to the smaller barn and southern pastures. These grasses were heavily grazed and may well have been introduced from imported hay. There was no indication that these species were established beyond the pen, as shown in the comparison of vegetation across the fence (Tables 1 and 2). Bermuda grass was well established in the pen sod and was common throughout the island in open lawn grasses and along the major roads. Bermuda grass may have displaced native species within the pen where grazing, trampling and mowing have encouraged its growth. Reproducing primarily by vegetative propagation, it thrives in a constantly disturbed habitat and does not tolerate heavy shade (King, 1963). Because of these attributes, bermuda grass was commonly used to sod highway shoulders and its establishment probably preceded the pen. It was not well established outside of the pen fence and, in the absence of pasture management, would probably decline in favor of native species. The buttercup was established in the small southern and barn pastures (Table 4) and was also noted in the lawn outside the pen at the main gate. Again, this species appeared to favor heavily disturbed areas. It may spread along the highway shoulders or lawns which are regularly mowed or disturbed, but it did not compete well with native species outside of these areas. The impact of the exotic species, therefore, appeared to be restricted to the area

Table 1. Comparison of vegetation average percent cover inside and outside of the Pony Pen fence in the shrub zone.

	<u>Inside Pen Fence</u>				<u>Outside Pen Fence</u>	
	97		100		97	100
<u>GRAMINOIDS</u>	June	August	June	August	June	June
<u>Cynodon dactylon</u> *	50	34	48	34		
<u>Fimbristylis spadicea</u>	1	7	3	12		
<u>Eleocharis rostellata</u>			12	6		
<u>Dichromena colorata</u>		1	1	7		
<u>Polypogon monspeliensis</u> *	1	1		1		
<u>Scirpus americanus</u>		1		1		
<u>Setaria geniculata</u>		1		1		
<u>Cyperus flavescens</u>		14		13		
<u>Juncus</u> spp.	1		1			
Other grasses	1	8	2			
<u>Juncus roemerianus</u>				38	60	
<u>Panicum</u> sp.				2		
<u>SHRUBS</u>						
<u>Hibiscus moscheutos</u>		1				
<u>Juniperus virginiana</u>			2	1	48	43
<u>Myrica cerifera</u>				1	19	33
<u>Baccharis halimifolia</u>			1		6	15
<u>Iva frutescens</u>			1		1	
<u>Parthenocissus quinquefolia</u>					8	25
<u>Rhus radicans</u>					14	3
<u>Rubus</u> sp.					4	1
<u>Ilex vomitoria</u>					10	4
<u>Persea borbonia</u>					5	1
<u>FORBS</u>						
<u>Hydrocotyle bonariensis</u>	16	18	22	25	1	8
<u>Solidago sempervirens</u>	18	6	8	4		2
<u>Centella asiatica</u>			1	1	1	1
<u>Oenothera fruticosa</u>			1			8
<u>Sisyrinchium arenicola</u>			1			1
<u>Ranunculus sardous</u> *	16	1				
<u>Ptilimnium capillaceum</u>	1	1				
<u>Lippia nodiflora</u>		1				
<u>Sabatia stellaris</u>		1				
<u>Mecardonia acuminata</u>		1				

*exotic species

Table 2. Comparison of vegetation average percent cover inside and outside of the Pony Pen fence in the lower salt marsh.

	Inside Pen Fence						Outside Pen Fence					
	94		96		95		94		96		95	
	June	August	June	August	June	August	June	August	June	August	June	August
GRAMINOIDS												
<i>Spartina alterniflora</i>	6	6	66	64	49	53		1	46	27	13	4
<i>Distichlis spicata</i>	2	10	4	13	2	1	18	8	12	13	13	4
<i>Fimbristylis spadicea</i>	2	38	2				1	16	9	1	9	8
<i>Spartina patens</i>	2	12					165	40		8	40	34
<i>Juncus roemerianus</i>	4								6			
<i>Eleocharis rostellata</i>	51	20										
<i>Setaria geniculata</i>												1
<i>Cynodon dactylon</i> *											2	
SHRUBS												
<i>Borrichia frutescens</i>	11	27	1				56	66	48	53	70	64
<i>Iva frutescens</i>											6	5
FORBS												
<i>Salicornia virginica</i>	1	1	3	1	20	30			7	7	2	3
<i>Solidago sempervirens</i>	8	6	1	1					1		4	2
<i>Cynanchum palustre</i>		1						2		1	1	2
<i>Hydrocotyle bonariensis</i>											1	1
<i>Rumex crispus</i>											2	1
<i>Agalinus purpurea</i>		5						1		1		
<i>Oenothera fruticosa</i>	2											
<i>Sesuvium portulacastrum</i>					2							

*exotic species

within the pen and poses no great threat to the native flora of the island outside of the pen.

The major differences of vegetation on either side of the fence in the lower salt marsh samples was the greater amount of shrubby species outside the fence, and slightly greater diversity of herb species inside the fence (Table 2). The pastures were regularly mowed as part of the management of the area for the ponies. This encouraged the growth of graminoids (grasses, sedges, and rushes), and discouraged growth of woody and determinant forb species (Table 5). The pastures were mowed at least two weeks before the August sample; this mowing may have affected the proportions of species in that sample relative to the June sample.

The shrub zone that roughly parallels the pen's east fence has been reduced by pasture management within the pen. Vegetation across this fence was radically different, being dominated by tall shrubs outside the fence and by grasses and forbs on the inside (Table 1). This shrub zone was created by the stabilization of the highway which impeded marine overwash. Its presence was, therefore, an artifact of human interference. The reduction of the shrub zone in favor of graminoid species within the pen produces a vegetation composition more similar to that which preceded the dune stabilization.

The composition of vegetation for each enclosure is presented in Tables 3 and 4. Graminoid productivity was highest in the north pasture, dominated by Eleocharis rostellata, and was considerably lower in the southern pastures (Table 6). This sample was not designed to be statistically significant, but to indicate a range of forage productivity. The lowest average productivity value of the southern pasture plots (7 kg/ha/day), multiplied by the size of the area (10 ha), yields

Table 3. Graminoid species average percent cover in early and late summer across enclosure transects.

Exclosure	1		2		3		4	
	June	August	June	August	June	August	June	August
<u>Cynodon dactylon</u> *	20	5	50	43	42	28	18	6
<u>Fimbristylis spadicea</u>		8	7	18	1	4		3
<u>Setaria geniculata</u>		3		16		1		3
<u>Scirpus americanus</u>		1		5		1		1
<u>Eleocharis rostellata</u>	80	72	51	16			5	
<u>Juncus roemerianus</u>	2	1						
<u>Spartina patens</u>		8		1				
<u>Cyperus flavescens</u>				1		12		8
<u>Poa annua</u> *				2	1			
<u>Dichromena colorata</u>					1	3	1	1
<u>Polypogon monspeliensis</u> *					2	1		
<u>Lolium perenne</u> *							3	
<u>Tridens flavus</u> *							1	
<u>Carex</u> spp.							1	
<u>Juncus</u> spp.							2	
Other Grasses			3	2		14	26	25
TOTAL	102	98	111	104	47	65	57	47

*exotic Species

Table 4. Forb and woody species average percent cover in early and late summer across the exclosure transects.

Exclosure	1		2		3		4	
	June	August	June	August	June	August	June	August
<u>Hydrocotyle bonariensis</u>	3	5	8	6	13	22	62	41
<u>Solidago sempervirens</u>	3	4	7	2	16	11	21	8
<u>Lippia nodiflora</u>		1	1	2	3	4	1	1
<u>Sabatia stellaris</u>		1				1		1
<u>Cynanchum palustre</u>		2		1				
<u>Pluchea purpurascens</u>		1						
<u>Sesuvium portulacastrum</u>	1							
<u>Samolus parviflorus</u>	1					2		
<u>Mecardonia acuminata</u>				1				
<u>Ipomoea sp.</u>				1				
<u>Ranunculus sardous</u> *					14	2		1
<u>Centella asiatica</u>					2	1	1	
<u>Sisyrinchium arenicola</u>					1			
<u>Ptilimnium capillaceum</u>					1			
<u>Cuscuta sp.</u>						1		
<u>Cirsium smallii</u>							1	1
<u>Erigeron quercifolius</u>							2	
<u>Oenothera fruticosa</u>							8	
<u>Physalis viscosa</u>								1

*exotic species

Table 4 continued:

Exclosure	1		2		3		4	
	June	August	June	August	June	August	June	August
<u>WOODY SPECIES</u>								
<u>Hibiscus moscheutos</u>	1	2				1		
<u>Borrchia frutescens</u>	2	2	1		1			1
<u>Rubus sp.</u>							2	1
<u>Rhus radicans</u>							1	1
<u>Baccharis halimifolia</u>							2	
<u>Juniperus virginiana</u>							1	1
<u>Ilex vomitoria</u>							1	
<u>Parthenocissus quinquefolia</u>								1
<u>Myrica cerifera</u>							15	3
TOTAL	11	18	17	14	50	45	118	62

Table 5. Dry weight (gms/m²) comparison of graminoid and forb/woody portions of exclosure clippings.

<u>Exclosure</u>	<u>Collection</u>	<u>Clipping Dry Weights (Gms/m²)</u>	
	<u>Date</u>	<u>Graminoids</u>	<u>Forb & Woody Spp.</u>
1	5-17	133.4	1.0
	7-14	101.1	7.4
	8-6	179.9	1.8
	10-3	68.3	0.2
	1-8	34.4	0.2
	4-11	6.2	0.3
	2	5-18	0.0
7-4		28.5	0.0
8-6		41.1	0.7
10-3		48.0	0.0
1-8		38.8	0.5
4-11		7.1	0.3
3		6-4	0.0
	7-4	4.8	9.2
	8-6	66.8	1.3
	10-3	112.1	2.4
4	6-4	35.4	34.6
	7-4	17.4	3.5
	8-6	28.6	5.9
	10-3	26.9	9.6

Table 6. Graminoid productivity (Kg/ha/day) forage dry weight for the four monthly clipped exclosure plots.

Exclosure	1	2	3	4
<u>Dominant</u>	<u>Eleocharis</u>	<u>Cynodon/Sedge</u>	<u>Cynodon/Grass</u>	<u>Mixed Grass</u>
July	22	6	2	6
August	60	14	22	10
October	11	8	19	4
January	3	4	-	-
April	<1	<1	-	-

Table 7. Comparison of total annual (325 days) productivity for monthly clipped, once clipped, and unclipped exclosure plots (kg/ha/day).

Exclosure	Monthly Clipped	Once Clipped	Unclipped
1	97	21	12
2	33	4	9

Summary

The exotic species established in the Pony Pen are bermuda grass, Cynodon dactylon, and an annual buttercup, Ranunculus sardous, and various pasture grass species. There is no evidence that these species threaten the native flora outside of the pen. The shrub zone around the pen is the result of human interference in natural ecosystem processes, and therefore does not represent the expected native ecosystem. Productivity estimates for the summer season indicate adequate forage for 24 to 30 ponies. However, a distinct decline in productivity with the onset of autumn indicates that winter season productivity is limiting.

Literature Cited

King, G. H. 1963. Pastures for the South. 4th Ed. Interstate Printers and Publ., Danville, IL. p. 59

Redford, A. E., H. E. Ahles, and C. R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. Univ. North Carolina Press, Chapel Hill. 1183 pp.

Ocracoke Island Pony Pen Collection and species List
 Cape Hatteras National Seashore
 Hyde County, North Carolina

FORBS AND WOODY PLANTS

Scientific Name	Common Name	Family Name	Collection Date
<u>Agalinus maritima</u> (Raf.) Raf.	Gerardia	SCROPHULARIACEAE	8/06/84
<u>Arenaria sepyllifolia</u> L.	Sandwort	CARYOPHYLLACEAE	5/18/84
<u>Baccharis halimifolia</u> L.	Groundsel	ASTERACEAE	5/18/84
<u>Bacopa monnieri</u> (L.) Pennel	Bacopa	SCROPHULARIACEAE	7/04/84
<u>Borrchia frutescens</u> (L.) DC	Sea Ox-eye	ASTERACEAE	5/19/84
<u>Capsella bursa-pastoris</u> (L.) Medicus	Shepherd's Purse	BRASSICACEAE	5/18/84
<u>Centella asiatica</u> (L.) Urban	Chinaman's Hat	APIACEAE	8/06/84
<u>Cerastium holosteoides</u> , var <u>vulgare</u> (Hartman) Hylander	Mouse-ear Chickweed	CARYOPHYLLACEAE	5/18/84
<u>Erigeron quercifolius</u> Lam.	Oak-leaved Fleabane	ASTERACEAE	5/18/84
<u>Euphorbia supina</u> Raf.	Supine Euphorbia	EUPHORBIACEAE	5/18/84
<u>Geranium carolinianum</u> L.	Carolina Cranesbill	GERANIACEAE	5/18/84
<u>Hibiscus moschuetos</u> , ssp. <u>palustris</u> (L.) Clausen	Rose Mallos	MALVACEAE	7/04/84
<u>Hydrocotyle bonariensis</u> Lam.	Pennywort	APIACEAE	5/18/84
<u>Iva frutescens</u> L.	Marsh Elder	ASTERACEAE	8/06/84
<u>Lippia nodiflora</u> (L.) Michaux	Cape-weed	VERBENACEAE	7/30/84
<u>Lytrum lineare</u> L.	Loosestrife	LYTHRACEAE	8/06/84
<u>Mikania scandens</u> (L.) Willd.	Climbing Hempweed	ASTERACEAE	5/19/84
<u>Oenothera fruticosa</u> L.	Sundrops	ONAGRACEAE	5/19/84
<u>Physalis viscosa</u> ssp. <u>maritima</u> (M.A. Curtis) Waterfall	Ground Cherry	SOLANACEAE	5/18/84
<u>Phytolacca americana</u> L.	Pokeweed	PHYTOLACCACEAE	6/05/84
<u>Plantago virginica</u> L.	Virginia Plantain	PLANTAGINACEAE	5/18/84
<u>Pluchea camphorata</u> (L.) DC	Marsh-fleabane	ASTERACEAE	8/06/84
<u>Ptilimnium capillaceum</u> (Michaux) Raf.	Mock-bishop Weed	APIACEAE	5/18/84
<u>Ranunculus sardous</u> Crantz	Buttercup	RANUNCULACEAE	5/18/84
<u>Rumex acetosella</u> L.	Sheep-sorrel	POLYGONACEAE	8/06/84
<u>Rumex crispus</u> L.	Crisp Dock	POLYGONACEAE	5/18/84
<u>Sabatia stellaris</u> Pursh.	Marsh Pink	GENTIANACEAE	5/18/84
<u>Salicornia virginica</u> L.	Glasswort	CHENOPODIACEAE	8/06/84
<u>Samolus parviflorus</u> Raf.	Water Pimpernel	PRIMULACEAE	5/18/84
<u>Sisyrinchium arenicola</u> Bicknell	Blue-eyed Grass	IRIDACEAE	5/18/84
<u>Solanum carolinense</u> L.	Carolina Nightshade	SOLANACEAE	6/05/84
<u>Solidago sempervirens</u> L.	Seaside Goldenrod	ASTERACEAE	5/18/84
<u>Spiranthes laciniata</u> (Small) Ames	Lace-lip Spiral Orchid	ORCHIDACEAE	7/04/84
<u>Stellaria media</u> (L.) Cyrillo	Chickweed	CARYOPHYLLACEAE	5/18/84
<u>Trifolium dubium</u> Sibthorp	Low Hop Clover	FABACEAE	5/18/84
<u>Trifolium repens</u> L.	White Clover	FABACEAE	5/18/84

Ocracoke Island Pony Pen Species List
 Cape Hatteras National Seashore
 Hyde County, North Carolina

Additional species, not collected but noted in the area.

FORBS AND WOODY PLANTS

Scientific Name	Common Name	Family Name
<u>Cirsium smallii</u> Britton	Thistle	ASTERACEAE
<u>Cuscuta</u> sp.	Dodder	CONVOLVULACEAE
<u>Cynanchum palustre</u> (Pursh) Heller	Creeping Milkweed	ASCLEPIADACEAE
<u>Ilex vomitoria</u> Aiton	Yaupon	AQUIFOLIACEAE
<u>Ipomea</u> sp.	Morning Glory	CONVOLVULACEAE
<u>Juniperus virginiana</u> L.	Red Cedar	CUPRESSACEAE
<u>Myrica cerifera</u> L.	Wax Myrtle	MYRICACEAE
<u>Parthenocissus quinquefolia</u> (L.) Planchon	Virginia Creeper	VITACEAE
<u>Persea borbonia</u> (L.) Sprengel	Red Bay	LAURACEAE
<u>Rhus radicans</u> L.	Poison Ivy	ANACARDIACEAE
<u>Rubus</u> sp.	Dewberry	ROSACEAE
<u>Sesuvium portulacastrum</u> L.	Sea Purslane	AIZOACEAE