

THE EFFECT OF HURRICANE HUGO ON
THE VASCULAR FLORA OF FORT SUMTER NATIONAL MONUMENT, SOUTH
CAROLINA

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ABSTRACT

Stalter, R. (Dept. Biol. Sci., St. Johns Univ., Jamaica, NY 11439) and E. E. Lamont (N.Y. Botanical Garden, Bronx, NY 10458). The vascular flora of Fort Sumter National Monument, South Carolina. Bull. Torrey Bot. Club 118: xx-xx. 1991.--The vascular flora of Fort Sumter National Monument is based exclusively on collections made by the authors from March 29, 1990 to October 26, 1990. Altogether 73 vascular plant species in 61 genera and 22 families are here reported. Of these, 8 are new records for Charleston County, South Carolina. Largest families are Poaceae (19 species) and Asteraceae (13 species).

Key Words: Vascular flora, Fort Sumter, Hurricane Hugo

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Hurricanes have ravaged the South Carolina coast from time immemorial. The most recent hurricane, Hurricane Hugo, was one of the most savage storms to strike the South Carolina coast. The eye of the storm was centered at over Charleston at midnight, September 21, 1989 at ^(I don't believe the tide was high) high tide. The coastal vegetation from Charleston north to Litchfield Beach, S.C. was ravaged by the powerful winds and the hurricane surge, the marked rise in water level associated with the storm. Charleston recorded sustained wind speeds of 200 km/hr with gusts as high as 230 km/hr. Water washed over walls of the fort and was two meters deep at the parade grounds (Figure 1). The hurricane surge in the vicinity of Charleston was 4 meters; the surge reached nearly 6 meters, at McEllanville, ~~40~~ 50 km north of Charleston.

Hurricanes with winds as severe as those of Hugo will strike the South Carolina coast once every 200 years (Anonymous 1974). Since a storm of Hugo's magnitude strikes a specific coastal area on an average of less than once in one's lifetime, a study of the affect of this storm on the vegetation was conducted. The objective of this study is to obtain a record of the vegetation of Fort Sumter one growing season after being struck by a severe hurricane. The vegetation present in 1990, will be compared with the vegetation present at Fort Sumter 10 and 25 years from now.

Fort Sumter (32°54'N, 80° 02W) was one of a series of coastal fortifications built by the United States after the War of 1812. Plans to construct the fort were drawn up in 1827 and construction begun in 1829. The fort was named Sumter in the honor of Thomas Sumter, brigadier general commanding the South Carolina militia during the Revolutionary War (Anonymous 1984).

During the early construction work was slow and difficult hindered by the

fort today. The twelve inch guns were obsolete by 1943, and were removed for scrap. Four 90 mm guns replaced the antiquated 19th century guns during the latter part of World War Two.

The fort was transferred from the War Department to the National Park Service and became a National Monument in 1948. In 1990, the Monument was visited by approximately 200,000 people (Ruth personnel communication). Visitors to Fort Sumter come from throughout the United States and include foreign tourists as well. Visitors have probably brought many exotic seeds and propagules to the fort.

Climate

The climate of South Carolina is subtropical with mild winters and high humidity. Summers are long, hot, and humid. Mean January temperature is ~~10°C~~ ^{10.8°C} (51.5°F) while July, the hottest month has a mean of ~~27.8°C~~ ² (81.5°F). The growing season averages 294 days. Most rainfall occurs during the summer and early fall, ~~(48-54 in.)~~ ^{197.6 mm} July is the wettest month with ~~7.78 in.~~ ^{48.8 mm} of rain. November is the driest month with an average of ~~1.92 in.~~ ¹¹⁸³ of rain. The driest period is November through February. Average annual rainfall is ~~1300~~ ¹¹⁸³ mm (Anonymous 1974).

Methods

The vegetation at Fort Sumter South Carolina was sampled on four occasions: March 30, June 17, August 27, and October 27, 1990 for a total of 4 field days. Herbarium vouchers were prepared for all vascular taxa and are deposited at Fort Sumter National Monument, South Carolina. Nomenclature follows that of Radford et al (1968).

Results

The vascular flora of Fort Sumter, South Carolina consists of 22 families, 60 genera, and 73 species and varieties of which xx are native. Eight species are confirmed for Charleston County for the first time. The Poaceae with 14 genera and 19 species and Asteraceae with 10 genera and 13 species are the largest families. Together they comprise 40 percent of all genera and 45 percent of all species. A table of the vascular flora is presented in Table 1.

Discussion

The vegetation of Fort Sumter, is divided into three general communities: (1) the salt marsh community; (2) poorly developed dune community; (3) the maintained lawn community.

Salt Marsh Community

The salt marsh community is dominated by Spartina alterniflora, which can tolerate tidal flooding and saline conditions. Zonation of vegetation in this salt marsh is pronounced. Salicornia virginica is mixed with S. alterniflora in the higher portion of the marsh where tidal flooding is not as prolonged or as deep as flooding in the lowest portion of the marsh occupied by S. alterniflora. Borrchia frutescens borders S. alterniflora and S. virginica. Iva frutescens and a single Baccharis halimifolia border the former species. Iva and Baccharis may have been more abundant at Fort Sumter before Hurricane Hugo.

The Dune Community

The Dune Community at Fort Sumter was covered by 2 meters of water during the height of the storm and subjected to severe erosion by wind driven waves. Uniola paniculata, the dominant plant on coastal dunes in South Carolina (Stalter 1973) was represented by a single plant. Panicum amarum, which

accompanies U. paniculata in the primary dunes of South Carolina (Coker 1905, Gaddy et al 1979) was represented by a population of seven plants. The most interesting member of this community is the showy Oenothera drummondii, which only occurs in Charleston County, South Carolina and Galveston, Texas (Radford Ahles and Bell 1968, Stalter 1975). Other dune plants include Strophostyles helvola, Salsola kali, Ipomea lacunosa and Cenchrus spp.

The Man-Maintained Lawn

Grasses are dominant on the maintained portions of the fort (Figure 1). The lawns are cut once a week favoring graminoid species. Grasses, most notably Paspalum spp., Sporobolus poriettii, Digitaria sanguinalis and Cynodon dactylon are dominant here (Figure 1). The diminutive and uncommon Portulacca pilosa grows along the wall south west of the flag pole. Sagina procumbens thrives in soil between brick pathways. Erigeron quercifolius was observed in full anthesis on unmowed portions of the lawn on March 30th 1989.

Resurrection fern, Polypodium polypodioides, was a common inhabitant of the inner walls of Fort Sumter before Hurricane Hugo. Resurrection fern was initially killed by wind driven salt spray and sea water; P. polypodioides has reappeared on the left face of the case mate ruins in August 1990.

It is difficult to determine the effect of Hurricane Hugo on the vegetation at Fort Sumter since no records of the vegetation present at Fort Sumter prior to Hurricane Hugo exist. Spartina alterniflora, S. patens, Salicornia virginica and Borrichia frutescens can tolerate tidal flooding; these species were probably little affected by Hugo's tidal surge. Severe hurricanes such as Hugo may bury vegetation with organic ooze or sand (Stubbs 1966) though no evidence of deposition was noted by the rangers who visited Fort Sumter immediately after the

storm. Soil erosion was evident in the dune community and probably adversely affected the dune vegetation, especially Uniola paniculata, as only one individual of U. paniculata was observed in October 1990, a year after Hugo. Strophostyles helvola, Oenothera humifusa, O. drummondii, Cenchrus spp., and Ipomoea lacunosa were well established on the low dunes one growing season after the storm. Although the Parade Ground within the fort was flooded with sea water during the storm, the grasses there were probably not adversely affected. The grasses present in the lawns of Fort Sumter are similar to those reported by Stalter (1975) in lawns at the Isle of Palms, South Carolina in the early 1970's.

EUPHORBIACEAE

Croton glandulosus
Crotonopsis sp.
Euphorbia maculata

FABACEAE

Medicago polymorpha
Melilotus alba
! *Melilotus officinalis*
Strophostyles helvola
Vicia angustifolia

GERANIACEAE

Geranium carolinianum

LAMIACEAE

Lamium amplexicaule

MALVACEAE

Modiola caroliniana

ONAGRACEAE

Oenothera drummondii
O. laciniata

OXALIDACEAE

! *Oxalis dillenii*

PHYTOLACCACEAE

Phytolacca americana

PLANTAGINACEAE

Plantago lanceolata

POLYGONACEAE

Rumex crispus

PORTULACACEAE

! *Portulaca pilosa*

RUBIACEAE

Diodia teres

SCROPHULARIACEAE

Linaria canadensis
Veronica arvensis
V. peregrina

LILIOPSIDA**CYPEACEAE**

Cyperus strigosus

POACEAE

Bromus catharticus

Cenchrus longispinus

C. pauciflorus

C. tribuloides

! *Chloris petraea*

Cynodon dactylon

Digitaria sanguinalis

Eleusine indica

Festuca octoflora

Lolium perenne

Panicum amarum

Paspalum dilatatum

P. notatum

P. notatum var. *saurae*

Poa annua

Spartina alterniflora

S. patens

Sporobolus pioretii

Uniola paniculata

! *Triplasis purpurea*

LITERATURE CITED

- Anonymous 1974. Climates of the United States. 1974. Vol. 1 and 2. Water Information Center, Inc., Port Washington, N.Y.
- Anonymous 1984. Fort Sumter Anvil of War. Handbook 127. Produced by the Division of Publications National Park Service U. S. Department of the Interior Washington, D.C. 1984. 63pp.
- Coker, W.C. 1905. Observations on the flora of the Isle of Palms, Charleston, S.C. Torreyia 5: 135-45.
- Gaddy, L.L., A. Starck, and R. Stalter. 1979. A floristic study of Deveaux Bank. Bulletin of the South Carolina Academy of Science. 41:52.
- Radford, A.E., H.E. Ahles, and C.R. Bell. 1968. Manual of the vascular flora of the Carolinas. The University of North Carolina Press, Chapel Hill, N. C. 1183 pp.

ACKNOWLEDGEMENTS

We wish to thank John Tucker, Superintendent for granting us permission to collect and identify the vascular plants at Fort Sumter and for providing R. Stalter with boat transportation to and from Fort Sumter; David Ruth, historian for providing us with information on the history of the fort and for access to the Fort Moultrie National Monument Ranger office; Robert C. Meyer for assistance in identifying grasses; Arthur Conquist for assistance in identifying questionable species; Chris Bae and Danoto Tramontozzi for assistance in preparing herbarium specimens; and to St. John's University for purchasing herbarium supplies.

12-20-90

- DAVE - (I think this page is
missing from the Sumter paper)

Dust

LITERATURE CITED

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